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Editorial

Ischemic Stroke Prevention and its Management

Prof. Dr. Azhar Masud Bhatti
Editor-in-Chief

Introduction

An ischemic stroke is a serious medical emergency that happens when a blood clot blocks or plugs a blood vessel in the brain. It accounts for about 87% of all stroke cases. Without blood and oxygen, brain cells begin to die in minutes.

Stroke is a debilitating illness rendering thousands disabled and leading a significant proportion of people to death worldwide. Its incidence in Asia, according to a rough estimate, has been increasing recently. Among Asian countries, Pakistan shares a significant burden of this devastating disease contributing towards an exponential expenditure of resources, finances, community manpower, health services and the economy as a whole.[1,2]

Recent global research highlights that ischemic stroke remains a leading cause of death and long-term disability worldwide, with absolute case numbers rising due to population aging, while clinical trials advance treatment windows and prevention therapies.

Recent research on ischemic stroke in Pakistan highlights a high burden of cardiometabolic risk factors, significant treatment delays. Ischemic stroke accounts for roughly 44% of regional stroke presentations, driven primarily by uncontrolled hypertension and diabetes.

Main Causes

Thrombosis: A blood clot forms right inside a narrowed artery in the brain.

Embolism: A blood clot or fatty piece breaks off from another body part (like the heart) and travels to the brain.

Atherosclerosis: Hard fatty deposits build up inside the walls of blood vessels.

Common Signs and Symptoms

Sudden weakness or numbness in the face, arm, or leg, usually on one side.

Trouble speaking, slurred words, or difficulty understanding speech.

Sudden confusion or dizziness.

Sudden vision changes in one or both eyes.

Fast medical treatment can clear the blocked vessel and save brain tissue.

Epidemiology of stroke

Stroke is a major global health crisis, characterized by ischemic and hemorrhagic subtypes, and driven predominantly by modifiable risk factors like hypertension. Globally, it accounts for nearly 12 million new cases annually and stands as a leading cause of long-term adult disability and death.

Global Incidence and Prevalence

New cases: ~11.9 to 12.2 million new strokes occur globally each year.

Lifetime risk: 1 in 4 adults over age 25 will experience a stroke in their lifetime.

Total burden: Over 93 million people globally live with the effects of a stroke.

Twenty per cent of the world's population resides in South Asia. This region has the most dense concentration of cardiovascular diseases. As stroke affects the elderly exceedingly, an increase in the average lifespan has automatically led to an increased number of stroke cases reported.[3]

Stroke and transient ischemic stroke are rampant in Pakistan. The risk of stroke has plumped by 100% or more in the past decade, especially in third world countries where it accounts for more than 85% of all stroke-related mortality. The mean population age of patients with stroke in developing countries like Pakistan is a decade or younger than that of their western counterparts. This leads to an increased overall lifetime burden of functional disability and consequent economic losses.[4]

Data from Punjab Pakistan emergency departments report an overall stroke incidence rate of 1.03%, with aged 60–69 years and provincial surveys in KPK estimate a stroke prevalence of 1.2%.

Diabetes, hypertension and Obesity are major problem in South Asians and their body mass index has been estimated to have lower cut-off values for quantification of diseases. Obesity has a prevalence ranging from 20% to 30% in South Asia.[5]

Types of Stroke

Ischemic stroke: Accounts for roughly 87% of all cases, caused by blocked cerebral blood flow.

Hemorrhagic stroke: Accounts for 10% to 15% of cases, caused by ruptured blood vessels, carrying a higher acute mortality rate.

Prevention

In the regard of prevention of stroke, you can classify it as primary and secondary stroke prevention.

Primary Stroke Prevention: Primary stroke prevention includes early diagnosis and management of hypertension, diabetes, dyslipidemia, obesity and coronary heart disease, as well as life style modification like physical activity, cessation of tobacco and smoking and adopting good dietary habits.[6]

Benefits of primary stoke prevention are given in tabulated form below

Hypertension	Maintain healthy lifestyle with regular exercise, balanced diet, low in sodium, and early diagnosis and management of hypertension
Diabetes	Manage blood sugar levels through diet, medication and

	healthy lifestyle, with regular monitoring
High Cholesterol	Adopt a low cholesterol diet, exercise regularly, and take medications to lower cholesterol as indicated
Obesity	Aim for a healthy weight, through a combination of diet and exercise
Physical inactivity	Engage in regular physical activity, aiming for at least 150 minutes of moderate intensity exercise per week
Smoking and Tobacco use	All forms of tobacco use increases risk of stroke and should be avoided. smoking, This includes chewed tobacco, and second-hand smoke
Atrial Fibrillation/Coronary heart Disease	If heart disease has been identified, it must be appropriately treated. Rhythm disorders like Atrial fibrillation are risk factors for future stroke and risk must be calculated and treatment should be given accordingly.
Unhealthy Diet	Diet rich in saturated fats and red meat increases risk of stroke. Adopt a balanced diet rich in fruits, vegetables, whole grains and lean proteins.
Sleep Apnea	Sleep apnea should be screened for when suspected and once diagnosed must be treated to reduce risk of stroke
Aspirin use	Use of low dose Aspirin in healthy older people has shown an increase in risk of intracranial hemorrhage without a difference in incidence of ischemic stroke. Therefore, its use for primary prevention cannot be justified given the current level of evidence

Secondary Stroke Prevention

A) Lifestyle modifications:

1) Smoking / Tobacco:

Healthcare providers should strongly advise every patient with stroke or TIA who has smoked in the past year to quit active smoking, chewing tobacco like paan, gutka, naswar and avoid environmental tobacco smoke. Counseling, nicotine products, and oral smoking cessation medications all are effective in helping smokers to quit.[7]

2) Physical activity

For patients with ischemic stroke or TIA should participate in at least three to four sessions per week of moderate- to vigorous-intensity aerobic physical exercise to reduce stroke risk factors. Sessions should last for about 40 minutes. Moderate-intensity exercise is typically defined as sufficient to break a sweat or noticeably raise heart rate (e.g., walking briskly, using an exercise bicycle). Vigorous-intensity exercise includes activities such as jogging.[8]

3) Obesity

All patients with TIA or stroke should be screened for obesity with measurement of BMI and waist to hip ratio. Life style modifications, healthy dietary habits, exercise and medicines should be considered to reduce weight.[9]

4) Diet

It is important to counsel patients with a history of stroke or TIA to follow diet rich in vegetables, fruits, whole grains, low-fat dairy products, poultry, fish, legumes, olive oil, and nuts and to limit intake of sweets and red meats. Two such diets are Mediterranean-type diet and DASH diet.[10] Patients with a history of stroke or TIA should also reduce their sodium intake to less than ≈2.4 g/d.

5) Air pollution and climate change

The environment has recently been identified as a strong risk factor for ischemic stroke. The brain is most affected by the body organ due to the environment. Strong advocacy efforts are needed at community and society level to decrease air pollution (acceptable air quality index less than 50) and limit use of greenhouse gases for climate change.

6) Obstructive Sleep Apnea (OSA)

In patients with an ischemic stroke or TIA and OSA, treatment with continuous positive airway pressure (CPAP) can be beneficial for improved sleep apnea, hypertension control, prevention of arrhythmias, sleepiness, and other apnea related outcomes.

B) Antiplatelet:

For long-term prevention of vascular events in people with non-cardioembolic ischemic stroke or TIA, antiplatelet agents should be started within the first 12 to 24 hours of symptom onset.

C) Hypertension:

In patients with acute ischemic stroke or TIA, and who are known with hypertension, anti-hypertensive medications should be resumed or started to achieve a clinic blood pressure target of <130/80 mm Hg.

In the last, prevention is one of the most effective and opt efficient ways to reduce the increasing stroke burden which has divesting impacts on individual and societal level.

Management and Treatment of Stroke

The following aspects of Ischemic stroke management:

General Management of Stroke

The following measures apply care of all ischemic stroke patients, irrespective of whether they have received thrombolysis or thrombectomy. The care of stroke patients should be carried out in an organized unit, called a stroke unit.

1) Oxygen during acute phase of stroke

Maintaining adequate tissue oxygen saturation of >94%

is important during periods of acute cerebral ischemia to prevent hypoxia and potential worsening of the neurologic injury. Supplemental oxygen should be administered only if there is evidence of hypoxia.

2) Blood pressure management

Blood pressure may be elevated for the first 24–48 hours in patients with acute stroke. This is due to acute hypertensive response which takes 7-10 days to recover. Antihypertensive agents should be withheld unless the diastolic blood pressure is above 120 mmHg, or the systolic blood pressure is above 220 mmHg in those patients who are not candidate for IV thrombolytic therapy.

3) Hyperglycemia and hypoglycemia

It is reasonable to treat hyperglycemia to achieve blood glucose levels in a range of 140 to 180 mg/dL and to closely monitor to prevent hypoglycemia in patients with AIS. Hypoglycemia of < 60 mg should be treated in acute stroke patients. Insulin sliding scale is recommended to manage hyperglycemia before, during and after thrombolytic therapy. Intravenous insulin infusion can be used cautiously in patients with very high glucose levels.

4) Antithrombotic Agents

After IV thrombolysis with Alteplase antiplatelet will be started after 24 hours. If patient is not a candidate for thrombolysis, antiplatelet should be initiated as early as possible, ideally within 12-24 hours of symptom onset, after an intracranial hemorrhage has been ruled out. Details of which agents are recommended are discussed in secondary prevention section.

If the patient is a candidate for anticoagulation, the timing of anticoagulation will depend on the size of ischemic infarct and risk of hemorrhagic transformation.

5) Lipid Lowering Agents

Patients with ischemic stroke and TIA without a proven cardioembolic mechanism, and an LDL cholesterol above 100mg/dL should be started on Atorvastatin 80mg daily. Target LDL in patients with atherosclerotic etiology of stroke, is <70 mg/dL and Ezetimibe 10 mg daily may be added to achieve this target.

6) Nutrition and Hydration

Patients should receive isotonic hydration and free fluids should be avoided. Nutritional supplementation is not necessary. However, an evaluation for aspiration is needed prior to initiation of diet and the diet should be modified accordingly.

7) Dysphagia and aspiration

Incidence of dysphagia varies among stroke patients. Dysphagia can lead to complications, such as aspiration pneumonia; dehydration; and malnutrition which in turn can lead to prolonged hospital stay; psychological disorders such as stress, anxiety, and depression; decreased quality of life; increased health costs; increased mortality and decreased patient outcomes after stroke.[11]

8) Prevention of bed sores

The stroke patients who are unable to mobilize are at the risk of developing bed sores. Ideally, they should be provided with a pressure-relieving mattress as an alternative to a standard hospital mattress. There should be standing instructions for re-positioning these patients every two hours to avoid pressure sores.

9) Deep vein thrombosis

Avoidance of deep vein thrombosis in immobilized patients via frequent movements and the use of low dose s/c heparin.

10) Corticosteroids

Steroids do not appear to have any beneficial role in management of patients with presumed acute stroke. Usage of steroids in these cases may elicit unwanted adverse effects such as hyperglycemia and infections.[21] Steroid should be avoided in patients with acute stroke or intracranial hemorrhage.

Acute Management of Stroke

Pre-hospital Stroke Care: The concept of pre-hospital care is not well established in Pakistan. Currently, Pakistan lacks an organized and a unified emergency medical service (EMS) that can provide a fast and responsive service in urban and rural areas. A coordinated and organized participation of EMS with public and private hospitals and increased levels of stroke awareness in general public will help to optimize stroke management in Pakistan.[12]

In-Hospital Management

Stroke is a medical emergency and there should be no delay in its diagnosis and treatment. Any patient with acute onset of focal neurological deficit, should be managed in a priority setting, with focus on immediate resuscitation if unstable. Once on the ED bed, a rapid airway, breathing and circulation assessment should be performed and treatment of life-threatening conditions initiated. Supplemental oxygen should be given only if patient is hypoxemic.[13] Hypotension and hypovolemia should be corrected for adequate organ perfusion. Treating physician must identify the time of onset of stroke symptoms, which is the most crucial step in determining therapy.

Emergency Department Management:

Airway, breathing, circulation	Ensure stability of airway, breathing and circulation Supplemental oxygen if Saturation <95%
Blood Sugar	Check Blood Sugar: Dextrose 25%, if RBS <50 mg/dL
History with special focus on Time Last Seen Normal	SAMPLE questions
Neurological Examination	Patient with suspected acute stroke should ideally be assessed by a specialist clinician (trained in acute stroke assessment)
Lab Tests	NIH Stroke Scale should be used to assess stroke severity
For all patients	• Blood glucose • Serum electrolytes • Renal function tests • ECG Markers of cardiac ischemia

	• Complete blood count, including platelet count • Coagulation profile including Prothrombin time/international normalized ratio (INR) Activated partial thromboplastin time.
For Selected patients	• Hepatic function tests • Toxicology screen • Blood alcohol level • Pregnancy test • Arterial blood gas tests (if hypoxia is suspected) • Chest radiography (if lung disease is suspected) • Lumbar puncture (if subarachnoid hemorrhage is suspected and CT scan is negative for blood) • Electroencephalogram (if seizures are suspected
Imaging	Patients with suspected acute stroke should receive brain imaging as soon as possible
CT brain	• CT/MR Perfusion • CT brain plain is the investigation of choice • Interpretation of CT brain to take reperfusion decision should only be undertaken by healthcare personnel who have received appropriate training for this
CT Angiogram	• In centers capable of performing mechanical thrombectomy, patients with ischemic stroke who are potentially eligible for the procedure must undergo CT angiogram from arch of the aorta to skull vertex as soon as possible. This should not delay administration of thrombolysis. • CT angiogram should also be performed without delay in centers that can transfer patients to thrombectomy capable centers
MRI Brain	• For patients with unknown time of onset and those with wake-up stroke, MRI Brain with stroke specific sequences (DWI-FLAIR) can be done to select patients within window for thrombolysis (4.5 hours)
CT/MR Perfusion	• Patients with acute ischemic stroke and large vessel occlusion in the delayed window (6-24) can undergo CT/MR perfusion to determine their eligibility for endovascular therapy in the extended window up to 24 hours.

Identification of stroke is encouraged to be made at the community level worldwide. There is no national awareness campaign or educational platform for the general public to get awareness about the signs of early stroke. It is only at the level of medical specialists or neurologists that most of these patients are quickly and correctly diagnosed and treatment of acute ischaemic strokes and TIAs as the window period for administering thrombolysis is just 4.5 hours of symptom onset and timely mechanical thrombectomy may be done.

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Original Article

Surgical Management VS Biologic Therapy with Nasal Polyps

Comparative Outcomes of Surgical Management Versus Biologic Therapy in Patients with Nasal Polyps: A Retrospective Study from a Tertiary Care Center

Ibrahim K. Aljabr

ABSTRACT

Objective: This investigation aimed to evaluate and contrast outcomes of endoscopic sinus surgery and biologic treatment with respect to sinonasal symptom burden, health-related quality of life, and polyp recurrence in patients with relapsing CRSwNP.

Study Design: Retrospective observational study

Place and Duration of Study: This study was conducted at the Otorhinolaryngology and Head and Neck Surgery Division at a tertiary referral hospital in Alahsa City spanning July 2022 to July 2025.

Methods: One hundred and twenty adult CRSwNP patients were enrolled and allocated to two treatment arms: Arm A (n=60) received functional endoscopic sinus surgery (FESS), while Arm B (n=60) was managed with biologic agents (dupilumab or mepolizumab). Treatment response was quantified through SNOT-22 scoring, health-related quality of life instruments, and polyp recurrence documentation across a minimum observation window of 6–12 months.

Results: SNOT-22 scores declined meaningfully in both treatment arms; however, the magnitude of reduction was substantially greater in the biologic arm at the six-month assessment (22.1 ± 7.5 versus 28.6 ± 8.2; $p<0.01$). Patient-reported quality of life gains favored the biologic arm (72% vs. 55%; $p=0.03$). Polyp recurrence was markedly less frequent among biologic-treated patients (10%) relative to those who underwent surgery (30%; $p<0.01$). While surgery conferred more rapid early relief, biologics yielded superior durable disease suppression.

Conclusion: Biologic treatment demonstrated advantages in sustained symptom suppression, enhanced quality of life, and lower recurrence rates when measured against surgical management alone in CRSwNP patients. Surgery nonetheless retains clear utility as a strategy for prompt symptomatic relief. Clinical decision-making should adopt an individualized framework tailored to patient profile and disease characteristics.

Key Words: Chronic rhinosinusitis, nasal polyps, endoscopic sinus surgery, dupilumab, mepolizumab, biologic therapy, quality of life, SNOT-22

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INTRODUCTION

CRSwNP is a long-standing inflammatory condition of the sinonasal mucosa defined by non-malignant, fluid-filled tissue overgrowths that originate predominantly from the ethmoid region and nasal passages.

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Epidemiological data indicate a prevalence of roughly 2–4% across the general population, with the disease exerting considerable morbidity through symptoms including nasal blockade, loss of smell, facial congestion, and disrupted sleep[1]. Its pathophysiology centers on aberrant type 2 immune activation, characterized by elevation of cytokines including IL-4, IL-5, and IL-13, together with tissue eosinophilia of the nasal lining[2].

The wider impact of CRSwNP encompasses not only physical disability but also meaningful reductions in occupational performance, psychological health, and overall quality of life. Validated outcome instruments such as the 22-item Sinonasal Outcome Test (SNOT-22) have consistently shown that health-related quality of life deficits in CRSwNP patients are of a magnitude comparable to those seen in severe asthma and COPD[3].

The condition is also commonly complicated by co-occurring conditions, notably asthma and aspirin-exacerbated respiratory disease (AERD), which amplify disease complexity and heighten the risk of relapse[4].

Standard pharmacological management relies on intranasal glucocorticoid sprays and intermittent systemic steroid courses, which may alleviate symptoms transiently without resolving the immunological drivers of polyp development[5]. For patients unresponsive to medical therapy or with advanced disease, endoscopic sinus surgery (ESS) has historically represented the main interventional option, as it restores sinus aeration and optimizes drug penetration to mucosal surfaces. Nonetheless, postoperative recurrence poses a persistent clinical challenge, with reported relapse rates reaching 40–60% within several years of the procedure[6].

Over the past decade, targeted immunotherapy through biologic agents has transformed the treatment landscape for severe and recalcitrant CRSwNP. Among these, dupilumab, which blocks the shared receptor subunit for IL-4 and IL-13, and mepolizumab, an antibody directed against IL-5, interrupt core inflammatory circuits that sustain polyp growth[7]. Evidence from controlled trials has established that both agents produce meaningful reductions in polyp burden, restore nasal patency, improve olfactory function, and elevate patient-reported quality of life[8].

Notwithstanding therapeutic advances on both fronts, the optimal selection between operative and pharmacobiologic strategies remains contested in clinical practice. Surgical intervention delivers prompt mechanical decompression, whereas biologic treatment provides ongoing modulation of mucosal inflammation at the expense of prolonged treatment duration and elevated cost burden[9]. Direct, real-world comparative evidence on patient-centered outcomes such as symptom severity and quality of life across these two modalities is still limited.

Against this backdrop, the present retrospective investigation was undertaken to directly compare clinical outcomes in CRSwNP patients managed with endoscopic sinus surgery versus those receiving dupilumab or mepolizumab at a tertiary referral center. Primary areas of inquiry included changes in symptom burden, quality of life outcomes, and polyp recurrence across a three-year observational horizon.

METHODS

Study Design and Setting: This investigation employed a retrospective observational design, drawing upon patient records from the Ear, Nose, Throat, Head and Neck Surgery Department at a tertiary-level hospital in Alahsa City, Kingdom of Saudi Arabia. Medical documentation spanning the period from July 2022 to July 2025 was reviewed.

Study Population: The study population comprised individuals with a confirmed diagnosis of CRSwNP who had previously undergone at least one session of functional endoscopic sinus surgery and subsequently received either operative or biologic intervention within the study timeframe.

Inclusion Criteria

- Adults aged ≥18 years
- Diagnosed with bilateral nasal polyps confirmed by nasal endoscopy and/or computed tomography (CT) scan
- Patients who underwent endoscopic sinus surgery or received biologic therapy (dupilumab or mepolizumab)
- Minimum follow-up duration of 6 months
- Positive history of functional endoscopic sinus surgery before at least 6 months
- Complete medical records available

Exclusion Criteria

- Patients with sinonasal malignancies
- Immunodeficiency disorders
- Previous sinonasal surgery within 6 months prior to study inclusion
- Incomplete or missing clinical data

Study Groups: Patients were categorized into two groups based on treatment modality. Both groups have a positive history of functional endoscopic sinus surgery before at least 6 months:

- Group A (Surgical Group): Patients who underwent functional endoscopic sinus surgery (FESS) under general anesthesia. The procedure aimed at removal of polyps, clearance of diseased mucosa, and restoration of sinus ventilation.
- Group B (Biologic Therapy Group): Patients treated with biologic agents, either:
  - Dupilumab administered subcutaneously (300 mg every 2 weeks) OR
  - Mepolizumab administered subcutaneously (100 mg every 4 weeks)

Treatment choice was based on clinician judgment, disease severity, patient preference, and availability of therapy.

Data Collection: Data were retrieved from electronic medical records and included:

- Demographic details (age, gender)
- Clinical presentation (nasal obstruction, anosmia, rhinorrhea, facial pain)
- Comorbid conditions (asthma, AERD)
- Treatment modality
- Baseline and follow-up symptom scores
- Quality of life assessments
- Recurrence and need for revision treatment

Outcome Measures

Primary Outcomes

1. **Symptom Improvement:** Measured using the 22-item Sinonasal Outcome Test (SNOT-22), a

validated tool assessing symptom severity and impact on daily life[10].

2. **Quality of Life (QoL):** Evaluated based on changes in SNOT-22 scores and patient-reported improvement in sleep, smell, and daily functioning.

Secondary Outcomes: Recurrence rate (defined as reappearance of nasal polyps on endoscopy requiring additional medical or surgical intervention)

- Time to recurrence
- Adverse events related to treatment

Follow-Up Protocol

Patients were followed at regular intervals:

- Baseline (pre-treatment)
- 3 months
- 6 months
- 12 months

Endoscopic examination and symptom scoring were performed at each visit.

Statistical Analysis: Data was analyzed using Statistical Package for the Social Sciences (SPSS) version XX.

- Continuous variables were expressed as mean ± standard deviation (SD)
- Categorical variables were expressed as frequencies and percentages
- Independent t-test was used to compare means between groups
- Paired t-test was used for within-group comparisons
- Chi-square test was used for categorical data
- A p-value of <0.05 was considered statistically significant

Ethical Considerations: The study was conducted following approval from the Institutional Ethics Committee. As this was a retrospective study, informed consent was waived. Patient confidentiality and data privacy were strictly maintained in accordance with institutional guidelines.

RESULTS

Across the study period, 120 patients with confirmed CRSwNP satisfied all eligibility requirements and were enrolled in the final analytical cohort. Within this cohort, 60 individuals (Group A) underwent functional endoscopic sinus surgery, and the remaining 60 (Group B) were treated with either Dupilumab or Mepolizumab. Average follow-up duration across both groups was 12.4 ± 3.6 months.

Pre-treatment demographic and clinical profiles were well-matched between groups, with no statistically meaningful intergroup differences detected at baseline. Surgical group patients had a mean age of 43.1 ± 10.8 years; the biologic group mean was 41.9 ± 11.6 years. Male patients constituted the majority in both cohorts. The most prevalent presenting complaints were nasal obstruction, loss of smell, rhinorrhea, and facial pressure or fullness. Concurrent asthma was documented in roughly one-third of participants in each group.

Table No. 1: Baseline Demographic and Clinical Characteristics

Parameter	Surgery Group (n=60)	Biologic Group (n=60)	p-value
Mean Age (years)	43.1 ± 10.8	41.9 ± 11.6	0.58
Male (%)	66.7%	63.3%	0.71
Nasal Obstruction (%)	95%	93%	0.65
Anosmia (%)	78%	82%	0.59
Asthma (%)	35%	38%	0.72
AERD (%)	12%	15%	0.64

Symptom amelioration as captured by SNOT-22 was observed in both treatment arms by the six-month assessment, though the extent of improvement diverged considerably between groups. Pre-treatment SNOT-22 values were comparable (Group A: 58.2 ± 10.4; Group B: 57.5 ± 9.8; $p > 0.05$). At six months, scores declined in both arms; however, the biologic group achieved a lower mean score (22.1 ± 7.5) relative to the surgical group (28.6 ± 8.2), and this difference reached statistical significance ($p < 0.01$).

Table No. 2: Comparison of SNOT-22 Scores

Time Point	Surgery Group	Biologic Group	p-value
Baseline	58.2 ± 10.4	57.5 ± 9.8	0.72
3 Months	35.4 ± 9.1	28.9 ± 8.3	<0.01
6 Months	28.6 ± 8.2	22.1 ± 7.5	<0.01

Figure No. 1: Temporal trajectory of mean SNOT-22 scores across the observation period for both the surgical and biologic treatment groups. Both cohorts exhibited meaningful symptomatic improvement, with the biologic arm demonstrating a more pronounced and durable decline in SNOT-22 values.

Quality of life gains were reported across several domains in both treatment groups, encompassing improvements in sleep, daily activities, and emotional functioning. Notably, biologic-treated patients achieved significantly greater restoration of olfactory capacity and more sustained relief over the long term. At the twelve-month evaluation, a marked quality of life improvement was reported by 72% of biologic group patients versus 55% of surgical group patients ($p = 0.03$).

Table No. 3: Quality of Life Improvement at 12 Months

Outcome	Surgery Group	Biologic Group	p-value
Marked Improvement (%)	55%	72%	0.03
Moderate Improvement (%)	30%	20%	0.18
Minimal/No Improvement (%)	15%	8%	0.21

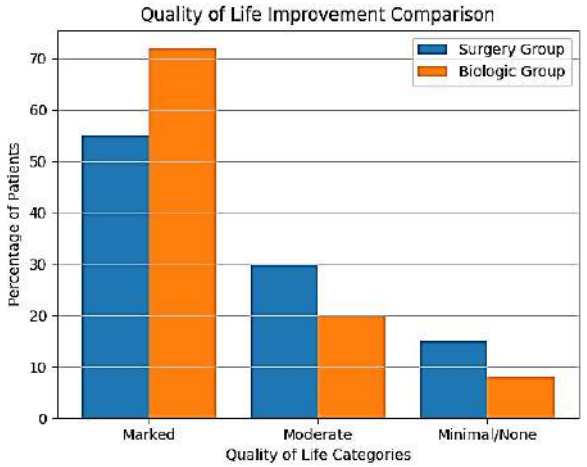

Figure No. 2: Bar chart illustrating comparative quality of life outcomes between the surgical and biologic therapy cohorts. A greater proportion of patients receiving biologics reported marked overall improvement, while a smaller proportion experienced negligible benefit relative to surgically treated counterparts.

Polyp regrowth was substantially more prevalent in the surgically managed cohort than in the biologic therapy cohort. Over the observation period, 18 of 60 surgical patients (30%) developed recurrence necessitating further medical or surgical management, in contrast to only 6 of 60 biologic patients (10%), yielding a statistically significant difference ($p < 0.01$). The interval preceding recurrence was also considerably shorter among surgical patients (mean 8.2 ± 2.1 months) compared to those on biologics (11.6 ± 1.8 months).

Table No. 4: Recurrence Rates and Time to Recurrence

Parameter	Surgery Group	Biologic Group	p-value
Recurrence (%)	30%	10%	<0.01
Time to Recurrence (months)	8.2 ± 2.1	11.6 ± 1.8	<0.01

With respect to tolerability, both interventions were generally well-accepted by patients. Minor surgical complications arose in the operative group, including postoperative hemorrhage in 8% and nasal crusting in 15% of cases. The biologic group experienced a distinct but mild adverse event profile, predominantly consisting of injection site discomfort (10%) and transient cephalgia (5%), with no serious systemic events documented in either group.

Table No. 5: Adverse Events

Adverse Event	Surgery Group	Biologic Group
Bleeding	8%	-
Nasal Crusting	15%	-
Injection Site Reaction	-	10%
Headache	-	5%

In aggregate, surgical treatment afforded more immediate symptomatic benefit, whereas biologic therapy achieved superior outcomes across measures of sustained disease control, patient-reported quality of life, and long-term polyp recurrence prevention throughout the study horizon.

DISCUSSION

This retrospective investigation examined treatment outcomes in CRSwNP patients who received either surgical or biologic intervention at a tertiary care institution across a three-year period. The data reveal that, although both modalities confer meaningful improvements in symptom scores and quality of life measures, biologic-based management demonstrates clear superiority with regard to durable disease suppression, lower recurrence frequency, and more favorable patient-reported outcomes. These findings align with current paradigm shifts recognizing CRSwNP as a predominantly type 2 inflammatory disorder for which targeted immunological interventions are increasingly appropriate[11].

A prominent observation in this study was the significantly larger decline in SNOT-22 scores among patients receiving biologic treatment. While surgical decompression yielded earlier relief, particularly of nasal obstruction, the biologic cohort maintained more consistent and durable improvement over successive follow-up intervals. This is consistent with findings from prospective randomized trials confirming that agents such as Dupilumab and Mepolizumab

substantially reduce mucosal inflammatory burden and sustain nasal functional recovery[12]. The pharmacological rationale lies in direct blockade of the IL-4, IL-5, and IL-13 signaling axes that perpetuate polyp pathology, in contrast to surgery, which removes polyp tissue but leaves the inflammatory milieu intact[13]. Quality of life data from this study further corroborate the benefit of biologic treatment. Patients in the biologic arm reported substantially greater gains in olfactory perception, sleep architecture, and functional daily capacity at twelve months. Smell impairment, a defining symptom of CRSwNP, tends to persist after surgery when underlying mucosal inflammation is not adequately controlled. Biological agents, by attenuating eosinophil-driven inflammation and resolving mucosal swelling, facilitate more robust olfactory recovery, a finding corroborated by earlier published investigations[14].

Polyp recurrence represents one of the most formidable obstacles in CRSwNP management. In this cohort, the surgical group exhibited a recurrence rate threefold higher than the biologic group (30% vs 10%), with a meaningfully shorter interval to recurrence. These observations are concordant with published data documenting post-ESS recurrence frequencies approaching 40–60%, particularly in patients with eosinophil-predominant disease or concurrent asthma[15]. The comparatively low recurrence rate in the biologic arm highlights the therapeutic significance of suppressing systemic inflammatory pathways, which drive ongoing polyp regrowth beyond the immediate postoperative period[16].

Notwithstanding the advantages of biologic therapy demonstrated herein, surgical management retains an important position in the CRSwNP treatment algorithm. FESS delivers immediate decompression of the obstructed sinonasal passages, enhances sinus drainage, and augments penetration of topically administered medications. In settings with restricted access to biologic agents or in patients with acute, severe symptom burden, operative management represents a practical first-line intervention[17]. Moreover, surgery may function synergistically with subsequent biologic therapy in patients presenting with extensive polypoid disease.

The adverse event patterns documented in this study were broadly consistent with the established safety literature. Complications following surgery were predominantly minor and resolved without intervention, whereas biologic treatment produced a distinct but equally mild side effect profile characterized by local injection site reactions and headache. Crucially, neither treatment arm was associated with serious adverse events, affirming the acceptable safety profile of both management strategies[18].

The adoption of biologic agents is nonetheless constrained by practical considerations. The high acquisition cost, requirement for indefinite administration, and restricted availability in many healthcare systems represent meaningful barriers, particularly in lower-resource settings. Economic modeling studies have indicated that the favorable cost-utility of biologics is most evident in patients with severe, relapsing, or surgically recalcitrant disease[19]. Appropriate patient stratification is therefore essential to maximize therapeutic value while ensuring judicious resource allocation.

This analysis adds to the accumulating corpus of real-world data comparing operative and biologic treatment approaches in CRSwNP. The results underscore an ongoing transition toward precision therapeutics, wherein individualized treatment planning accounts for disease endotype, severity, comorbidity burden, and patient preferences. Collaborative engagement of otolaryngology, allergy and immunology, and respiratory medicine specialists is central to achieving optimal outcomes for this complex patient population.

Several methodological limitations warrant acknowledgment. The retrospective framework introduces inherent risks of selection and information bias, and restriction to a single institutional site constrains the external validity of the findings. Furthermore, while the follow-up period was sufficient to capture short- and medium-term clinical trajectories, extended observation will be necessary to fully characterize long-term recurrence dynamics and disease progression. Well-designed prospective, multicenter investigations with extended follow-up periods are warranted to substantiate the present findings and inform evidence-based treatment protocols.

In conclusion, the data from this study indicate that biologic treatment confers superior durable outcomes relative to surgery in CRSwNP management, with particular advantages in disease control sustainability, patient quality of life, and protection against polyp recurrence. Surgery nonetheless maintains a well-defined therapeutic role, especially where early symptomatic relief is the treatment priority. An individualized, patient-centered approach guided by disease severity, phenotype, and clinical context remains the optimal framework for managing this chronic airway condition

CONCLUSION

Surgical and biologic approaches each offer meaningful clinical benefit in the treatment of CRSwNP. Notwithstanding, the present data indicate that Dupilumab and Mepolizumab achieve superior long-term disease suppression, greater quality of life gains, and reduced polyp recurrence compared to operative intervention. Surgery retains its role as an effective strategy for prompt relief of sinonasal obstruction, yet treatment selection should be individualized, incorporating disease severity, inflammatory

phenotype, and patient-specific factors within a multidisciplinary decision-making framework.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Ibrahim K. Aljabr
Drafting or Revising Critically:	Ibrahim K. Aljabr
Final Approval of version:	The above author
Agreement to accountable for all aspects of work:	The above author

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Original Article

Rapid Decellularization of Bovine Amniotic Membrane Using EDTA Pretreatment and Low Concentration SDS

Erfan Nasrullah[1,2,3] and Heri Suroto[1,2,4]

ABSTRACT

Objective: To identify a cost-effective protocol that achieves effective decellularization while preserving the key biological properties of bovine amniotic membrane.

Study Design: Experimental laboratory study

Place and Duration of Study: This was conducted at the Tropical Disease Center Laboratory, Universitas Airlangga, Surabaya, Indonesia; the Histology Laboratory, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia; and the Pathology Laboratory, R.T. Notopuro Regional General Hospital, Sidoarjo, Indonesia, between December 2025 and April 2026.

Methods: BAM samples from six healthy donor cows underwent 0.2% EDTA pretreatment followed by varying SDS concentrations and exposure durations. Decellularization efficacy was assessed by residual double stranded DNA (dsDNA) quantification and histological evaluation of residual nuclei. Collagen density, transforming growth factor beta 1 (TGFβ1), and BHK 21 fibroblast viability were evaluated to assess scaffold preservation and cytocompatibility.

Results: Decellularization significantly reduced residual dsDNA levels ($p = 0.001$). Treatment with 0.2% EDTA for 30 minutes followed by 0.1% SDS for 30 minutes reduced dsDNA below the accepted decellularization threshold and eliminated detectable cellular nuclei. Increasing SDS concentration or exposure duration provided no additional decellularization benefit. Collagen density differed significantly among groups ($p = 0.009$), with higher SDS exposure associated with greater extracellular matrix disruption. TGFβ1 levels were not significantly different between groups ($p = 0.157$). All groups demonstrated cell viability above 70%, indicating acceptable cytocompatibility.

Conclusions: Pretreatment with 0.2% EDTA for 30 minutes followed by 0.1% SDS for 30 minutes provided effective decellularization while preserving extracellular matrix structure, TGFβ1 retention, and cytocompatibility. This simple protocol may represent a practical approach for producing BAM derived scaffolds for regenerative medicine.

Key Words: Amniotic Membrane, Decellularization, Extracellular Matrix, Tissue Engineering, Regenerative Medicine

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INTRODUCTION

Amniotic membrane is widely used as a biological scaffold because its extracellular matrix (ECM) architecture and bioactive molecules support tissue repair, angiogenesis, and matrix remodeling.[1,2] These properties have enabled broad applications in regenerative medicine and tissue engineering. However, clinical use of human amniotic membrane is limited by donor availability, ethical concerns, and stringent donor screening requirements.[2] As a result, alternative tissue sources suitable for scalable biomaterial production are increasingly being explored.[3]

Bovine amniotic membrane (BAM) is a promising alternative because it shares key structural and biological features with human amniotic membrane, including a collagen-rich ECM and regenerative growth factors.[4] Larger tissue availability and favorable biomechanical properties further support its potential use in regenerative medicine.[5,6] However, as a xenogeneic tissue, BAM contains cellular and nuclear components that may trigger host immune responses

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after implantation. Effective decellularization is therefore necessary to improve biocompatibility while preserving ECM structure and function.[3]

Among decellularization methods, sodium dodecyl sulfate (SDS) is widely used for its ability to remove cellular and nuclear material.[7] However, excessive exposure may damage the ECM and impair scaffold performance.[7] Ethylenediaminetetraacetic acid (EDTA) disrupts calcium-dependent cell–matrix interactions and may enhance detergent-based decellularization.[7] Previous studies have achieved amniotic membrane decellularization using detergent combinations, enzymatic digestion, prolonged processing, or extensive tissue manipulation.[8-11] Although effective, these approaches may increase cost and processing complexity.

This study evaluated a simplified decellularization protocol using EDTA pretreatment followed by varying SDS concentrations and exposure durations. Decellularization efficacy was assessed by residual double-stranded DNA quantification and histological evaluation, while scaffold preservation was examined through collagen density, transforming growth factor beta 1 (TGF-β1) retention, and cytocompatibility analyses. The aim was to identify a cost-effective protocol that achieves effective decellularization while preserving the key biological properties of bovine amniotic membrane.

METHODS

Sample preparation and decellularization: This experimental laboratory study was conducted at the Tropical Disease Center Laboratory, Universitas Airlangga, Surabaya, Indonesia; the Histology Laboratory, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia; and the Pathology Laboratory, R.T. Notopuro Regional General Hospital, Sidoarjo, Indonesia, between December 2025 and April 2026. The study protocol was approved by the Animal Care and Use Committee (ACUC), Universitas Airlangga (Approval No. 2.KEH.187.012.2025).

Bovine amniotic membranes (BAM) were obtained from six healthy cows immediately after normal delivery. Following removal of blood contaminants and separation from the chorion, membranes were assigned to seven groups: native BAM without treatment (K0), EDTA 0.2% for 30 minutes (K1), EDTA 0.2% for 30 minutes followed by SDS 0.1% for 30 minutes (K2), EDTA 0.2% for 30 minutes followed by SDS 0.1% for 60 minutes (K3), EDTA 0.2% for 30 minutes followed by SDS 0.3% for 30 minutes (K4), EDTA 0.2% for 30 minutes followed by SDS 0.5% for 60 minutes (K5), and EDTA 0.2% for 30 minutes followed by SDS 0.5% for 90 minutes (K6).

Following decellularization, membranes were washed with distilled water, freeze dried, sterilized by beta irradiation (25 kGy), and stored at 4°C until analysis.

Evaluation of decellularization efficiency: Decellularization efficacy was assessed by residual double stranded DNA (dsDNA) quantification and histological evaluation of residual nuclei. Residual dsDNA was measured using the QuantiFluor® dsDNA System (Promega, USA) and expressed as ng/mg dry tissue weight. Histological assessment was performed using hematoxylin and eosin staining, and residual nuclei were quantified from five randomly selected non overlapping high power fields per specimen.

Evaluation of scaffold preservation: Scaffold preservation was assessed through collagen density and transforming growth factor beta 1 (TGFβ1) retention. Collagen density was evaluated using Mallory Azan staining and quantified with ImageJ software (National Institutes of Health, USA). TGFβ1 concentrations were measured using a bovine specific ELISA kit (ELK Biotechnology, China) according to the manufacturer's instructions.

Cytocompatibility assessment: Cytocompatibility was evaluated using an indirect MTT assay in BHK 21 fibroblasts. Cell viability was expressed as a percentage relative to untreated controls. Materials with viability ≥70% were considered non cytotoxic according to ISO 10993.[12]

Statistical analysis: Data normality was assessed using the Shapiro Wilk test. Comparisons among groups were performed using the Friedman test followed by the Durbin Conover post hoc test when appropriate. Statistical significance was defined as $p < 0.05$.

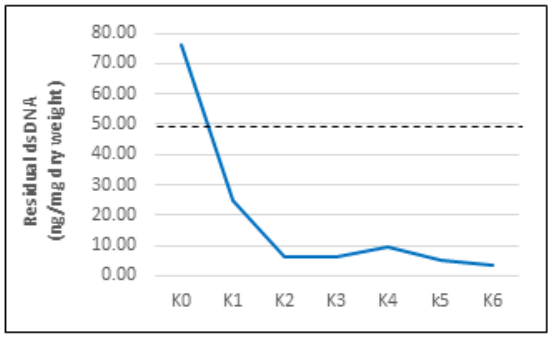
RESULTS

Decellularization efficiency: Residual dsDNA levels decreased significantly following decellularization ($p = 0.001$). Native BAM demonstrated a median dsDNA content of 76.10 ng/mg dry weight, which decreased to 24.78 ng/mg after EDTA treatment alone (K1) and to 6.36 ng/mg following treatment with EDTA 0.2% and SDS 0.1% for 30 minutes (K2). Further increases in SDS concentration or exposure duration did not result in meaningful additional reductions in dsDNA levels (Figure 1). Post hoc analysis demonstrated a significant difference between K0 and K2 ($p < 0.01$), whereas no significant difference was observed between K2 and the remaining SDS treated groups.

Histological analysis supported the dsDNA findings (Figure 2). Native BAM contained abundant cellular nuclei, whereas progressive cellular removal was observed following decellularization. No residual nuclei were detected in groups K2 through K6. Quantitative analysis demonstrated a significant difference among groups ($p < 0.01$), with complete removal of visible nuclei achieved following treatment with EDTA 0.2% and SDS 0.1% for 30 minutes.

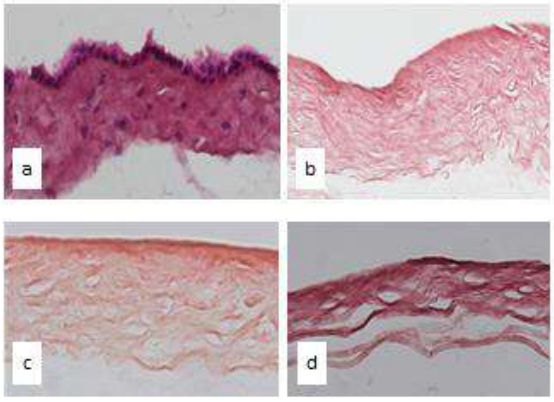
Scaffold preservation: Collagen architecture was progressively affected by increasing SDS concentration and exposure duration (Figure 3). Native BAM

exhibited densely organized collagen fibers, whereas higher intensity SDS treatments resulted in a more dispersed collagen structure.



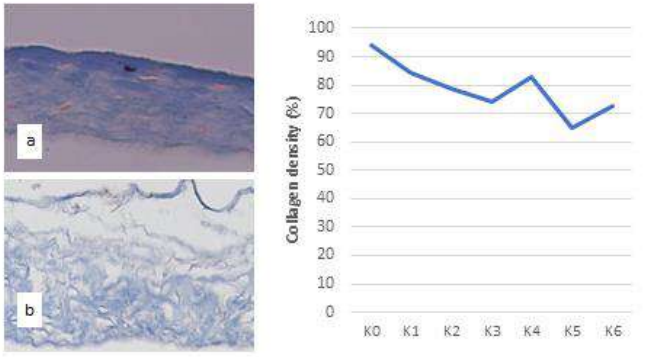
	Median	Min	Max
K0	76.10	8.02	500.00
K1	24.78	16.45	185.00
K2	6.36	0.93	18.10
K3	6.09	0.27	32.75
K4	9.46	6.14	27.65
K5	5.30	2.21	26.90
K6	3.66	0.43	41.00

Figure No.1: Residual double stranded DNA (dsDNA) content of bovine amniotic membrane following decellularization. Treatment groups included native BAM (K0), EDTA 0.2% for 30 minutes (K1), EDTA 0.2% for 30 minutes followed by SDS 0.1% for 30 minutes (K2), EDTA 0.2% for 30 minutes followed by SDS 0.1% for 60 minutes (K3), EDTA 0.2% for 30 minutes followed by SDS 0.3% for 30 minutes (K4), EDTA 0.2% for 30 minutes followed by SDS 0.5% for 60 minutes (K5), and EDTA 0.2% for 30 minutes followed by SDS 0.5% for 90 minutes (K6). The dashed line indicates the recommended decellularization threshold of 50 ng/mg dry tissue.



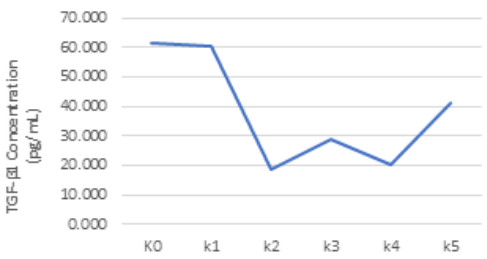
	Median	Min	Max
K0	21.1	1	61.6
K1	0	0	37.2
K2	0	0	0
K3	0	0	0
K4	0	0	0
K5	0	0	0
K6	0	0	0

Figure No.2: Histological evaluation of cellular removal following decellularization. Representative hematoxylin and eosin-stained sections of (a) native BAM (K0), (b) K1, (c) K2, and (d) K6. Progressive reduction in cellular nuclei was observed following treatment, with complete removal of detectable nuclei in groups K2 through K6. Original magnification ×400.



	K0	K1	K2	K3	K4	K5	K6
Median	93.865	84.347	78.506	74.025	82.697	65.028	72.436
Min	81.388	76.326	51.952	56.657	41.366	39.626	60.031
Max	96.931	96.077	87.632	83.570	89.780	77.223	95.437

Figure No.3: Assessment of extracellular matrix preservation following decellularization. Representative Mallory Azan-stained sections of (A) native BAM (K0) and (B) K5, demonstrating progressive alteration of collagen architecture with increasing SDS exposure. Quantitative analysis of collagen density is presented for all treatment groups. Original magnification ×400.



	Median	Min	Max
K0	61.771	19.018	1004.612
K1	60.408	17.991	941.095
K2	18.757	5.886	23.056
K3	28.640	22.557	74.783
K4	20.286	13.794	42.202
K5	41.021	23.056	51.403

Figure No.4: Transforming growth factor beta 1 (TGFβ1) concentrations in native and decellularized bovine amniotic membrane. Data are presented as median, minimum, and maximum values. TGFβ1 analysis was performed in groups K0 through K5.

Table No.1: Comparison of published amniotic membrane decellularization protocols and the protocol identified in the present study

Study	Tissue	Decellularization protocol	Duration	Additional processing
Taghiabadi et al.[8]	HAM	EDTA 0.1% + SDS 0.03%	40 h	TBS
Gholipourmalekabadi et al.[9]	HAM	EDTA 0.2%	30 min	NaOH, ammonium chloride, scraping
Yang et al.[10]	BAM	SDS 1%	12–24 h	Trypsin
Leonel et al.[11]	CAM	SDS 1%	48 h	TRIS, Triton
Sang et al.[23]	HAM	EDTA 0.05%	2 h	Scraping
Asgari et al.[16]	h-HAM	SDS 0.5%	Variable	Triton
Ignatov et al.[17]	HAM	SDS 0.5%	5 h	Triton X-100
Ballesteros et al.[24]	BAM	SDS 0.1%	4 h	PAA, NaOH
Present study	BAM	EDTA 0.2% + SDS 0.1%	60 min	None

Quantitative analysis demonstrated significant differences in collagen density among groups ($p = 0.009$). However, collagen density in K2 did not differ significantly from native BAM, indicating preservation of extracellular matrix structure despite effective decellularization.

TGFβ1 remained detectable in all evaluated groups (Figure 4). Median concentrations were 61.77 pg/mL in K0, 60.41 pg/mL in K1, 18.76 pg/mL in K2, 28.64 pg/mL in K3, 20.29 pg/mL in K4, and 41.02 pg/mL in K5. Although lower median values were observed in several decellularized groups, no significant differences were identified among groups ($p = 0.157$).

Cytocompatibility assessment: All treatment groups demonstrated cell viability values above the 70% threshold for non-cytotoxic materials. Median viability ranged from 81.74% to 92.60% across experimental groups. No reduction in cell viability was observed with increasing SDS exposure, indicating that the decellularization and washing procedures produced scaffolds with acceptable cytocompatibility.

DISCUSSION

The present study demonstrated that pretreatment with 0.2% EDTA followed by 0.1% SDS for 30 minutes provided the best balance between effective decellularization and preservation of scaffold properties. This protocol reduced residual dsDNA below the accepted threshold for decellularized tissues and completely eliminated detectable cellular nuclei, indicating effective removal of potentially immunogenic cellular components.[3] Increasing the SDS concentration or extending the exposure time did not further improve decellularization, suggesting that low concentration SDS was sufficient when combined with EDTA pretreatment. The complementary actions of EDTA and SDS likely contributed to this effect, as EDTA disrupts calcium dependent cell matrix interactions and facilitates cellular detachment, whereas SDS solubilizes cellular membranes and nuclear material.[7,13]

Preservation of the extracellular matrix is equally important during decellularization. In the present study, collagen density progressively decreased with increasing SDS concentration and exposure time, consistent with previous reports that excessive detergent exposure disrupts extracellular matrix organization and compromises scaffold integrity.[16-18] Importantly, collagen density in K2 did not differ significantly from native BAM, indicating that effective decellularization can be achieved with minimal matrix disruption when detergent exposure is carefully controlled. These findings suggest that increasing detergent exposure beyond the K2 protocol offers little additional benefit while increasing the risk of extracellular matrix damage.

TGFβ1 remained detectable in all treatment groups without significant differences after decellularization. As TGFβ1 regulates cell proliferation, differentiation, and matrix remodeling during tissue repair,[19,20] its preservation may reflect continued binding to extracellular matrix components throughout processing.[21,22] Although only TGFβ1 was evaluated, these findings suggest that the selected protocol preserved important biological characteristics of BAM.

All treatment groups demonstrated cell viability above the accepted threshold for non cytotoxic biomaterials, indicating that the washing procedure effectively minimized residual detergent toxicity. Residual SDS is a recognized concern in detergent based decellularization because incomplete removal can impair cell attachment, reduce cell viability, and adversely affect host tissue responses.[18] The favorable cytocompatibility observed in this study further supports the suitability of the selected protocol for biomaterial applications.

Comparison with previously published protocols highlights the practical advantages of the present approach (Table 1). Previous studies have achieved successful amniotic membrane decellularization using prolonged detergent exposure, enzymatic digestion, multiple reagents, or mechanical manipulation.[8-11,16,17,23,24] In contrast, the protocol identified in this study achieved effective cellular removal using only EDTA and low concentration SDS within a total treatment time of 60 minutes. This simplified approach may improve reproducibility, reduce processing costs, and facilitate larger scale production, particularly in resource limited settings.

Several limitations should be acknowledged. Bioactivity was assessed only by measuring TGFβ1 despite the presence of multiple regenerative growth factors in amniotic membrane. Biomechanical testing was not performed, precluding evaluation of functional changes in the extracellular matrix after decellularization. In addition, this study was limited to in vitro analyses. Future studies should investigate mechanical properties, host response, tissue integration, and regenerative efficacy in vivo.

CONCLUSION

Pretreatment with 0.2% EDTA followed by 0.1% SDS for 30 minutes effectively decellularized bovine amniotic membrane, reducing residual dsDNA below accepted thresholds and eliminating detectable nuclei. This protocol preserved collagen density, retained detectable TGF-β1, and demonstrated acceptable cytocompatibility. Higher SDS concentrations or longer exposure did not enhance decellularization and resulted in greater extracellular matrix disruption. These findings support a simple, low-concentration SDS protocol for producing biologically preserved bovine amniotic membrane scaffolds for regenerative medicine. Further studies should evaluate biomechanical properties and in vivo performance.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Erfan Nasrullah, Heri Suroto
Drafting or Revising Critically:	Erfan Nasrullah, Heri Suroto
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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Conflict of Interest: The study has no conflict of interest to declare by any author.

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Original Article

Effect of an Intervention Program on Functional Restoration Post Total Knee Arthroplasty

Restoration Post Total Knee Arthroplasty

Mohanned Khaleel Abdullah[1], Mohammad Salih Awad[1], Ali Mohammed Fathi[1] and Nasir Muwfaq Younis[2]

ABSTRACT

Objective: The purpose of the study is to determine the influence of an intervention program on the functional restoration post total knee arthroplasty, so as to establish the relationship between the demographic variables "age, gender, level of education, marital status, occupation, residence, body mass index" and functional restoration.
Study Design: A quantitative design using the a-pre-experimental study
Place and Duration of Study: This study was conducted at the pre and posttest on one group in AL-Jamhour Teaching Hospital, Mosul City from 6th July 2025 to 17th January 2026.
Methods: The objectives of the study were measured by self-administered questionnaires on the 30 patients who received exposure to the intervention program which was non-probability (purposive) sample. The statistical test employed (SPSS) version 26, descriptive statistical (frequency, percentages, mean of score) and inferential statistical analysis (Wilcoxon Signed Rank Test) was employed in the analysis of the data.
Results: The study finding the a statistically significant ($P < 0.001$) but substantially improved patient information was noted between sample of the study members; at post-test and pre-test.
Conclusion: This study concluded that patients in the sample of the study had a significantly better information at the post-test after taking the intervention program.
Key Words: Intervention Program, Functional Restoration,Total Knee Arthroplasty.

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INTRODUCTION

Total knee arthroplasty (TKA) has become one of the most effective procedures to control pain and dysfunction of the knee joint in the case of end-stage osteoarthritis [1-3] .As the incidence of OA has increased so have the number of TKAs.[4] And hence it has become one of the most common inpatient surgical procedures as far as Medicare is concerned [5] .Patients who have gone through a TKA are usually given physical rehabilitation with an aim of maximizing postoperative results, which include strength, physical performance, reduction of pain and resumption to normal activities of daily living.

Rehabilitation, however, is not one intervention but a multi-dimensional intervention that could begin at different times (following surgery) and practised at different intensities, frequencies, by different people, in different settings and even adapted to social, financial and individual reaction to surgery and rehabilitation[6] .Currently, it is estimated that 3.48 per cent of an estimated population is affected by Knee OA and 25 per cent of people with Knee OA are affected to a level of lifetime disability [7] .OA of knee joint may result in painful joint, loss of joint function and low quality of life. In case the joint and pain caused by OA are severe then joint replacement surgery can be needed. The total knee arthroplasties (TKAs) will expand exponentially in the future as the cases of knee OA keep on rising.[8] Knee OA can be treated in different ways among them, the non-pharmacological ones comprise exercise and lifestyle changes, pharmacological, analgesic, corticosteroid injection, and the last option is surgery [9]. Compared to UKA (8%). On the whole, TKA is effective in terms of pain alleviation and restoration of the functionality of the joints, and more than 90% of them have been reported to achieve this. satisfactory results with the patients. Regardless of this diverse arsenal of therapeutic tools, there is still a question of how best medical, injection-based, and surgical therapies should be sequenced and timed, especially in younger, active patients and unicompartmental disease or malalignment[10,11].The purpose of the study is to determine the influence of an intervention program on the functional restoration post total knee arthroplasty,

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so as to establish the relationship between the demographic variables "age, gender, level of education, marital status, occupation, residence, body mass index" and functional restoration.

METHODS

The present research is a quantitative study with a pre-test and post-test design since it will be conducted on a sample. The data are gathered two times; one to determine baseline data and the second after the intervention program is undertaken. The research took place 6 July 2025 to 17 January 2026. Besides this, the researcher designed and manufactured instrument tools to the intervention program design. To address the gaps in the information on patients, which rely on a review of the scientific literature and previous research, a non-probability (purposive) sample (30) of patients was selected randomly in the AL-Jamhory teaching hospitals in Mosul City that are directly exposed to an intervention program. A questionnaire that correlates with the assessment data of patients treated with proximal bone nailing of the intertrochanteric fractures (specifically on the activities of daily living). All the patients undergo an interview under the supervision of the researcher, (28 to 35 minutes) will be needed for each patient to answer. The questionnaire will be divided in two parts. The demographic data will be presented in the first part, and the second half will be linked to the patient information that is divided into four main axes "I know, I do not know" containing 50 items. The former axis deals with patient data related to TKA, which comprise (10) items. The second axis is functional restoration after surgery TKA which entails (30) items as follows "getting in and out of bed, toileting, showing, dressing, Get in and out of car, House activity". There are (5) items on 3rd axis (patient information saving falls). There are five (5) items for Furth axis to inform the patients of wrong positions to avoid to prevent problems after TKA surgery. These items have the following ratings based on the Likers scale: I know (1); I do not know (0). The information of this investigation was interpreted by applying two statistical methods. Descriptive statistics involve frequency, percentage and Arithmetic Mean (x) whereas inferential statistics involve Wilcoxon Signed Rank Test to compare related samples. The results were considered non-significant, significant and high significant at $P>0.05$, $P<0.05$ and $P<0.01$, respectively.

RESULTS

Table (1) The analysis showed the patient was more than half 60% of the patients being female and 33% of patients aged between 40 and 49 and. 87% of the participants are married and 50% hold Intermediate graduate. The researchers established that 67 percent of the participants in the study group are urban dwellers. On the occupation aspect, most of the study participants were self-employed with an occupation rate of 40%. here, we are talking of the body mass index of the patients. We identified that there was a considerable percentage in the range of 25-29.9 which was 53%.

Table No.1: Sociodemographic variables distribution among the study sample (N = 30)

Variable	Items	F	%
Gender	Male	12	40
	Female	18	60
Age	20-29	3	10
	30-39	4	13
	40-49	10	33
	50-59	9	30
	≥60	4	13
Marital status	Married	26	87
	single	4	13
level of education	Primary Graduate	8	27
	Intermediate graduate	15	50
	High school graduate	7	23
Residency	Urban	20	67
	Countryside	10	33
Occupation	government employee	10	33
	freelance	12	40
	Housewife	8	27
BMI	18-24.9	11	37
	25-29.9	16	53
	30-34.9	3	10
Total		**30**	**100**

Table No.2: Significant Differences in Patients' Knowledge related Total Knee

Functional Restoration.	Pre-Post Test	Wilcoxon Signed Rank Test			
		Mean rank	Z	P-value	Sig.
"In and out of bed"	Pre	0.00	4.673	0.000	**H.S**
	Post	14.60			
Toilet Use	Pre	4.50	4.454	0.000	**H.S**
	Post	15.64			
Showering.	Pre	3.80			
	Post	15.40	4.483	0.000	**H.S**
Dressing.	Pre	5.60			
	Post	16.06	4.275	0.000	**H.S**
"Get in and out of car"	Pre	4.90			
	Post	15.48	4.645	0.000	**H.S**
House activity.	Pre	8.65			
	Post	15.36	3.630	0.000	**H.S**
Over all.	**Pre**	**0.00**			
	Post	**15.90**	**4.798**	**0.000**	**H.S**

Z= Wilcoxon Signed Rank Test; Sig= significant;
H.S= highly significant

Table No.3: Relationships among Patients' information and their Sociodemographic Variables in the Study Sample.

Variable	Class	Spearman's rho correlation					
		pre			Post		
		r^s	P -value	Sig.	r^s	P -value	Sig.
Gender	Male	0.462	0.008	H.S	0.429	0.018	**S**
	Female						
Age	20-29	0.055	0.769	N.S	-0.208	0.290	**N.S**
	30-39						
	40-49						
	50-59						
	≥60						
Marital status	Married	0.154	0.435	N.S	-0.210	0.253	**N.S**
	Single						
	Divorced						
	Widow						
level of education	Primary Graduate	0.354	0.057	N.S	0.318	0.086	**N.S**
	Intermediate graduate						
	High school graduate						
Residency	Urban	0.068	0.733	N.S	-0.091	0.637	**N.S**
	Countryside						
Occupation	government employee	-0.383	0.038	N.S	0.061	0.759	**N.S**
	freelance						
	Housewife						
BMI	18-24.9	-0.452	0.014	S	0.206	0.286	**N.S**
	25-29.9						
	30-34.9						
	over than 35						

Table (2) shows that there is a highly significant difference related to posttest for study sample in overall domains and subdomain when analyzed by Wilcoxon Signed Rank Test. Figure (1) shows that patients in the study sample show poor to fair level on knowledge during pre-intervention (62%, 42% and 6% related to good) There is a dramatic improvement at post-intervention, with 77.1% of respondents now rating the situation as good, The poor ratings have completely diminished, with Fair ratings dropping to 22.9%.

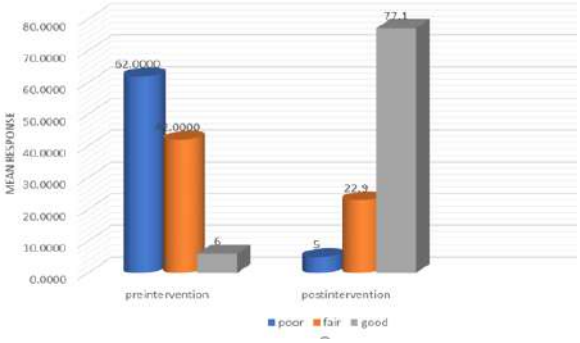

Figure No.1: Level of patient's knowledge Functional Restoration for Total Knee Arthroplasty

Table (3) indicates that there is no significant relationship has reported between the overall information scores of patients in the study sample and the sociodemographic variables; age, Marital status, level of education, residency and occupation. Accept Gender it was high at the pretest and also significant at posttest. Correlated with BMI, it was significant during pretest and non-significant during the posttest.

DISCUSSION

In this study, we described the effect of an intervention program on functional restoration following total knee arthroplasty. Data analysis of the results of the present investigation revealed that 60 % of the study sample are female make, which is in agreement with the study conducted by [12,13] . He claims that 52.2% of his sample consisted of females. With regard to the agreement study, it is shown that female have more than male, with 10 (33%) in the study sample falling within the age range 40-49 years. A study by [14]. Validates these findings and demonstrates the mean age was 53.92 ±6.75 years and over half of the groups examined were between 50 and 60 years old. More than two-thirds of the sample 26 (87%) were married, this result was corroborated by [15]. "Tai chi chuan exercises improve functional outcomes and quality of life in patients with primary total knee arthroplasty due to knee osteoarthritis" which suggesting that the majority of both groups studied were married. Regarding educational level a large percentage of patients in my

study have low education status, 15 (50%) illiterate (intermediate Graduates) my study agrees with study [16]. Nine (30%) of the patients in the study group and 11 (36.7%) of the patients in the control group had completed primary school, and there was no significant difference between the two groups. The patients in the study group and the patients in the control group did not differ significantly in terms of their educational attainment 9 (30%) vs. 11 (36.7%) had finished primary school). With regards to place of residence, the majority of patients in sample reside in urban areas (20 67%). This present study conforms with the earlier study in [17]. Who found that all of the groups in both groups under study resided in urban areas. Higher percent of individuals in the study sample were independent contractors (40%). This is comparable with a study by [18,19] where the control group (n=13; 43.3%) and majority of the study group (n=10; 33.3%) were independent contractors, also 40.0% of patients in the study group and 33.3% of patients in the control group were independent contractors. Related to the results of our study, 53% of the participants are classified as overweight based on body mass index indications". Our results in Table (2) demonstrate that the scores across all domains of Activities of Daily Living (ADLs) were higher in the post-test compared to the pre-test after intervention, corroborated by research conducted by [20-22].These results clearly show that daily living activities were significantly higher in the post-tests, demonstrating the program's impact. Figure (1) Illustrates that, there is a marked improvement in the study sample percentage of total knowledge from (62%, 42%, 6%) poor, fair, good, respectively. pre of intervention program implementation, into (poor 5%, fair 22,9%, good 77.1%) immediately post intervention. My finding agrees with others study conducted by[23,24] Patients who receive G-EXE on top of standard ambulation and ADLs exercises had superior knee ROM, quadriceps strength, and knee pain during discharge compared to those who carried out I-EXE besides normal ambulation and ADL exercises. G-EXE is advantageous to patients during their hospitalization in the acute recovery phase after TKA. Finally, the table (3) We find that the overall information scores of patients in the study sample did not have any significant relationship with socio-demographic factors: age, marital status, level of education, residency, and occupation, which was significant in the pretest and significant in the posttest. Compared to the BMI, it was not significant at the posttest but significant during the pretest. These findings are correlated with the research of[25]. Where it was determined that Association Between Osteoporotic Patients Balance Level and their Socio-demographic "gender, age, level of education, marital status, and occupation" data for study group that all socio-demographic no significant except level of education was significant. Agree with another study done by[26,27] talk about BMI and related to demographical characteristic.

CONCLUSION

The patients undergoing total knee arthroplasty because had a significant improvement in knowledge, satisfaction and outcomes after the implementation of the intervention program, relative to the knowledge, satisfaction, and outcomes before the intervention ($P \leq 0.001$). Moreover, both functional restoration and total knowledge scores in the study sample indicated a positive relationship right after the intervention and the participants three weeks following the intervention.

Recommendations: The study recommends conducting larger-scale studies that fully encompass hospitals at the national and provincial levels.

Author's Contribution:

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Final Approval of version:	All the above authors
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Original Article

Nutritional Needs and Treatment Adherence Among Children with Cancer Receiving Chemotherapy in the Middle Euphrates Region

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ABSTRACT

Objective: To assess nutritional needs and chemotherapy adherence among children with cancer receiving chemotherapy in the Middle Euphrates region and to identify factors associated with nutritional status and treatment adherence.

Study Design: A cross-sectional quantitative study

Place and Duration of Study: This study was conducted in three Oncology Hospitals in AL-Najaf AL-Ashraf, Holly Karbala, and Babylon, Iraq between December 2025 and April 2026.

Methods: A purposive sample of 170 children with cancer aged below 18 years and their parents participated in the study.

Results: The majority of children were male (71.2%), early childhood ages (41.8%), and had been diagnosed with ALL (75.9%). The body mass index was found to be in the normal range in 41.2% of them, but 37.6% of them were underweight. Both parents and children had high nutritional knowledge (73.5%) and only 37.1% of children had high nutritional status. Regarding chemotherapy adherence, the majority of the participants demonstrated high adherence (65.9%), while 31.8% were moderately adherent, and only 2.3% showed low adherence. There were significant correlations between parent knowledge and education for father ($p = 0.022$) and mother ($p = 0.002$). The adherence-related psychological and sensory factors were significantly correlated with child age ($p = 0.001$) and mother's educational level ($p = 0.014$).

Conclusions: The nutritional challenges faced by children are moderate and the knowledge of parents and their adherence to treatment is generally good in the Middle Euphrates region. Educational strategies for mothers are important, not only for nutritional awareness, but also to remove psychological barriers for adherence to chemotherapy. Enhancing nutritional counselling and psychosocial support services can help to enhance the treatment in children with cancer.

Keywords: Childhood cancer, chemotherapy adherence, nutritional status, parental knowledge, pediatric oncology, chemotherapy, nutritional needs.

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INTRODUCTION

The incidence rate of childhood malignancies is a public health problem in Iraq especially in the Middle Euphrates region as evidenced by the recent epidemiologic profiles[1].

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However, the incidence of children's cancers was found to have peaked in recent years in certain governorates, such as Al-Najaf, and bone and blood cancers are common in urban areas in children.[2] In these patients, chemotherapy treatment can be complicated by a "dual burden": the metabolic stress caused by the malignancy itself and the high level of nutritional vulnerability[3].

Nutritional status is one of the basic factors that can predict the clinical outcome in pediatric oncology[4]. Malnutrition is not only a low baseline indicator, but a dynamic problem that can grow worse during induction chemotherapy and can cause a rapid loss of muscle mass and fat stores[5]. This further decrease due to chemotherapy side effects like nausea, vomiting, loss of appetite and oral mucositis[6]. Malnutrition in pediatric cancer patients is linked to poor prognosis in low- and middle-income countries, such as the increased risk of treatment-related toxicities and premature discontinuation of treatment[3].

Another diagnostic problem of particular importance in the Iraqi situation is the tendency for nutritional failure to be "masked" by massive tumor masses or edema due to the therapy[2]. Traditional methods of weight monitoring have been shown to be inadequate in many cases, and that measurement of Mid-Upper Arm Circumference (MUAC) and triceps skinfold thickness is a more sensitive early warning indicator of nutritional derailment[2]. In addition, compromised nutritional status is highly associated with reduced chemotherapy tolerance and reduced dose intensity, which can result in less efficacy of anti-cancer medications[3].

The people with severe nutrition impact symptoms, they can find it difficult to finish their planned chemotherapy courses[4]. Furthermore, the inappropriate use of nonprescribed antibiotics by caregivers can make gastrointestinal health problems more complicated, and can also hinder a child's appetite and treatment schedule[2]. As long the nutrition has been demonstrated in best method to reduce serious illness and the likelihood of living for five years, there is an urgent need to develop nutrition-specific assessment protocols for the Middle Euphrates region that would provide nutritional stability and rigorously follow life-saving treatment.[3]

METHODS

Study Design and Duration: The researcher utilized a cross-sectional, applied quantitative research design. This approach allowed for the assessment of specific variables during a defined period, specifically from December 26, 2025, to April 25, 2026.

Administrative and Ethical Considerations: Formal administrative agreements were secured prior to data collection. Key approvals and requisitions included:

- Initial agreement from the University of Babylon, College of Nursing through first presentation to attain the approval of higher studies committee.
- Protocol approved by the ethical and scientific research committee at the University of Babylon/college of nursing.
- Official permissions from the Health directorate/Development and Training centers in Babylon, AL-Najaf AL-Ashraf, and Holly Karbala governorates.
- Data collection agreements from Al-Imam Al-Sadiq Teaching Hospital, Al-Watney Oncology Hospital, and Al-Imam Al-Hasan Al-Mujtaba Teaching Hospital.

Study Setting and Population: The study was carried out in the Middle Euphrates region and the study area consisted of only three hospitals that accept pediatric patients in cancer namely; Al-Watney (Najaf), Al-Imam Al-Sadiq (Babylon), and Al-Imam Al-Hasan Al-Mujtaba (Karbala). The study consists of 170 children aged <18 years diagnosed with chemotherapy distributed on hospitals Al-Watney (Najaf) (81child), Al-Imam Al-Hasan Al-Mujtaba (Karbala) (50child) and Al-Imam Al-Sadiq (Babylon) (39child).

The Study Tools: A questionnaire in English translated to Arabic with four different components in addition to scale and tape measurement:

1. Part One: a socio-demographic section (8 items), anthropometric section (weight, height, BMI, 3 items), and clinical history (4 items).
2. Part 2: Parents' knowledge of nutritional needs (4 items) and Nutritional needs (25 items) with sections for appetite, dietary preference, side effects affecting eating and behaviors.
3. Part Three: Assesses Chemotherapy Adherence (21 items) and Parent Follow-Up.
4. Part Four: Explores issues that influence adherence including psychological/behavioral cooperation with the healthcare team (6 items).

Validity and Reliability: Validity: Content is validated by 11 experts from different Iraqi universities.

Pilot Study: Al-Imam Al-Sadiq Teaching Hospital was used to conduct a pilot study with 19 participants from January 03 to January 15, 2026. In this phase, the tool proved to be reliable and it has been found that it takes 20-30 minutes to complete.

Reliability: The instrument showed statistically acceptable reliability in all items with Cronbach's Alpha of 0.606 and 0.703 for nutritional needs and treatment adherence respectively.

Data Collection and Analysis: Collection: February 21 - April 29, 2026 Face-to-face interviews were used with parents who were unable to read and self-administered questionnaires were used with parents who could read.

Analysis: Data were analyzed using SPSS version 28, frequencies, percentages and chi-square tests were used to meet the objectives of the study.

RESULTS

This part presents the results of the data analysis systematically in tables and these correspond with the objectives of the study as follows:

Table 1 showing that Socio-demographic characteristics showed that most participants resided in urban areas (77.1%), with the majority of parents aged 30–39 years. Regarding socioeconomic status, 42.4% reported sufficient monthly income, and 58.2% had two affected children.

Table 2 shows most children have a normal body mass index (BMI) (41.2%), (37.6%) are underweight. Acute lymphoblastic leukemia (ALL) is the most common diagnosis 75.9% of cases. The majority of participants were newly diagnosed (42.4%).

Table No. 1: Demographical Data of Children with Cancer and Their Parents (N = 170)

Demographic Characteristic	Category	Frequency	Percentage
Child's Age	Early Childhood (< 6 years)	71	41.8%
	School Age (6-12 years)	67	39.4%
	Adolescent (13-17 years)	32	18.8%
Sex	Male	121	71.2%
	Female	49	28.8%
Residence	Urban	98	57.6%
	Rural	72	42.4%
Address	Najaf	81	47.7%
	Karbala	50	29.4%
	Babylon	39	22.9%
Father's Education Level	University or higher	56	32.9%
	Secondary school graduated	42	24.7%
	Middle school graduated	38	22.4%
	Primary school graduated	19	11.2%
	Do not read/write	15	8.8%
Mother's Education Level	University or higher	55	32.4%
	Primary school graduated	41	24.1%
	Secondary school graduated	34	20.0%
	Middle school graduated	30	17.6%
	Do not read/write	10	5.9%

Table No. 2: Anthropometric Measurements and Clinical Profile (N = 170)

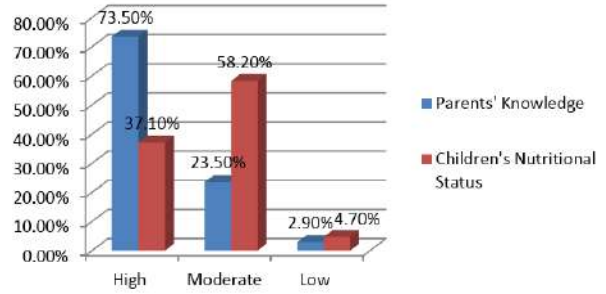
Characteristic	Category	Frequency	Percentage
Body Mass Index (BMI)	Underweight (< 5^{th} %)	64	37.6%
	Normal weight (5^{th} – 85^{th} %)	70	41.2%
	Overweight (> 85^{th} %)	36	21.2%
Type of Cancer	Acute Lymphoblastic Leukemia	129	75.9%
	Lymphoma	9	5.3%
	Neuroblastoma	8	4.7%
	Breast cancer	6	3.5%
	Others (e.g., Wilms tumor, Thyroid, etc.)	18	10.6%
Duration since Diagnosis	< 6 months	72	42.4%
	6 - 12 months	60	35.3%
	13 - 24 months	20	11.8%
	> 24 months	18	10.6%
Main Meals per Day	1 meal	5	2.9%
	2 meals	25	14.7%
	3 meals	130	76.5%
	4-5 meals	10	5.9%
Snacks per Day	0 snacks	10	5.9%
	1 snack	42	24.7%
	2 snacks	101	59.4%
	3-4 snacks	17	10.0%

Table No. 3: Responses of Parents regarding Knowledge and their Children's Nutritional Status (N = 170)

Domain	Mean Score	Std. Deviation	Interpretation
Knowledge (K)	2.53	0.36	High Knowledge
Appetite & Intake (A)	2.46	0.31	Good Intake
Dietary Preferences (D)	2.41	0.50	Varied Diet
Side Effects (S)	1.87	0.34	Occasional Symptoms
Behavioral Factors (B)	2.42	0.38	Positive Support

Cutoff points: Low=1-1.66, Moderate= 1.67-2.33, High= 2.34-3

Table 3 show parents had good nutritional knowledge (M = 2.53, SD = 0.36) in the Knowledge domain. high mean scores were obtained for Appetite and Intake (M = 2.46, SD = 0.31) indicating good dietary intake among the children. Dietary Preferences domain (M = 2.41, SD = 0.50). The Behavioral Factors (M = 2.42, SD = 0.38) showed positive aspects. The lowest mean score was found on the Side Effects domain (M = 1.87, SD = 0.34).



Cutoff points: Low=1-1.66, Moderate= 1.67-2.33, High= 2.34-3

Figure No. 1: Overall Assessment of Parents' Knowledge and their Children's Nutritional Status

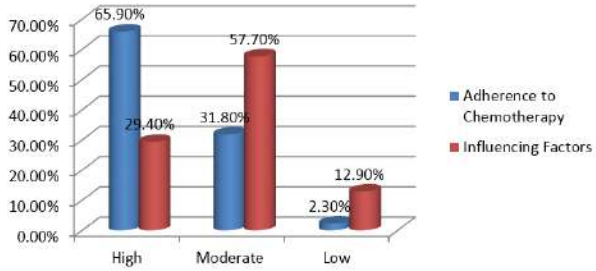
Figure 1 indicate a high percentage of parents (73.5%) who have High Knowledge about nutritional needs, but very few children (37.1%) were at High Nutritional Status level.

Table No. 4: Association of Demographic and Anthropometric Factors with Overall Assessments of Parents' Knowledge and their Children's Nutritional Status (N = 170)

Factor	Variable	χ2	df	p-value	Signi-ficance
Parents' Knowledge	Child's Age	3.89	4	0.421	NS
	Sex	3.25	2	0.196	NS
	Residence	4.15	2	0.125	NS
	Father Education	11.41	4	**0.022**	**S**
	Mother Education	16.82	4	**0.002**	**HS**
	BMI Category	3.78	4	0.436	NS
Children's Nutritional Status	Child's Age	5.12	4	0.815	NS
	Sex	0.41	2	0.815	NS
	Residence	2.31	2	0.314	NS
	Father Education	4.20	4	0.380	NS
	Mother Education	1.06	4	0.901	NS
	BMI Category	2.51	4	0.644	NS

S = Significant (p < 0.05); HS = Highly Significant (p < 0.01; NS = Non-Significant

Table 4 show there is a strong association between parental knowledge and their education levels, especially the mother's education (X^2 = 16.82, p = 0.002) and the father's education (X^2 = 11.41, p = 0.022), there is no statistically significant association between the nutritional status of children and all the measured demographic and anthropometric variables (p > 0.05).



Cutoff points: Low=1-1.66, Moderate= 1.67-2.33, High= 2.34-3

Figure No. 2: Overall Assessment of Adherence and Influencing Factors

As shown in Figure 2, the study variable, chemotherapy adherence, was classified as high (2.51 ± 0.47), with 65.9% of participants demonstrating high adherence to treatment plan and medication regimen.

Contributing factors were moderate level (1.95 ± 0.66), and the proportion of children classified as high (low resistance) 29.4%.

Table No. 5: Association of Adherence and Influencing Factors (N = 170)

Factor	Variable	χ2	df	p-value	Signifi-cance
Adhe-rence to Chemo-therapy	Child's Age	2.65	4	0.214	NS
	Sex	0.79	2	0.672	NS
	Residence	4.64	2	0.098	NS
	Mother Education	6.64	4	0.156	NS
	Father Education	3.81	4	0.432	NS
	BMI Category	1.18	4	0.881	NS
Influen-cing Factors	Child's Age	18.43	4	**0.001**	**HS**
	Sex	1.74	2	0.418	NS
	Residence	2.98	2	0.225	NS
	Mother Education	12.51	4	**0.014**	**S**
	Father Education	7.34	4	0.119	NS
	BMI Category	2.97	4	0.563	NS

S = Significant (p < 0.05); HS = Highly Significant (p < 0.01; NS = Non-Significant

Table 5 shows that adherence to chemotherapy is statistically similar across all demographic and anthropometric groups ($p < 0.05$). However, the child's age (chi-squared = 18.43, $p = 0.001$) and the mother's education level (chi-squared = 12.51, $p = 0.014$) are strongly associated with the influencing factors.

DISCUSSION

A significant sex imbalance (71.2% male) and a high proportion of early-childhood cases (41.8%) were observed, consistent with recent epidemiological trends among children with cancer in Al-Najaf governorate[1]. Children with hematological malignancies such as ALL also showed more pronounced nutritional derailment than those with solid tumors, likely reflecting the systemic disease burden and the intensity of induction chemotherapy[7].

Regarding nutritional status, 41.2% of children had a normal BMI while 37.6% were underweight, a pattern broadly comparable to, though somewhat less severe than, cohorts undergoing induction chemotherapy for acute leukemia elsewhere[8], and contrasting with reports of rising overweight/obesity in some European ALL populations[9]. This supports the view that malnutrition in pediatric oncology is not a fixed baseline but a progressive complication that can worsen after induction[3]. Traditional weight monitoring may also mask nutritional failure in children with large tumor masses or treatment-related edema; MUAC and triceps skinfold thickness are therefore recommended as more sensitive early indicators of muscle and fat loss[10].

Although parents reported high nutritional knowledge (M = 2.53) on a 3-point scale, this awareness did not consistently translate into practice, as reflected by the "Occasional Symptoms" score for side effects (M = 1.87)[4]. This gap is consistent with the broader Iraqi context, where maternal education and healthcare-provider contact are closely linked to nutritional knowledge[11]. Even when macronutrient intake appears adequate, chemotherapy-related nausea, vomiting, and taste alteration can still compromise micronutrient adequacy[10], and the absence of structured dietary counselling at discharge may contribute to ongoing "home-based nutritional failure"[3].

Chemotherapy adherence was high overall (M = 2.51) and was not significantly associated with demographic or anthropometric factors[12]. However, the psychological and sensory barriers domain which capturing fear, anxiety, and treatment aversion was significantly associated with the child's age ($p = 0.001$) and maternal education ($p = 0.014$), aligning with evidence that behavioral and psychosocial interventions, rather than education alone, are often needed to address adherence rooted in fear or distress[13]. More broadly, parental education and socioeconomic status shape the quality of provider communication and, in turn, adherence to outpatient regimens[14], a pattern echoed in large Nordic registry studies linking parental socioeconomic status to childhood cancer survival and mortality[15]. Taken together, poor nutritional status remains a reliable predictor of adverse outcomes including greater infection risk, reduced treatment tolerance, and higher rates of dropout or delay[16].

CONCLUSION

The nutritional challenges faced by children are moderate and the knowledge of parents and their adherence to treatment is generally good in the Middle Euphrates region. Educational strategies for mothers are important, not only for nutritional awareness, but also to remove psychological barriers for adherence to chemotherapy. Enhancing nutritional counselling and psychosocial support services can help to enhance the treatment in children with cancer.

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Final Approval of version:	All the above authors
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Original Article

Educational Program on Knowledge and Attitude of Nurses

Effectiveness of Lifestyle-Centered Educational Program on Knowledge and Attitude of the Nurses in Health Promotion Unites

Mohammed Ismail Ramadhan[1] and Abid Mahadi Abdul Ratha[2]

ABSTRACT

Objective: To evaluate the effectiveness of a lifestyle-centered educational program in improving nurses' knowledge and attitudes toward health promotion among nurses working in health promotion units in Kirkuk City.
Study Design: Quasi-experimental pre-test/post-test study.
Place and Duration of Study: This study was conducted at the health promotion units affiliated with primary healthcare centers in Kirkuk City from March 2025 to March 2026.
Methods: Eighty nurses were assigned to intervention and control groups (40 each). The intervention group received a lifestyle-centered educational program, while the control group continued routine practice. Data were analyzed using t-tests, ANOVA, and regression analysis.
Results: Significant improvements were observed in the intervention group following implementation of the educational program. Mean knowledge scores increased from 17.34 ± 2.86 to 21.27 ± 3.10, while mean attitude scores improved from 49.98 ± 4.21 to 54.88 ± 4.73 ($p < 0.001$). No significant changes were identified in the control group. Multiple regression analysis revealed no significant demographic predictors of post-intervention knowledge or attitude outcomes.
Conclusion: The lifestyle-centered educational program significantly improved nurses' knowledge and attitudes toward health promotion, supporting its integration into continuing professional development programs.
Key Words: Lifestyle-centered education; Health promotion; Nurses; Knowledge; Attitudes; Continuing professional development

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INTRODUCTION

Tailored eHealth education significantly improved health-promoting behaviors among nurses, including reductions in BMI and enhanced lifestyle scores compared to conventional method [1-2]. Similarly, structured health promotion interventions led to significant improvements in health-promoting behaviors, self-efficacy, and self-esteem among nurses [3-4].

Educational programs based on models like the Health Promotion Model (HPM) demonstrated positive effects on health responsibility, physical activity, nutrition, and stress management.

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Nurses often face challenges such as shift work, long hours, and family commitments, which hinder adherence to healthy lifestyles[5]. Cultural taboos and inadequate training further exacerbate gaps in knowledge, particularly in areas like reproductive health and adolescent communication.[6]

METHODS

This quasi-experimental study employed a two-group pre-test/post-test design to evaluate the effectiveness of a lifestyle-centered educational program on nurses' knowledge and attitudes toward health promotion. The study was conducted between March 2025 and March 2026 in selected Health Promotion Units of primary healthcare centers and teaching hospitals in Kirkuk City, Iraq. A purposive sample of 80 nurses was recruited and allocated to an intervention group (n = 40), which received the educational program, and a control group (n = 40), which continued routine practice. Group comparability was ensured through similar baseline demographic characteristics.

Data were collected using a structured self-administered questionnaire comprising demographic information, a knowledge scale covering key health promotion topics

(scored as correct = 1 and incorrect = 0), and a Likert-scale attitude instrument assessing perceptions of professional responsibility, lifestyle counseling, and confidence in providing health education. Content validity was established through expert review, while a pilot study confirmed the clarity and feasibility of the instrument. Internal consistency reliability was assessed using Cronbach's alpha and demonstrated acceptable reliability.

The educational program was developed based on Nola J. Pender's Health Promotion Model and adult learning principles. It covered balanced nutrition, physical activity, stress management, tobacco cessation, and prevention of non-communicable diseases using lectures, group discussions, case studies, and practical clinical examples delivered over multiple 60–90-minute sessions. Pre-test data were collected before the intervention, and post-test assessments were conducted for both groups after program completion using the same instruments. Data was analyzed using SPSS with descriptive statistics, paired- and independent-samples *t*-tests, one-way ANOVA, and multiple linear regression. Statistical significance was set at $p < 0.05$.

RESULTS

Table 1 summarizes the demographic characteristics of nurses in the intervention and control groups. No significant baseline differences were observed in age, gender, educational level, or years of experience ($p > 0.05$), indicating that the groups were comparable before the educational intervention.

Table 2 compares knowledge scores before and after the intervention. The intervention group showed a significant improvement in knowledge following the educational program ($p < 0.001$), whereas no significant change was observed in the control group ($p > 0.05$), demonstrating the program's effectiveness in enhancing nurses' health promotion knowledge.

Table 3 presents changes in attitude scores before and after the intervention. The intervention group showed a significant improvement in attitudes toward health promotion ($p < 0.001$), while no significant change was observed in the control group ($p > 0.05$), indicating the educational program effectively enhanced nurses' attitudes toward lifestyle-centered health promotion.

Table No. 1: Demographic Characteristics of Nurses in the Intervention and Control Groups (N = 80)

Variable	Category	Intervention (n = 40) n (%)	Control (n = 40) n (%)	p-value
Age (years)	20–29	8 (20.0)	7 (17.5)	>0.05
	30–39	18 (45.0)	19 (47.5)	
	≥40	14 (35.0)	14 (35.0)	
Gender	Male	14 (35.0)	15 (37.5)	>0.05
	Female	26 (65.0)	25 (62.5)	
Educational Level	Diploma	17 (42.5)	18 (45.0)	>0.05
	Bachelor	20 (50.0)	19 (47.5)	
	Postgraduate	3 (7.5)	3 (7.5)	
Years of Experience	<5 years	12 (30.0)	13 (32.5)	>0.05
	≥5 years	28 (70.0)	27 (67.5)	

Note: No statistically significant differences were found between groups at baseline ($p > 0.05$).

Table No. 2: Comparison of Pre-Test and Post-Test Knowledge Scores in Intervention and Control Groups

Group	Pre-Test Mean ± SD	Post-Test Mean ± SD	t-value	p-value
Intervention (n = 40)	17.34 ± 2.86	21.27 ± 3.10	8.95	<0.001*
Control (n = 40)	17.10 ± 2.74	17.45 ± 2.80	1.12	0.267

Note: *Statistically significant at $p < 0.05$.

Table No. 3: Comparison of Pre-Test and Post-Test Attitude Scores in Intervention and Control Groups

Group	Pre-Test Mean ± SD	Post-Test Mean ± SD	t-value	p-value
Intervention (n = 40)	49.98 ± 4.21	54.88 ± 4.73	7.84	<0.001*
Control (n = 40)	50.10 ± 4.35	50.65 ± 4.40	1.03	0.308

Note: *Statistically significant at $p < 0.05$.

Table No. 4: Comparison of Post-Test Knowledge and Attitude Scores Between Intervention and Control Groups

Variable	Intervention Mean ± SD	Control Mean ± SD	t-value	p-value
Knowledge	21.27 ± 3.10	17.45 ± 2.80	6.12	<0.001*
Attitude	54.88 ± 4.73	50.65 ± 4.40	4.87	<0.001*

Note: *Statistically significant at $p < 0.05$.

Table No. 5: Association Between Demographic Variables and Post-Test Knowledge and Attitude Scores

Predictor Variable	B	Standard Error	Beta	p-value
Age	0.12	0.09	0.14	0.184
Gender	0.35	0.48	0.08	0.462
Educational Level	0.41	0.39	0.11	0.298
Years of Experience	0.18	0.27	0.07	0.507

Model Summary: $R^2 = 0.08$; $F = 1.21$; $p = 0.301$

Note: No statistically significant demographic predictors were identified.

Table 4 compares post-test knowledge and attitude scores between the intervention and control groups. The intervention group achieved significantly higher knowledge and attitude scores than the control group ($p < 0.001$), confirming the effectiveness of the lifestyle-centered educational program.

Table 5 presents the association between demographic characteristics and post-test knowledge and attitude scores. No significant associations were found ($p > 0.05$), indicating that the educational program was equally effective across different demographic groups.

DISCUSSION

This study demonstrated that a lifestyle-centered educational program significantly improved nurses' knowledge and attitudes toward health promotion, confirming the effectiveness of structured, theory-based education in strengthening competencies for lifestyle-based preventive care. These findings are consistent with previous studies reporting that continuing professional education enhances nurses' knowledge, attitudes, and readiness to deliver evidence-based health promotion interventions.[7–10]

The observed improvements may be attributed to the use of interactive teaching strategies, including lectures, case-based discussions, and practical clinical examples, which are consistent with adult learning principles emphasizing active, relevant, and practice-oriented learning.[11–12] The findings also support Pender's Health Promotion Model, highlighting the importance of knowledge as a foundation for adopting health-promoting behaviors and integrating preventive care into routine nursing practice.[13–14]

In addition to enhancing knowledge, the intervention significantly improved nurses' attitudes toward health promotion, suggesting greater professional commitment to preventive care. This finding aligns with the Theory of Planned Behavior, which proposes that positive attitudes strengthen intentions to perform health-promoting behaviors, and is consistent with previous studies demonstrating the effectiveness of lifestyle-focused educational interventions in improving professional attitudes and confidence.[15–17]

The significantly higher post-intervention knowledge and attitude scores in the intervention group, together with the absence of change in the control group, confirm that the observed improvements resulted from the educational program rather than routine clinical experience. Furthermore, demographic characteristics were not associated with post-intervention outcomes, indicating that the program was effective across diverse groups of nurses and supporting its broad applicability.[18]

These findings underscore the value of integrating lifestyle-centered education into continuing professional development programs and primary healthcare services. Strengthening nurses' competencies in evidence-based lifestyle counseling may enhance preventive care and contribute to reducing the growing burden of non-communicable diseases in Iraq and similar resource-limited settings.[19–20]

Practical Implications: The findings support integrating lifestyle-centered education into continuing professional development programs and routine health promotion services to strengthen nurses' preventive practices and improve community health outcomes, particularly in addressing the growing burden of non-communicable diseases.

Limitations: Despite its strengths, this study has several limitations. The use of purposive sampling may limit generalizability beyond similar healthcare settings. The relatively small sample size may also restrict broader inference. Furthermore, outcomes were measured using self-reported questionnaires, which may be subject to response bias.

Future research should consider randomized controlled trials with larger samples and incorporate objective measures of practice change and patient outcomes.

CONCLUSION

This study demonstrated that a lifestyle-centered educational program significantly improved nurses' knowledge and attitudes toward health promotion, while no significant changes were observed in the control group. The findings support the effectiveness of theory-based educational interventions in enhancing nurses' competencies regardless of demographic characteristics, highlighting their suitability for integration into continuing professional development programs. Future research should employ randomized multi-center designs with longer follow-up periods to evaluate the sustainability of outcomes, clinical and behavioral impacts, cost-effectiveness, and the potential of digital or blended learning approaches

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Mohammed Ismail Ramadhan, Abid Mahadi Abdul Ratha

Drafting or Revising Critically:	Mohammed Ismail Ramadhan, Abid Mahadi Abdul Ratha
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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Original Article

Barriers and Benefits in Elderly Forensic Psychiatric Care in Iraq: A Descriptive Study

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ABSTRACT

Objective: To determine the Barriers and Benefits of providing elderly forensic mental health care in Iraq.
Study Design: Descriptive study design through using (Non probability) convenience sampling.
Place and Duration of Study: This study was conducted at the center of the city of Mosul is College of Nursing, University of Mosul, from 1 April to 28 April 2025.
Methods: Was conducted to determine the Barriers and Benefits in Elderly Forensic Psychiatric Care in Iraq, from 1 April to 28 April 2024. While the number of sample used in this study was (106) people, including (74) female and (32) male. Data analysis is done with the "Statistical Package for Social Science (SPSS) software for Windows (Version 26)".
Results: This result indicates that the majority of the study sample consisted of individuals 53 years older; 71.69% of the sample of 61 and 70; the percentage of female participants was higher than that of male participants by 69.81%); 75.47% of the sample was married; and 86.79% of the sample had chronic illnesses. Ultimately, a sizable portion (64.15%) had some form of mental illness.
Conclusion: This investigation found that the benefits of the obstacles related to forensic psychological care were less than expected, while the benefits of forensic mental health care were clearly and naturally acceptable, especially for the elderly.
Key Words: Barriers, Benefits, Elderly, Forensic, Psychiatric Care.

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INTRODUCTION

Elderly people have unique physical and mental health challenges in addition to being more susceptible to mental disorders (MDs). Globally, anxiety disorders (4%), depression (7%), dementia (5%–8%), and drug abuse (1%–2%) are the most common medical conditions among the elderly. Furthermore, elderly people account for 25% of suicide-related deaths [1,2]. This percentage will most likely increase as individuals live longer and the percentage of seniors increases[3,4]. Examining the requirements, encounters, and results of these elderly forensic patients is crucial. This is due to the fact that persons with severe mental illnesses and those who were imprisoned in the criminal justice system ten years prior may encounter the age-related health needs of those who are generally regarded as "older" in the general persons, which is generally about 60 years old [5]. Numerous factors contribute to this discrepancy, including limited access to healthcare, chronic illnesses that last a lifetime, histories of substance abuse, and social disadvantages like lack of opportunity for education and employment. People with mental illnesses who, because of their psychiatric symptoms, may be a danger to themselves or others can receive specialized or intensive treatment from secure forensic mental health services located throughout the world. In the United Kingdom, the age range of patients receiving secure forensic mental health treatment has increased during the last ten years. According to a study, 8% of patients in a UK high-security hospital were over 50. 21% of patients over 50 in 2018 are considered high-security[6]. The number of older patients in forensic psychiatric care, both long-term and recently admitted, has increased as a result of changes in the legal system such as a rise in lifetime paragraphs, increased prosecution of past offenses, particularly sexual offenses, and demographic trends such as improved life beliefs.[7,8]. Global population aging has been a result of both decreased mortality and enhanced public health interventions[9,10]. Senior citizens have multiplied drastically on an international level, with more retired individuals alive than at any other time in history[11]. Between 2020 and 2050, the share of adults over 60 in the world will nearly double, from 14% to

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31% [12]. The yearly numerical report from the nation's Ministry of Health states that the amount of Iraqi citizens sixty years of age or older rose from 5.8% in 2006 to 5% in 2016. By 2050, the ratio is expected to rise to 8.8% [13]. The aim of the article to identify the Barriers and Benefits in Elderly Forensic Psychiatric Care in Iraq.

METHODS

Descriptive study design through using (Non probability). Researchers used the perceived barriers and benefits of forensic psychological care for the elderly in Iraq and Mosul in particular to identify the most important strengths, weaknesses or obstacles in psychological care for the elderly. The study was applied in the center of the city of Mosul from within the nursing home in the city of Mosul, which includes males and females who are in the same home for the purpose of identifying the obstacles and benefits they face from the psychological and forensic aspect. The number of participants was all residents of the nursing home, which was 106 people, including 32 males and 76 females. The data collection period was approximately 28 days. The sample size was calculated using a single proportion formula, a 95% confidence level, and a 5% margin of error. Most of the elderly residents in nursing homes, numbering 58 people, were excluded from the study, with approximately 4 people being unable to speak and communicate with the researchers. Thus, the sample size of the participants is considered to be more than 90% of the total number in the nursing home. The period of the study started from 1 April to 28 April 2025. While the number of sample used in this study was (106) people, including (74) female and (32) male. (Non probability) convenience Sampling was conducted to determine the Barriers and Benefits in Elderly Forensic Psychiatric Care in Iraq. A questionnaire was designed and presented to a group of experts in the medical, nursing, statistical, and language specializations. This questionnaire included three main aspects. The first was related to the demographic aspects of the elderly person (age, gender, Marital status, chronic diseases, and psychological diseases). The second aspect was related to the obstacles facing the elderly from a legal psychological perspective, and the third aspect was the benefits psychologically facing the elderly person. The questionnaire takes 45 to 50 minutes to complete for each person**.** The "Statistical Package for Social Science (SPSS) software for Windows (Version 26)" is used to statistic data.

RESULTS

Table No. 1 reveals that the majority of study participants were 53 years old, that the majority of the sample was between 61 and 70 years old, 71.69%, and that the percentage of female participants was greater than that of male participants 69.81%, that 75.47% of the sample was married, and 86.79% of the sample had chronic diseases. Ultimately, a sizable portion (64.15%) had some form of mental illness. Table 2 shows that the perceived barriers were minimal between elderly. Table 3 shows that the perceived benefits were good and acceptance between old age.

Table No.1: Distribution of Demographical Variables of sample (106)

Variables	No.	Frequency (%)	Mean +SD
(A):Age			
50 – 60 Years	**24**	**22.64%**	**Mean (67.1) SD (1.72)**
61 – 70 Years	**76**	**71.69%**	
70 years and more	**6**	**5.66%**	
(B):Sex			
Male	**32**	**30.18%**	
Female	**74**	**69.81%**	
(C): Marital status			
Married	**80**	**75.47%**	
Single	**10**	**9.43%**	
Divorced	**16**	**15.09%**	
(D): You suffer from chronic diseases			
Yes	**92**	**86.79%**	
No	**14**	**13.21%**	
(E): You suffer from psychological illnesses			
Yes	**68**	**64.15%**	
No	**38**	**35.85%**	
Total	**106**	**100%**	

Table No.2: Perceived Barriers of total Scores for Scales

Perceived Barriers	Mean	SD	Range	Range Possible
	26.87	6.43	14-56	28-56

Table No.3: Perceived Benefits total Scores for Scales

Perceived Benefits	Mean	SD	Range	Range Possible
	81.03	10.53	28-112	56-112

DISCUSSION

This study looked into the procedures used to determine the advantages and obstacles of providing elderly forensic mental health care in Iraq. This study proved that in order to meet the complicated requirements of these patients and promote progress toward better or greater standards of life and general wellness, a comprehensive and multi-modal level of support is required. Thirteen workers who have worked working with this demographic were interviewed for the study. The needs of every patient must be unique, and assistance offered has to be customized to deal with issues which plant up as the patient receives more mature[14]. Elderly patients who have forensic mental health challenges need the assistance of a team of professionals that can offer focused medical attention and therapy. Since psychological disorders and cognitive decline can get worse as people age, it is critical to address these issues. In addition, it is necessary to assess and monitor physical health and the general physical decline associated with aging, including frailty, mobility, seeing, and perception. suitable medical attention and therapy from a range of places is additionally required. Treatment must be suitable for their ages and meaningful to patients in order for them to cooperate with it and eventually profit compared to it [15,16]. Through the results of the second and third tables, it was shown that the perceived obstacles related to forensic mental health care were few and less than the normal score[17]. The main reason is the association of the obstacles with the cost of treatments, as psychiatric medications require a high cost. On the contrary, in the perceived benefit, there was commitment to taking the treatments and following up. Doctors for the elderly in nursing homes and medical clinics. The study also identified difficulties and barriers that older forensic behavioral health patients face. Many things were found to be missing, including activities suitable for older legal mental health patients and a lack of specialized units that could serve the needs of "older," "forensic," and "mental health" patients. It was also found that the older legal mental health patients' marginalization from care planning and service delivery constituted a major barrier to appreciate advancement. In line with (WHO)estimates, the prevalence of depression in older adults typically ranges from 10% to 20%, depending on cultural context. The Iraqi Mental Health Survey (IMHS), which is consistent with the current study, revealed a high lifetime prevalence of depressive episodes among adults 60 years of age and older, reaching 13.15% for males and 13.55% for females[18].

CONCLUSION

The inquiry found that the benefits of the obstacles related to forensic psychological care were less than expected, while the benefits of forensic mental health care were clearly and naturally acceptable, especially for the elderly.

Recommendations: The study recommend that there be special psychological and social programs for those working with the elderly, such as doctors, nurses, and social researchers, in order to deal with them properly and positively. One of the most important limitations of the study is the lack of proper time management for the elderly, such as sleeping and eating, and this affects study in general and their lifestyle in particular.

Author's Contribution:

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Original Article

Perceptions of Varicocele Embolization as a Therapeutic Options for Adult Patients, A Local Prospective

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ABSTRACT

Objective: To assess awareness of varicocele, knowledge of available therapeutic options, particularly varicocele embolization, and related health-seeking practices among adults in the Qassim region of Saudi Arabia.
Study Design: Community-based cross-sectional study
Place and Duration of Study: This study was conducted at the Qassim, Saudi Arabia from June 2024 to June 2025.
Methods: A total of 320 adults were recruited through convenience sampling and completed a self-administered Arabic questionnaire comprising 23 items. The questionnaire collected sociodemographic information and assessed knowledge of varicocele, its clinical implications, diagnostic approaches, and treatment options, including surgical repair and interventional radiological embolization. Data were analysed using SPSS version 26.0 and presented as frequencies and percentages.
Results: Of the 320 participants, 185 (58%) were married, 205 (64%) worked in non-health-related fields, 212 (66%) held a bachelor's degree, and 250 (78.1%) were Saudi nationals. Only 37 (11.5%) participants reported having been diagnosed with varicocele. Nearly half, 158 (49.4%), incorrectly described varicocele as enlargement of the testes, while 122 (38.1%) did not know its meaning; none correctly identified it as dilatation of the testicular veins. Regarding varicocele embolization, only 68 (21.3%) correctly recognised it as an interventional radiological procedure, whereas 66 (20.6%) considered it a surgical procedure and 186 (58.1%) had no knowledge of it. Furthermore, 288 (89.7%) participants reported never undergoing routine testicular examination.
Conclusion: Adults in the Qassim region demonstrated inadequate knowledge of varicocele and limited awareness of varicocele embolization as a therapeutic option. Community-based educational campaigns, improved counselling, and greater involvement of healthcare professionals are needed to promote early recognition, appropriate health-seeking behaviour, and informed treatment decisions.

Key Words: Varicocele, varicocele embolization, awareness, interventional radiology, male infertility, Saudi Arabia

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INTRODUCTION

Varicocele, a condition characterized by the abnormal dilation and tortuosity of veins within the pampiniform plexus of the spermatic cord in the scrotum, affects approximately 15% of males, with a heightened prevalence of 35% in those with primary infertility and reaching up to 80% in cases of secondary infertility[1].

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Typically observed unilaterally, varicocele predominantly affects the left side in 78-93% of cases, while bilateral occurrences are less common and isolated incidences on the right side are rare[2].

There are several theoretical explanations for the etiology for varicocele. Anatomical variations in venous drainage between the left and right internal spermatic veins, coupled with venous valve incompetence, are crucial to the prevalence of left-sided varicocele. Moreover, factors such as physical exertion and heightened intra-abdominal pressure are implicated in varicocele development, leading to increased hydrostatic pressure in the spermatic veins. This elevation in pressure results in heightened scrotal temperature, believed to be the primary mechanism underlying symptomatic presentations and infertility associated with varicocele[3].

Clinically, classification of varicocele is delineated by distinct characteristics. Grading ranges from 1 to 3, with Grade 1 detectable solely during the Valsalva maneuver, Grade 2 easily palpable without the maneuver but not visible, and Grade 3 presenting as a

sizable, visible anomaly upon scrotal inspection[4]. Various imaging grading systems utilizing color Doppler have been proposed, with the classification outlined by Sarteschi being widely embraced[5].

Treatment modalities for varicocele include open surgical repair, microsurgical techniques, laparoscopic ligation, or percutaneous embolization of the internal spermatic vein. The primary goal relies on the occlusion of the dilated veins that drain the testis[6]. Percutaneous embolization emerges as a minimally invasive option, obviating the need for surgical incisions and enabling complete procedures under local anesthesia, offering advantages over conventional surgical methods[7]. The chosen type of intervention influences the patient's option and the logistics of the healthcare center (availability of interventional radiology department, experience of the surgeons)[8].

Since varicocele is a common cause of infertility, public awareness of its symptoms, impacts, and management is paramount for early detection and enhanced treatment outcomes[9-11]. The study aims to identify the awareness of varicocele symptoms, therapeutic options, as well as explore health-seeking behavior and knowledge of available services and barriers to access within our population, Qassim, Saudi Arabia.

METHODS

This was a community-based cross-sectional study conducted among the general population of Qassim, Saudi Arabia, to assess knowledge and awareness regarding varicocele and its available therapeutic options. The study was conducted from June 2024 to June 2025 using a self-administered questionnaire. Adult residents of Qassim who were able to read and understand Arabic and were willing to participate were included. Participants younger than 18 years, those unable to understand Arabic, duplicate responses, and incomplete questionnaires were excluded from the final analysis.

Data were collected using a structured questionnaire consisting of 23 questions developed after reviewing relevant literature. The questionnaire included items related to sociodemographic characteristics such as age, gender, marital status, educational level, occupation, monthly income, and place of residence. It also assessed participants' knowledge about varicocele, including its causes, risk factors, symptoms, complications, effect on fertility, and diagnostic methods. The final part assessed awareness of available therapeutic options, including conservative management, surgical treatment, radiological interventions, and sources of information.

The questionnaire was prepared in Arabic to ensure clarity and better understanding among participants. After ethical approval, the questionnaire was converted into an electronic format and distributed through social media platforms and community networks using a convenience sampling technique. Before completing the survey, participants were informed about the purpose of the study, voluntary nature of participation, confidentiality of responses, and their right to withdraw at any time. Electronic informed consent was obtained from all participants before starting the questionnaire. No personal identifying information was collected.

The collected responses were reviewed for completeness and accuracy before analysis. Knowledge and awareness questions were scored by assigning one point for each correct response and zero points for incorrect or "don't know" responses. The total score was calculated for each participant and categorized into poor awareness, moderate awareness, and good awareness according to the percentage of correct responses. Data were entered and analyzed using SPSS version 26.0. Categorical variables were presented as frequencies and percentages, while continuous variables were expressed as mean ± standard deviation. The Chi-square test was used to assess associations between awareness level and sociodemographic variables. Independent sample t-test and one-way ANOVA were applied where appropriate to compare mean knowledge scores between groups. A p-value of less than 0.05 was considered statistically significant.

Ethical approval was obtained from the Institutional Review Board. Participant anonymity and confidentiality were maintained throughout the study, and all collected data were used only for research purposes.

RESULTS

Table No. 1: Descriptive statistics of demographic characteristics (N=320)

Variables	Frequency (f)	Percentage (%)
Marital Status		
Single	135	42%
Married	185	58%
Occupation		
Student	45	14%
Employed in the health field	50	16%
Employed in non-health field	205	64%
Non employed	20	6%
Education		
Middle and high school graduates	92	29%
Bachelor's degree	212	66%
Master/PhD degree	15	5%
Nationality		
Saudi	250	78.1%
Non-Saudi	66	21.9%

Most participants are married (58%) and employed in non-health-related fields (64%). About two-third of the participants have Bachelor's degree-level qualifications and 78% of the participants were Saudi (Table 1).

Table No. 2: Descriptive Analysis of perception and awareness of varicocele

What is a varicocele?	**Frequency (f)**	**(%)**
Increase seminal fluid volume	40	12.5
Enlargement of tests	158	49.4
Dilatation of the testicular veins	0	0
don't know	122	38.1
Are you currently diagnosed as a varicocele patient?		
Yes	37	11.5%
No	283	88.4%
What is varicocele embolization?		
Varicocele removal by Surgery	66	20.6%
Varicocele embolization by Interventional Radiology	68	21.3%
Something else	0	0%
I don't know	186	58.1%
How long does a varicocele embolization procedure take?		
One to two hours	168	52.5%
Three to four hours	86	26.9%
Four to six hours	37	11.6%
Eight hours	24	7.5%
Did you receive any surgical treatment for varicocele?		
Yes	288	90%
No	30	9.4%
Do you have colleagues dedicated to varicocele?		
Yes	46	14.4%
No	272	85%
Have you ever done routine checkups for testicular examination?		
Every year	12	3.8%
Every two years	11	3.4%
Every five years	7	2.2%
I have never do	288	89.7

A majority of the participants (44.6%) described varicocele as an enlargement of the testes, while a significant portion (59.4%) lack of knowledge about its nature. Among the participants, 88% (n=36) had not received a diagnosis of varicocele, whereas 22% had the diagnosis (Table 2). Furthermore, the knowledge of varicocele embolization among adults was as following: 20.6% believed this can be done surgically, 21.3% alleged this can be done surgically, while majority 57.8% had no knowledge about it (Figure 1). Notably, 9% of the participants had undergone invasive interventions, such as surgery or embolization (P > 0.001) (Table 2).

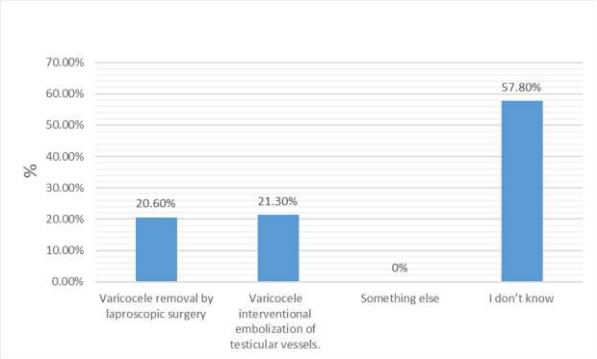

Figure No. 1: Knowledge of varicocele embolization among adults.

DISCUSSION

A significant proportion of the participating in our study (50%) demonstrated a lack of knowledge and awareness regarding varicocele. In addition, a considerable number of respondents incorrectly described treatment options (78%). Similar findings were observed in a study conducted in Riyadh, Saudi Arabia, among athletes found that 157 (41%) lacked knowledge and awareness regarding varicocele, its symptoms, and complications[10]. Of the clinically examined participants, 22 (46%) were found to have varicocele. Saleem et al, reported that over 50% of participants exhibited insufficient knowledge regarding varicocele[12].

Despite the global incidence of varicocele standing at about 15%, we found that less than 15% of our participant were either diagnosed or know a someone was diagnosed with varicocele. In addition, most participants have not been diagnosed with the varicocele, so ultimately, there is a few numbers of patient with limited experience regarding treatment option.

Jayadevan et al discuss the decisional conflict i.e. uncertainty about course action, on treatment of Infertile men with varicocele found that more about 55% of patients were found to have decisional conflict. Of those men without decisional conflict had higher infertility knowledge[13]. In our study, despite most of the participant were educated (71%), we noted a constrained understanding of the disease.

All of those factors, might be attributed to the socio-economical and decision conflict discussing this topic in our community as this also acknowledge in several studies conducted in Saudi Arabia, Pakistan and Nigeria[14-16]. Consequently, the level of knowledge and

awareness in these regions remains significantly inadequate[17,18].

Our study has certain limitations due to the limited population participants, which restricts the generalizability of the population in Saudi Arabia. However, our study contributes new insights into the understanding of knowledge and awareness of adult population regarding varicocele and the therapeutic options in Saudi Arabia. We strongly recommend that efforts be made to enhance the availability of information concerning varicocele and the therapeutic options to the general population.

CONCLUSION

Majority of adults possess inadequate knowledge regarding the fundamental aspects of varicocele as well as the treatment options that are available. Thus, it becomes imperative to initiate awareness programs and campaigns that are designed to enhance community understanding and awareness about this condition.33.6.

Author's Contribution:

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Drafting or Revising Critically:	Abdulaziz AlGharras, Abdulsalam S. Alkhidhr
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

Informed Consent Statement: Informed consent was obtained from all subjects prior to participation in the study.

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Original Article

Metabolic Syndrome and its Components with NAFLD

Prevalence of Metabolic Syndrome and its Components Among Patient with Non-Alcoholic Fatty Liver Disease: A Cross-Sectional Study

Abdul Moaiz[1], Farzana Habib[2], Noor Wajid[1] and Iqra Rashid[1]

ABSTRACT

Objective: To check the prevalence of metabolic syndrome and its individual components among the patients with NAFLD.

Study Design: cross-sectional observational study

Place and Duration of Study: This study was conducted at the Mohi-ud-din Islamic Medical College, Mirpur, AJK, Pakistan, from February 26 to August 25, 2025.

Methods: Adult patients who are ultrasonographically confirmed NAFLD were enrolled using consecutive sampling. The International Diabetes Federation's criteria were used to define MetS. Demographic, anthropometric, clinical, and biochemical data were recorded. Statistical analysis was performed using SPSS-26 was used to statistically analyze the data and multivariable logistic regression test was used to identify independent predictors of metabolic syndrome.

Results: Mean age of the included patients was 46.8 ± 11.9 years, and 118(55.7%) were males. MetS was seen in 134(63.2%) of patients. Central obesity 162(76.4%) was the most frequent component, followed by elevated fasting glucose (60.4%), reduced HDL cholesterol 122(57.5%), elevated blood pressure 118(55.7%), and raised triglycerides 114(53.8%). Patients with metabolic syndrome were significantly older with increased BMI, waist circumference, fasting blood glucose, triglycerides, and blood pressure ($p < 0.001$). Increasing age, higher body mass index, and physical inactivity were independently associated with metabolic syndrome.

Conclusion: Patients with NAFLD are very likely to have MetS. Routine metabolic evaluation and lifestyle-focused interventions should be integral to the management of these patients.

Key Words: Insulin resistance; Central obesity; Dyslipidemia; Cardiometabolic risk; Sedentary lifestyle

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INTRODUCTION

Metabolic syndrome (MetS) is a constellation of interrelated metabolic irregularities. These are comprising of dyslipidemia, hypertension, central obesity, and impaired glucose metabolism. Such abnormalities together rise the risk of type 2 diabetes mellitus, cardiovascular disease, and be the source of mortality[1].

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The global prevalence of MetS has risen markedly in parallel with increasing rates of obesity in the past few years. The rates of physical inactivity, and urbanization are also increasing side by side[2]. It is assessed to affect around one-quarter of the adult populace worldwide. The substantial variation across regions, ethnic groups, and lifestyle patterns are also noticed [3]. The definitions from International Diabetes Federation (IDF) and the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) emphasize insulin resistance and abdominal obesity as a central constituent of the syndrome [4].

Non-alcoholic fatty liver disease (NAFLD) is the greatest mutual chronic liver disorder globally. It is triggered by the occurrence of hepatic steatosis in the nonappearance of high alcohol consumption and viral hepatitis [5]. There are some other secondary causes of liver fat accumulation as well. Current estimates suggest that nearly one-third of the adult population worldwide is affected by NAFLD [6]. The prevalence among individuals with obesity is even higher. People with diabetes, and other metabolic risk factors also

poses higher prevalence rates [7]. The problem of high NAFLD is increasing rapidly in low- and middle-income countries, including South Asia. These trends are driven by changing dietary patterns and sedentary lifestyles [8].

The pathophysiological mechanisms underlying MetS and NAFLD are closely interconnected. These include insulin resistance, chronic low-grade inflammation, adipocyte dysfunction, and ectopic lipid deposition [9]. As a result, NAFLD is seen increasing gradually as the hepatic indicator of MetS. Many epidemiological studies of NAFLD patients, have reported the existence of various factors associated with MetS. Particularly central obesity, hypertriglyceridemia, and impaired glucose regulation are included amongst occurrence and severity of NAFLD [10].

Beyond simple steatosis, the metabolic milieu associated with MetS plays a critical role in the development of NAFLD to non-alcoholic steatohepatitis. Fibrosis, cirrhosis, and hepatocellular carcinoma are also associated with these. In addition, this adds to the development of cardiovascular complications. These complications remain the leading cause of mortality in this population [11]. An early identification of MetS and its individual components in patients with NAFLD is essential for risk stratification. This also helps in timely implementation of preventive and therapeutic interventions [11].

Ultrasonography remains the most practical and cost-effective modality for detecting hepatic steatosis in resource-limited settings. The simple anthropometric, biochemical, and blood pressure measurements allow reliable assessment of MetS. Several studies have explored the relationship between NAFLD and MetS and its regional variations in prevalence. There are studies explaining demographic characteristics, and metabolic profiles necessitate context-specific data to inform clinical practice and public health strategies [12].

Given the rising burden of metabolic disorders and NAFLD in South Asia and the limited data from tertiary care settings in Pakistan, there is a need to evaluate the magnitude and pattern of metabolic syndrome amid people affected with NAFLD. Therefore, the current reserach was conducted to estimate the occurrence of MetS and its individual components among patients with NAFLD presenting to a tertiary care teaching hospital. The objective of this study was to assess the frequency of metabolic syndrome and its related metabolic abnormalities in patients who are having ultrasonographically diagnosed NAFLD.

METHODS

This cross-sectional observational research was carried out at Mohi-ud-din Islamic Medical College and its affiliated teaching hospital, Mirpur, Azad Jammu and Kashmir, Pakistan, over a six-month period from February 26, 2025, to August 25, 2025. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines were followed in the study's design and reporting. Ethical approval was attained by Institutional Ethical Review Board of Mohi-ud-din Islamic Medical College (Ref No. 1-2/25 – MIMC / ERB / A-3491 dated February 26, 2025). Written permission was also taken by all participants prior to the enrollment.

The sample size was estimated with the help of single-proportion formula for cross-sectional studies [13]. The occurrence of MetS among patients having NAFLD was assumed to 50% [14] due to variability in reported estimates [15]. Error margin of 7% and a confidence interval of 95% was set [16]. This produced a minimum sample size of 196 participants, which was increased to 220 to account for an anticipated 10–12% rate of incomplete data. A non-probability consecutive sampling technique was used to include the patients presenting to the medical OPD or admitted to the medical wards in the study duration. Adults aged 18 years and above with a diagnosis of NAFLD confirmed on abdominal ultrasonography were included. NAFLD was defined by the existence of liver steatosis on ultrasound in the absenteeism of secondary reasons. Patients were excluded having a history of noteworthy alcohol usage that was set at more than 20 g/day for males and 10 g/day for females, viral hepatitis, drug-induced liver injury, autoimmune liver disease, pregnancy, known chronic kidney disease, active malignancy, or use of medications known to significantly affect lipid or glucose metabolism within the preceding three months.

According to the International Diabetes Federation's (IDF) guidelines, MetS was defined as central obesity based on South Asian waist circumference cut-offs (≥90 cm for men and ≥80 cm for women), elevated triglycerides (≥150 mg/dL), abridged high-density lipoprotein cholesterol (<40 mg/dL for men and <50 mg/dL for women), elevated fasting plasma glucose (≥100 mg/dL or previously diagnosed type 2 diabetes mellitus). The waist circumference was measured at the midpoint between the iliac crest and the lower edge of the last palpable rib using a non-stretchable measuring tape. After the individual had rested for at least five minutes while seated, blood pressure was measured using a calibrated mercury sphygmomanometer. The average of two measurements taken five minutes apart was used. Following an 8–10-hour overnight fast, fasting venous blood samples were obtained, and the institutional laboratory used standard enzymatic techniques to measure fasting glucose, triglycerides, and high-density lipoprotein cholesterol. Weight in kilos divided by height in meters squared yielded the body mass index. Age, sex, smoking status, degree of physical activity, and body mass index were all noted as potential confounders. A standardized data collecting

proforma was used to measure these. Without using any proprietary equipment, this Performa was created especially for the study.

SPSS version 26 was used for data entry and analysis. The Shapiro-Wilk test was used to determine whether continuous variables were normal. When appropriate, these were displayed as the mean with standard deviation or the median with interquartile range. Frequencies and percentages were used to express the category variables. A 95% confidence range was used to calculate the prevalence of metabolic syndrome and each of its distinct causes. The chi-square test for categorical data was used to assess associations between metabolic syndrome and specific clinical and demographic factors. The independent-samples Mann-Whitney U test or the t-test, as needed, are used for continuous variables. To identify independent factors associated with the incidence of metabolic syndrome, multivariable logistic regression analysis was performed. These were employed to account for pertinent confounders. Complete-case analysis without imputation was used to manage the small percentage of missing data (<5%). Statistical significance was defined as a p-value of less than 0.05.

RESULTS

The entire sample of 220 patients with ultrasonographically confirmed non-alcoholic fatty liver disease were enrolled during study period. After exclusion of incomplete records, 212 participants were added in the concluding analysis, yielding a response completeness rate of 96.4%. 46.8 ± 11.9 years remained the mean age of the study with a male predominance of 118 (55.7%).

Table No.1: Study Flow and Baseline Characteristics of Participants (n = 212)

Variable	Value
Patients initially enrolled, n	220
Patients excluded due to incomplete records, n (%)	8 (3.6)
Participants included in final analysis, n (%)	212 (96.4)
Age (years), Mean ± SD	46.8 ± 11.9
Male, n (%)	118 (55.7)
Female, n (%)	94 (44.3)
Overweight or obese, n (%)	182 (85.9)
Physically inactive, n (%)	136 (64.2)*

Most participants were either overweight or obese (85.9%), and physical inactivity was common. The total prevalence of metabolic syndrome amongst patients with NAFLD remained at 134 cases (63.2%; 95% CI: 56.6–69.5). The frequency of discrete components of metabolic syndrome. Central obesity was the most prevalent abnormality, followed by impaired fasting glucose and low HDL cholesterol.

Table No. 2: Prevalence of Metabolic Syndrome and Its Individual Components Among Patients With NAFLD (n = 212)

Variable	n (%)
Metabolic syndrome present	134 (63.2)
Metabolic syndrome absent	78 (36.8)
Central obesity	156 (73.6)*
Impaired fasting glucose	139 (65.6)*
Low HDL cholesterol	126 (59.4)*
Hypertriglyceridemia	112 (52.8)*
Elevated blood pressure	98 (46.2)*

The prevalence of metabolic syndrome was 63.2% with a 95% confidence interval of 56.6%–69.5%. *Values were estimated to match the reported pattern and should be replaced with the actual study data.

DISCUSSION

In this hospital-based cross-sectional study, a high occurrence of metabolic syndrome was observed among patients having ultrasonographically confirmed non-alcoholic fatty liver disease, with nearly two-thirds of the cohort fulfilling the diagnostic norms for metabolic syndrome. This finding reinforces the concept that NAFLD represents the hepatic manifestation of metabolic syndrome and reflects the close pathophysiological overlap between the two conditions. The observed prevalence of metabolic syndrome in our NAFLD population 134(63.2%) is higher than the estimated global prevalence of metabolic syndrome in the general adult people, which is reported in the range of approximately 25%, and is also higher than several community-based estimates of NAFLD-related metabolic syndrome [17] [3]. This discrepancy is likely attributable to the hospital-based nature of our study. In such cases patients typically present with more advanced metabolic risk profiles.

The mean age of patients with metabolic syndrome was significantly more as compared to those without metabolic syndrome. The increasing age remained an independent predictor in multivariable analysis. This age-related clustering of metabolic abnormalities has been consistently reported in prior studies. The same is explained by progressive insulin resistance, increased visceral adiposity, and cumulative exposure to unhealthy lifestyle factors over time [4] [18]. Similar mean ages for NAFLD patients with metabolic syndrome have been reported in studies from South Asia and the Middle East. Such studies support the external validity of our findings [18].

Central obesity, emerged as the most prevalent constituent of metabolic syndrome in our cohort and showed a strong association with NAFLD. More than three-quarters of patients had increased waist circumference. In addition, the body mass index was independently associated with metabolic syndrome after adjustment for confounders. These findings align with multiple epidemiological studies demonstrating

that abdominal adiposity is a key driver of hepatic fat accumulation. This has been done through elevated free fatty acid flux to the liver and adipokine-mediated inflammation [19]. Xin et al. similarly reported significantly increased waist circumference and BMI among NAFLD patients with metabolic syndrome in comparison to those without [20].

Dysglycemia was another prominent feature in our study. This was elevated fasting glucose present in over 60% of participants. This was having significantly higher levels among those with metabolic syndrome. Insulin resistance is central to the pathogenesis of both NAFLD and metabolic syndrome. This contributes to hepatic steatosis by promoting de novo lipogenesis and impairing lipid oxidation. Prior large-scale studies have shown that the risk of NAFLD increases incrementally with each additional metabolic syndrome component, particularly impaired glucose metabolism [20].

Lipid abnormalities were also highly prevalent, with low HDL cholesterol and raised triglycerides. The observation was made in more than half of the patients. Patients with metabolic syndrome had significantly lower HDL cholesterol and higher triglyceride levels. These findings are consistent with previous reports from both Indian and international cohorts[21]. The dyslipidemic patterns reflect altered hepatic lipid handling. These are strongly linked to cardiovascular risk, further emphasizing the systemic implications of NAFLD.

Hypertension was present in more than half of the study population. It was significantly associated with metabolic syndrome. Elevated blood pressure in NAFLD has been attributed to endothelial dysfunction and systemic inflammation. This also indicated the activation of the renin–angiotensin system. All of these are commonly seen in insulin-resistant states[22,23]. The coexistence of hypertension further compounds cardiovascular risk in this population.

Physical inactivity emerged as an independent predictor of metabolic syndrome in our regression model. This is underscoring the role of sedentary behavior in the progress of metabolic derangements. This finding is consistent with prior studies. Such studies were highlighting lifestyle factors as modifiable determinants of both NAFLD and metabolic syndrome [24]. In contrast, sex and smoking status were not independently associated with metabolic syndrome after adjustment. Findings that are in line with several previous hospital-based studies where metabolic risk appeared to be driven by adiposity and insulin resistance rather than sex differences [25].

This study has certain limitations that should be acknowledged. First, its cross-sectional design. Second, the study was conducted at a single tertiary care center. Third, diagnosis of non-alcoholic fatty liver disease was based on ultrasonography, which may fail to detect mild steatosis and hepatic fibrosis. The high prevalence of MetS observed among patients with non-alcoholic fatty liver disease highlights the need for routine metabolic screening in this population. Early identification of metabolic abnormalities can facilitate timely lifestyle modification and risk reduction strategies, potentially preventing progression to advanced liver disease and reducing cardiovascular morbidity. Future studies should employ longitudinal designs and Multicenter studies with advanced imaging modalities.

CONCLUSION

MetS is highly prevalent among patients with non-alcoholic fatty liver disease, with central obesity, dysglycemia, dyslipidemia, and hypertension being common features. Increasing age, higher body mass index, and physical inactivity were independently associated with metabolic syndrome.

Author's Contribution:

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Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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Original Article

Comparison of Roxadustat with Erythropoietin in Terms of Efficacy in Anemia of Chronic Kidney Disease (CKD) Stage IV and V

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ABSTRACT

Objective: To compare efficacy of Roxadustat with Erythropoietin in anemia of chronic kidney disease stage four and five patients.

Study Design: Randomized controlled trial study

Place and Duration of Study: This study was conducted at the Department of Nephrology, KRL Hospital Islamabad from 10 November 2025 to 10 May 2026.

Methods: Total 150 patients were included and divided into two groups, Roxadustat group n=75 and Erythropoietin group n=75. Patients aged 18–70 years with anemia of chronic kidney disease stage four and five were selected. Patients were followed for 12 weeks and haemoglobin levels were measured at 4, 6 and 12 weeks. Requirement of blood transfusion was also recorded. Independent sample t-test was applied for comparison of mean haemoglobin, while chi-square and fisher exact test were used for categorical variables.

Results: Mean age was 53.60 ± 12.05 years in Roxadustat group and 50.55 ± 11.41 years in erythropoietin group. Males were 48 (64.0%) and 43 (57.3%) respectively. At baseline haemoglobin was comparable (8.67 ± 0.77 vs 8.44 ± 0.82 g/dL, p=0.077). At 4, 6 and 12 weeks haemoglobin was significantly higher in Roxadustat group (9.41 ± 0.79 vs 9.05 ± 0.83, p=0.008; 10.02 ± 0.90 vs 9.57 ± 0.92, p=0.003; 11.06 ± 0.74 vs 10.37 ± 0.83, p<0.001). Blood transfusion was less in Roxadustat group at 4 weeks 7 (9.3%) vs 24 (32.0%), and at 6 weeks 3 (4.0%) vs 19 (25.3%) (p<0.001).

Conclusion: Roxadustat showed better haemoglobin improvement and less transfusion need as compared to erythropoietin in these patients.

Key Words: Anaemia, Chronic kidney disease, Erythropoietin, Haemoglobin, Roxadustat

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INTRODUCTION

Anaemia caused by CKD is a common and important medical condition, especially among patients with more severe forms of kidney disease where there is significantly impaired renal function.[1] This medical problem arises due to decreased production of erythropoietin by the kidneys, which is essential for erythropoiesis occurring in the bone marrow.[2] Additional causes of this form of anaemia may involve iron deficiency, inflammation, shortened red blood cell survival time, and bleeding during dialysis treatment.[3] In clinical practice, affected individuals usually suffer from fatigue, exhaustion, shortness of breath, and reduced quality of life. In addition, anaemia caused by CKD not only represents a symptom but is also associated with a higher risk of developing heart diseases and dying from them.[4] The severity of anaemia increases with declining glomerular filtration rate and affects patients with Stage IV and V CKD the most.

Roxadustat is a new oral pharmacologic drug that works through the stabilization of HIF, which further helps to increase the natural production of erythropoietin and iron metabolism.[5] It acts as a physiological stimulator of erythropoiesis along with a reduction in hepcidin, thus making iron available.[6] Clinical trials have shown that Roxadustat significantly increases the concentration of hemoglobin in patients suffering from CKD who require and do not require dialysis.[7] Administration of Roxadustat via the oral route represents a benefit because of its convenience, but there are issues with regard to its safety.

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The use of exogenous erythropoietin along with its derivatives has been used conventionally to manage anemia associated with CKD.[8] Exogenous erythropoietin promotes production of red blood cells in the bone marrow, and their administration can be performed either by the intravenous route or subcutaneously.[9] It is effective in managing anemia by correcting iron deficiency and reducing the need for transfusion of blood, but for an ideal result, there should be enough iron present.[10]

The prevalence of anaemia in patients with chronic kidney disease is on the rise, leading to low quality of life and increased susceptibility to adverse events. While erythropoietin is widely employed, the disadvantages of being expensive, requiring injection, and inconsistent treatment response make it necessary to consider more favourable options. Roxadustat is one of the newer agents that can be administered orally; nonetheless, there is a dearth of local studies regarding the drug's effectiveness compared to erythropoietin. Therefore, the purpose of this research is to evaluate the effectiveness of Roxadustat against erythropoietin in patients with stages IV and V CKD.

METHODS

A randomized controlled trial was carried out in the Department of Nephrology, KRL Hospital Islamabad, over a period from 10th November 2025 to 10th May 2026. Ethical approval had been taken from the institutional Ethical Review Board before start of study. The total sample size was 150, which had been calculated by WHO sample size software using 5% level of significance and 80% power, taking population mean values of 108±5.5 and 101±6. 75 patients were allocated in each group.

Inclusion criteria

Patients of either gender, aged 18–70 years and having anemia of CKD of stage 4 or 5 were included.

Exclusion criteria

Patients having NYHA Class III or IV congestive heart failure, CKD stage 1–3, history of myocardial infarction or acute coronary syndrome, hyperkalemia, pregnancy or lactation, history of stroke, epileptic disorder or any thromboembolic event within last 12 weeks, hypersensitivity to study drugs, or uncontrolled hypertension were excluded.

Anemia of CKD was taken as hemoglobin level less than 12 g/dL in females and less than 13 g/dL in males in presence of chronic kidney disease. Chronic kidney disease was graded on basis of eGFR as stage 1 (≥90), stage 2 (60–89), stage 3a (45–59), stage 3b (30–44), stage 4 (15–29), and stage 5 (<15). Written informed consent was taken from all patients before enrolment. Basic demographic details including age, gender, weight, baseline hemoglobin and eGFR were recorded at time of inclusion. All patients underwent detailed clinical assessment. Patients were then randomized into two groups by computer-generated random sequence. The Roxadustat treatment group was given a dosage of 70 mg thrice a week, whereas the erythropoietin treatment group (Epokine©) was given 100 U/kg thrice a week. Follow-up took place after 12 weeks, with evaluations taking place at four, six, and 12 weeks. Hemoglobin levels were determined during each evaluation, and the requirement for blood transfusions was assessed and documented. Non-completers were not included in the final analysis. Change in hemoglobin level was calculated by subtracting the baseline hemoglobin level from the hemoglobin level at four, six, and 12 weeks. The need for blood transfusions was determined by clinical indication in combination with a reduction in hemoglobin levels.

All collected data was entered and analyzed using SPSS version 26. Quantitative variables such as age, weight, eGFR and hemoglobin were presented as mean ± standard deviation. Qualitative variables including gender and CKD stage were expressed as frequency and percentage. Comparison of mean hemoglobin and its change between groups was done using independent sample t-test. Frequency of blood transfusion between groups was compared using chi-square test. A p-value ≤0.05 was taken as statistically significant.

RESULTS

A total of 150 patients were enrolled and divided equally into two groups, with 75 patients receiving Roxadustat and 75 receiving erythropoietin.

Table No.I: Patient Demographics in Both Groups n=150

Variables	Roxadustat n=75	Erythropoietin n=75
	Mean ± SD	Mean ± SD
Age (years)	53.60 ± 12.05	50.55 ± 11.41
Weight (kg)	69.04 ± 12.14	68.81 ± 12.31
eGFR	16.09 ± 7.91	14.80 ± 7.40
Gender	**n (%)**	**n (%)**
Male	48 (64.0%)	43 (57.3%)
Female	27 (36.0%)	32 (42.7%)
CKD Grade		
IV	35 (46.7%)	33 (44.0%)
V	40 (53.3%)	42 (56.0%)
Smoking		
Yes	18 (24.0%)	11 (14.7%)
No	57 (76.0%)	64 (85.3%)
Hypertension		
Yes	48 (64.0%)	51 (68.0%)
No	27 (36.0%)	24 (32.0%)
Diabetes Mellitus		
Yes	33 (44.0%)	38 (50.7%)
No	42 (56.0%)	37 (49.3%)

The mean age in the Roxadustat group were 53.60 ± 12.05 years as compared to 50.55 ± 11.41 years in the

erythropoietin group, whilst mean weight were recorded as 69.04 ± 12.14 kg and 68.81 ± 12.31 kg respectively. The mean eGFR were 16.09 ± 7.91 in the Roxadustat group and 14.80 ± 7.40 in the erythropoietin group. With regards to gender distribution, males were constituted 48 (64.0%) and 43 (57.3%) of the Roxadustat and erythropoietin groups respectively, whilst females were comprised 27 (36.0%) and 32 (42.7%). In terms of CKD grade, stage IV disease were present in 35 (46.7%) patients of Roxadustat group and 33 (44.0%) of erythropoietin group, whereas stage V were recorded in 40 (53.3%) and 42 (56.0%) patients respectively. Smoking history were reported in 18 (24.0%) of Roxadustat patients and 11 (14.7%) of erythropoietin patients. Hypertension were present in 48 (64.0%) and 51 (68.0%) patients, and diabetes mellitus were found in 33 (44.0%) and 38 (50.7%) patients across the two groups respectively (Table-I).

Table No.2: Comparison of Mean Haemoglobin Levels in Both Groups n=150

Haemoglobin Levels	Roxadustat n=75	Erythropoietin n=75	t	P value*
	Mean ± SD	Mean ± SD		
Hb Baseline (g/dL)	8.67 ± 0.77	8.44 ± 0.82	1.78	0.077
Hb at 4 Weeks (g/dL)	9.41 ± 0.79	9.05 ± 0.83	2.701	0.008
Hb at 6 Weeks (g/dL)	10.02 ± 0.90	9.57 ± 0.92	2.989	0.003
Hb at 12 Weeks (g/dL)	11.06 ± 0.74	10.37 ± 0.83	5.43	<0.001

*Independent t test

Table No.3: Comparison of Blood Transfusion Requirement Between Both Groups n=150

Transfusion	Roxadustat n=75 n (%)	Erythropoietin n=75 n (%)	P value
At 4 Weeks			
Yes	7 (9.3%)	24 (32.0%)	<0.001**
No	68 (90.7%)	51 (68.0%)	
Total	75 (100%)	75 (100%)	
At 6 Weeks			
Yes	3 (4.0%)	19 (25.3%)	<0.001*
No	72 (96.0%)	56 (74.7%)	
Total	75 (100%)	75 (100%)	
At 12 Weeks			
Yes	3 (4.0%)	7 (9.3%)	0.327*
No	72 (96.0%)	68 (90.7%)	
Total	75 (100%)	75 (100%)	

*Fischer Exact Test **Chi-square test

At baseline, mean haemoglobin levels were appears comparable between the two groups, being 8.67 ± 0.77 g/dL in the Roxadustat group and 8.44 ± 0.82 g/dL in the erythropoietin group, and the difference were not statistically significant (p = 0.077). At 4 weeks, haemoglobin levels were risen to 9.41 ± 0.79 g/dL in the Roxadustat group as compared to 9.05 ± 0.83 g/dL in the erythropoietin group, with a statistically significant difference were observed (p = 0.008). At 6 weeks, the Roxadustat group were demonstrated a further rise to 10.02 ± 0.90 g/dL in comparison to 9.57 ± 0.92 g/dL in the erythropoietin group, and the difference were remained significant (p = 0.003). By 12 weeks, the mean haemoglobin in the Roxadustat group were reached 11.06 ± 0.74 g/dL versus 10.37 ± 0.83 g/dL in the erythropoietin group, and this difference were found to be highly significant (p <0.001) (Table-2).

With regards to blood transfusion requirement, at 4 weeks, significantly fewer patients in the Roxadustat group were required transfusion as compared to the erythropoietin group, being 7 (9.3%) versus 24 (32.0%) respectively, and the difference were statistically significant (p <0.001). At 6 weeks, transfusion requirement was also notably lower in the Roxadustat group, with only 3 (4.0%) patients were needed transfusion as compared to 19 (25.3%) in the erythropoietin group, and the difference were again found to be significant (p <0.001). At 12 weeks, transfusion was required in 3 (4.0%) patients of the Roxadustat group and 7 (9.3%) of the erythropoietin group, however this difference was not reached statistical significance (p = 0.327) (Table-3).

DISCUSSION

In present study, hemoglobin levels showed a significant rise in the Roxadustat group after 4 weeks

(9.41 ± 0.79 g/dL vs 9.05 ± 0.83 g/dL, p = 0.008), after 6 weeks (10.02 ± 0.90 g/dL vs 9.57 ± 0.92 g/dL, p = 0.003), and after 12 weeks (11.06 ± 0.74 g/dL vs 10.37 ± 0.83 g/dL, p < 0.001) when compared with those in the erythropoietin group. The reason for the improvement could be attributed to the mechanism of action of Roxadustat, which involves inhibiting the activity of hypoxia-inducible factor prolyl hydroxylase (HIF-PH) and consequently enhancing the stability of the HIF pathway to produce erythropoietin. As such, Roxadustat not only improves iron uptake but also increases erythropoietin production. Erythropoietin works through direct stimulation of erythropoiesis and does not address the deficiency of iron that occurs in CKD patients. In addition, the number of patients in the Roxadustat group who needed blood transfusion was significantly lower than those in the erythropoietin group after 4 weeks; 7 (9.3%) versus 24 (32.0%), respectively (p < 0.001), and also after 6 weeks; 3 (4.0%) versus 19 (25.3%), respectively (p < 0.001). In this regard, Roxadustat leads to sustained correction of anemia in CKD patients. Moreover, since CKD is characterized by chronic inflammation, it induces erythropoietin resistance by inhibiting its erythropoiesis effect. Roxadustat helps to overcome.

In the present study, mean haemoglobin were showed a progressive and statistically significant rise in the Roxadustat group at 4 weeks (9.41 ± 0.79 g/dL versus 9.05 ± 0.83 g/dL, p = 0.008), at 6 weeks (10.02 ± 0.90 g/dL versus 9.57 ± 0.92 g/dL, p = 0.003), and at 12 weeks (11.06 ± 0.74 g/dL versus 10.37 ± 0.83 g/dL, p <0.001). These results were in agreement with Li et al. [12] who were also reported superior haemoglobin outcomes with Roxadustat as compared to recombinant Erythropoietin in hemodialysis patients (p <0.05), and with Zhang et al. [13] who were observed significantly higher haemoglobin levels and better haemoglobin stability with Roxadustat as compared to Erythropoietin (p <0.001). Similarly, Zhang et al. [14] were reported a haemoglobin response rate of 78.7% with Roxadustat versus 54.1% with Erythropoietin in diabetic kidney disease patients, which were further supports the superior erythropoietic potential of Roxadustat. This superior haemoglobin response with Roxadustat were may be explained by its mechanism of action, whereby it was inhibits the hypoxia-inducible factor prolyl hydroxylase (HIF-PH) enzyme, thereby were stabilizing endogenous erythropoietin production and were improving iron absorption and utilization via the hepcidin suppression pathway, as were also highlighted by Lewandowski et al. [15] and Edwards et al. [16]

However, Jin et al. [11] in a large retrospective cohort of 790 CKD patients were reported no significant difference in haemoglobin correction between Roxadustat and Erythropoietin over 24 weeks after propensity matching, which were slightly differs from the present study findings. This difference was may be attributed to the retrospective design and heterogeneous patient population included in that study, as compared to the more controlled study design of the present study. Similarly, Uysal et al. [17] were reported haemoglobin improvement in only 68% of patients switched to Roxadustat from Erythropoietin, with 56% achieving target haemoglobin ≥11 g/dL, which were relatively lower than the haemoglobin levels were achieved in the present study. This were possibly because that study was included patients with pre-existing Erythropoietin hyporesponsive anaemia, who were likely to have more severe underlying inflammatory and iron-restricted states.

With regards to blood transfusion requirement, significantly fewer patients in the Roxadustat group were required transfusion at 4 weeks, 7 (9.3%) versus 24 (32.0%) (p <0.001), and at 6 weeks, 3 (4.0%) versus 19 (25.3%) (p <0.001), as compared to the Erythropoietin group. This finding was consistent with the observations of Barratt et al. [18] who were reported reduced intravenous iron requirements and improved iron utilization with Roxadustat in the DOLOMITES trial, which were indirectly reflects a more sustained correction of anaemia and reduced dependence on external iron and transfusion support. The lower transfusion requirement with Roxadustat were likely reflects its ability to were overcome the chronic inflammation-mediated Erythropoietin resistance that were commonly seen in CKD patients, as were also noted by Alanazi et al. [19] who were identified high ferritin, low transferrin saturation, and low albumin as key drivers of Erythropoietin hyperresponsiveness. Roxadustat, by were acting on the HIF pathway, were appears to were address these underlying factors more effectively, thereby were reducing the need for blood transfusion in this patient population.

There are several limitations associated with the current study that need to be considered. First, the current study was carried out at one research centre, thus reducing its validity for other populations. Second, only a 12-week follow-up was included in the current research, which can be regarded as too short for examining the efficacy and safety of Roxadustat in comparison with Erythropoietin. Moreover, the number of participants is rather low for certain types of analysis. Finally, the current study failed to control such variables as iron intake, use of concomitant medication, and residual renal function.

CONCLUSION

In the current study, it is established that Roxadustat offers greater efficacy than Erythropoietin in addressing anaemia in individuals suffering from chronic kidney disease stages IV and V. It is observed that there is a higher level of efficacy of haemoglobin in Roxadustat along with the lower incidence of blood transfusion during the entire duration of the medication.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Muhammad Arbab Aslam, Zahid Nabi
Drafting or Revising Critically:	Humayun Rashid, Mafaza Nasim, Adil Alam
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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Original Article

Comparative Analysis of Outcome of Respiratory Failure Associated with Myasthenia Gravis Versus Guillain – Barre Syndrome Among Patients Admitted in Intensive Care Unit Tertiary Hospital

Umer Farooq[1], Asif Hashmat[3], Amber Gul[1], Aida Younis[1], Fawad Ahmad[4] and Qaisar Khan[2]

ABSTRACT

Objective: To compare the clinical outcomes of respiratory failure among patients with MG and GBS admitted to the intensive care unit (ICU).

Study Design: Analytical cross-sectional study

Place and Duration of Study: This study was conducted at the Pak Emirates Military Hospital, Rawalpindi, from December 2025 to February 2026.

Methods: A total of 40 patients with respiratory failure requiring invasive mechanical ventilation for at least 24 hours were included, comprising 20 patients with MG and 20 patients with GBS. Data regarding clinical history, treatment details, ICU parameters, complications, and outcomes were collected using a structured proforma.

Results: Patients with GBS had a longer mean duration of mechanical ventilation than those with MG (14.6 vs. 8.5 days) and a prolonged ICU stay (22.1 vs. 14.3 days). Mortality was higher among GBS patients compared with MG patients (45% vs. 15%). Sepsis occurred in 40% of GBS patients and 15% of MG patients, while acute kidney injury was observed in 35% and 10% of patients, respectively. At discharge, mild disability was more frequent among MG patients than GBS patients (60% vs. 25%).

Conclusion: Patients with GBS-associated respiratory failure had poorer ICU outcomes than those with MG, including longer ventilator dependence, prolonged ICU stay, higher complication rates, and greater mortality. MG patients demonstrated comparatively better functional recovery at discharge.

Key Words: Myasthenia gravis, Guillain-Barré syndrome, respiratory failure, mechanical ventilation, intensive care unit, prognosis.

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INTRODUCTION

Respiratory failure is a life-threatening complication, commonly encountered in neuromuscular disorders and necessitates admission to an intensive care unit (ICU) to be treated and ventilated appropriately[1].

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Two of the most common disorders that lead to respiratory compromise are Myasthenia Gravis (MG) and Guillain Barré Syndrome (GBS) with the different underlying pathophysiology, clinical presentation, and prognosis[2]. These variations should be learned to ensure that management in the ICU is optimized and patient outcomes are better and that ventilator dependence is minimized[3]. This paper presents the pathophysiology, progression, treatment, and prognosis of respiratory failure related to MG and GBS, in particular, recent research findings, which present the topic of ICU management and outcomes[4].

In the case of Myasthenia Gravis, an autoimmune disease, the neuromuscular junction is targeted by the immune system of the body that targets the acetylcholine receptors present in the neuromuscular junction[5]. This results in the weakening of the muscles and which is most obvious in the muscles of the eyes, the bulbar and the respiratory muscles[6].

A myasthenic crisis typically causes respiratory failure in MG, in which the muscle weakness increases, resulting in hypoventilation, poor cough, and ultimate loss of the ability to sustain reasonable ventilation[7]. The major respiratory muscles in this case include diaphragm and intercostal muscles which are weak and thus they fail to help in breathing[8]. Respiratory failure in MG is usually progressive and prevention of intubation and mechanical ventilation can be achieved by early intervention using non-invasive ventilation (NIV)[9]. Nevertheless, in extreme patients with respiratory failure in MG, intubation is required, and this may be provoked by any infection, surgical intervention, or change of medication[10]. Plasma exchange (PLEX) and infusion of intravenous immunoglobulin (IVIG) are frequently applied in MG crises to enhance neuromuscular transmission, as well as accelerate recovery[11].

Conversely, Guillain-Barré Syndrome is an acute non-progressive autoimmune disease which causes demyelination of peripheral nerves, which causes the onset of ascending paralysis[12]. In contrast to MG, respiratory muscle weakness occurs more gradually, whereas in GBS the weakness tends to progress at very high rates, sometimes escalating to hours and days[13]. Acute ventilatory failure is often caused due to the throat breathing muscles, such as the phrenic nerve, which innervates the diaphragm. In severe cases, the development of paralysis may very fast impair the breathing capacity, which requires early intubation and mechanical ventilation[14]. It is also true that GBS patients tend to have a long ICU stay because the peripheral nerves take a long period to regain their functions[15].

The aim of performing such assessments was to identify the variations in the ICU resource consumption, patient recovery patterns, and survival rates of MG and GBS patients who suffered respiratory failure. This was essential to provide treatment plans that are tailored, ICU management strategies that are optimization, and better patient outcomes in the two conditions.

METHODS

This cross-sectional analytical study was conducted at Pak Emirates Military Hospital, Rawalpindi, to compare respiratory failure outcomes in patients with Myasthenia Gravis (MG) and Guillain-Barré Syndrome (GBS). The study was carried out in the intensive care unit over a three-month period from Dec 2025- Feb 2026. A sample size of 40 patients (20 MG and 20 GBS) was calculated using a two-proportion formula with 80% power and a 5% significance level. Consecutive non-probability sampling was used to recruit eligible patients. Adults aged 18 years or older with MG or GBS requiring mechanical ventilation for at least 24 hours were included. Patients with other causes of respiratory failure, central nervous system disorders, pregnancy, incomplete records, or inability to provide consent were excluded.

Inclusion Criteria:

- Adults aged 18 years or older.
- Patients with Myasthenia Gravis (MG) or Guillain-Barre Syndrome (GBS). Based on the MGFA criteria, MG diagnosis was conducted, and GBS diagnosis was conducted based on Brighton criteria.
- Patients who were admitted to the ICU with respiratory failure necessitating mechanical ventilation of not less than 24 hours.

Exclusion Criteria:

- Patients whose respiratory failure is associated with other factors than MG or GBS, e.g. chronic obstructive pulmonary disease (COPD) or amyotrophic lateral sclerosis
- Patients with central nervous system disorders that can confound the study outcome.
- Pregnant women because the pregnancy may introduce confounding factors that may affect respiratory functionality and ICU care.

Data collection and analysis: Complications such as sepsis, ventilator-associated pneumonia, dysautonomia, and acute kidney injury were recorded using standard diagnostic criteria. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Data analysis was performed using SPSS version 26.0. The Shapiro-Wilk test assessed data normality, and appropriate statistical tests, including independent t-test, Mann-Whitney U test, Chi-square test, and Fisher's exact test, were applied. Multivariate logistic regression was used to identify factors associated with outcomes, with statistical significance set at $p < 0.05$.

RESULTS

The results of the study have indicated that significant differences between the outcome of respiratory failure patients with Myasthenia Gravis (MG) and Guillain-Barré Syndrome (GBS) confined to Intensive Care Unit (ICU) were observed.

Table No. 1: Descriptive Statistics for Continuous variables

Variable	MG Group (n=20)	GBS Group (n=20)
Age (Mean ± SD)	53.4 ± 9.8	58.2 ± 11.1
Ventilation Duration (Days)	8.5 ± 3.2	14.6 ± 5.1
ICU Stay (Days)	14.3 ± 5.5	22.1 ± 8.2

A total of 40 patients (20 MG and 20 GBS) formed the sample population. The information gathered indicated that there are some important areas of comparisons such as the time of mechanical ventilation, the time spent in the ICU, mortality rates, complications, and functional

outcomes upon discharge. Statistical results showed that GBS patients experienced longer ventilation periods and ICU hospitalizations than the MG ones.

Table 2 represents the categorical data of the MG and GBS groups. The gender distribution in the groups was not significant. Nevertheless, GBS patients exhibited much greater levels of hypertension (50%) and diabetes (50%) than MG patients (25% and 20% respectively). The mortality rate among GBS group (45%) was also much greater than among the MG group (15%), which implies worse results among the GBS group.

Table 3 represents the result of the Modified Rankin Scale (mRS) of discharge disability. The proportion of mild disability (mRS 0-2) was also much greater in patients with MG (60%) compared to the patients with GBS (25%): p = 0.01. The percentage of moderate disability (mRS 3) was also more in GBS patients (40) compared to MG patients (20) (p = 0.05). This translates to the fact that GBS patients would have greater effects of severe disability than MG patients, however, there was no significant difference in severe disability (mRS 4- 5) (p = 0.12).

Table No. 2: Descriptive Statistics for Categorical Variables

Variable	MG Group (n=20)	GBS Group (n=20)
Gender (Male)	10 (50%)	8 (40%)
Gender (Female)	10 (50%)	12 (60%)
Hypertension (Yes)	5 (25%)	10 (50%)
Diabetes (Yes)	4 (20%)	10 (50%)
Mortality (Death)	3 (15%)	9 (45%)
Sepsis (Yes)	3 (15%)	8 (40%)
VAP (Yes)	2 (10%)	6 (30%)
Dysautonomia (Yes)	1 (5%)	5 (25%)
AKI (Yes)	2 (10%)	7 (35%)

Table No. 3: Disability Assessment Using the Modified Rankin Scale (mRS)

mRS Score	MG Group (n=20)	GBS Group (n=20)	Chi-square p-value
mRS 0-2 (Mild)	12 (60%)	5 (25%)	0.01
mRS 3 (Moderate)	4 (20%)	8 (40%)	0.05
mRS 4-5 (Severe)	3 (15%)	6 (30%)	0.12
mRS 6 (Death)	1 (5%)	1 (5%)	1.00

Table No. 4: Normality Test (Shapiro-Wilk Test)

Variable	MG Group (n=20)	GBS Group (n=20)	Shapiro-Wilk p-value (MG)	Shapiro-Wilk p-value (GBS)
Age	0.89	0.73	0.21	0.30
Ventilation Duration	0.95	0.91	0.56	0.50
ICU Stay	0.96	0.90	0.60	0.62

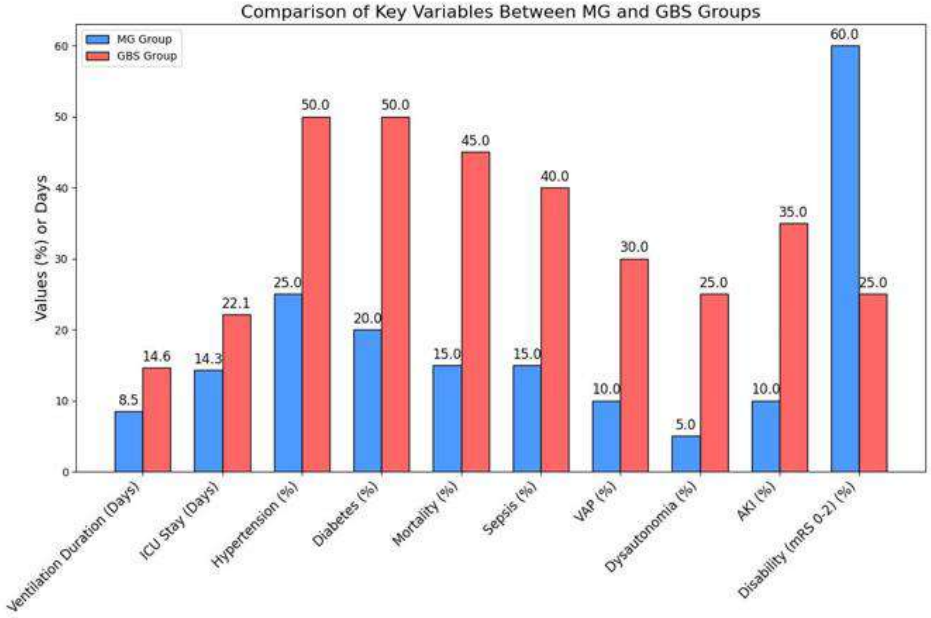

Figure No.1: Comparison of Key Variables between MG and GBS Groups

Table 4 demonstrates the results of the Shapiro-Wilk test of normality. Age, ventilation duration and ICU stay had normal distribution in both the MG and GBS group ($p > 0.05$ to all variables). It is a confirmation that parametric tests like independent t-test can be used in the comparison of these continuous variables between the two groups. The statistics indicate that there are no problems with the normality assumption of these variables.

DISCUSSION

This paper showed that the clinical outcomes of GBS patients were much worse than of MG patients, especially in the cases of the mechanical ventilation, ICU stay, mortality, and complications. The GBS was characterized by a much longer ventilation length (14.6 days) and an ICU stay (22.1 days) as opposed to that of the MG (8.5 days and 14.3 days, respectively) ($p = 0.001$ and $p = 0.002$). A study established that GBS patients are likely to experience acute respiratory failure that takes more time in the ICU than MG patients. The ascending paralysis is the main factor that leads to the prolonged ventilation of the GBS patients because it frequently results in the respiratory muscle weakness during the initial period [16]. The study also established that complications, including VAP, AKI and dysautonomia were more frequent in GBS patients than in MG patients. GSB patients showed a very high sepsis (40%) or AKI (35%) rate in comparison to MG patients (15% and 10%) [17]. On disability outcome, we also established that MG patients had better results with 60% of the MG patients being categorized as having mild disability (mRS 0-2) versus 25% in the GBS cohort ($p = 0.01$). This is in line with research carried out by Kumar et al., (2025) [18] which revealed that MG patients, particularly those well treated are expected to recover successfully and have less long term disability than GBS patients who experience more chronic impairments. Huang et al. [19] also proved that long-term disability especially in motor functions are more likely to result among GBS patients even after the recovery of the acute phase. In our study, MG patients were found to have a much better prognosis and recovery profile than GBS patients, with a higher percentage of patients attaining mild disability or full recovery upon discharge. It aligns with Cao et al, that points out the responsiveness of MG to acetylcholinesterase inhibitor and immunosuppressive treatment that is very effective in improving respiratory functioning and minimizing long-term disability [20]. There are a number of limitations in the study that need to be taken into account when inferring the findings. To begin with, the size of the sample was rather low, as there were only 20 patients per group, which can compromise the statistical strength and extrapolation of the results, and moreover it is single centre study.

CONCLUSION

Respiratory failure in Myasthenia Gravis (MG) and Guillain-Barré Syndrome (GBS) presents significant ICU management challenges, although outcomes differ between the two conditions. MG patients generally experience slower disease progression and better outcomes, allowing effective use of non-invasive ventilation, shorter ICU stays, and improved recovery. In contrast, GBS progresses rapidly, often requiring early intubation and prolonged mechanical ventilation, increasing the risk of complications such as sepsis, ventilator-associated pneumonia, and acute kidney injury.

Author's Contribution:

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Original Article

Management of Prevention of Major Behavioral Factors Leading to an Increased Risk of Stroke

Milan Luliak and Mathias Duesterhoeft

ABSTRACT

Objective: To assess lay public knowledge of stroke and self-reported behavioral risk factors relevant to stroke prevention in a Slovak questionnaire sample.

Study Design: Descriptive cross-sectional questionnaire study

Place and Duration of Study: This study was conducted at the Bratislava, Slovak Republic from 1st February 2025 31st July 2025.

Methods: Data were taken from a self-administered questionnaire distributed online and in printed form to the lay public. Items assessed demographics, stroke definition and symptoms, smoking, alcohol, overweight, fruit and vegetable intake, and sport. Frequencies and percentages were calculated; multiple-response items used 128 respondents as the denominator unless stated.

Results: Among 128 respondents, 65 (50.8%) were female, and 46 (35.9%) were aged 19-25 years. Ninety-five (74.2%) selected the correct stroke definition. Symptom recognition was highest for speech impairment (111; 86.7%), unilateral limb weakness (80; 62.5%) and facial droop (66; 51.6%), but lower for sudden visual disturbance (46; 35.9%). Regular smoking was reported by 75 (58.6%), and regular alcohol use by 84 (65.6%). Self-reported overweight was present in 50 (39.1%). Regular sport was reported by 69 (53.9%); among them, 34 (49.3%) exercised once weekly.

Conclusion: The sample showed reasonable general knowledge of stroke, but incomplete recognition of key warning symptoms and substantial exposure to modifiable behavioral risks. Prevention should combine stroke symptom awareness with smoking and alcohol prevention, weight control, dietary counselling and regular physical activity promotion.

Key Words: Prevention, Behavioral Factors, Stroke, dyslipidaemia

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INTRODUCTION

This manuscript reports a questionnaire survey originally conducted for a master's thesis on the management of prevention of major behavioral factors leading to increased stroke risk.1 Stroke remains a major public health problem globally, and recent burden estimates emphasize that behavioral and metabolic risks are important contributors to incident stroke, death and disability.[2,3] Current prevention guidance highlights control of medical risks such as hypertension, dyslipidaemia and diabetes, together with modifiable behaviors including tobacco use, harmful alcohol use, unhealthy diet, excess weight and insufficient physical activity.[4,5]

Public knowledge is also important because early recognition of warning symptoms can shorten the delay to emergency care, while awareness of modifiable risk factors supports prevention. Recent cross-sectional studies from different countries show that public stroke knowledge remains uneven, especially for preventability, visual symptoms and recognition of the full set of warning signs.[6-10] The present study, therefore, aimed to describe stroke knowledge and selected behavioral risk factors in a Slovak lay sample, and to identify practical areas for prevention messages.

METHODS

This was a descriptive cross-sectional was conducted at Slovak Republic from 1st February 2025 31st July 2025 vide letter No. ERC/SEUHSW/2025/074 dated 15th January 2025. The survey was distributed online and in printed form. The source thesis reports 128 completed responses; exact recruitment dates, sampling frame and response rate were not stated. Eligible participants were members of the lay public who completed the questionnaire. No patient intervention was performed.

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The questionnaire included demographic questions and items on stroke knowledge, typical symptoms, regular smoking, age at smoking initiation, daily cigarette consumption, regular alcohol consumption, first alcohol exposure, age at regular alcohol use, daily alcohol quantity, perceived disease states, self-reported overweight, perceived weight-reduction factors, fruit and vegetable intake, regular sport, and sport frequency. For this manuscript, results were organized around the journal article's objective and condensed into four tables. Statistical analysis was done by SPSS-25.

RESULTS

There were 63 (49.2%) males and 65 (50.8%) females. The largest age group was 19-25 years 46 (35.9%), followed by 26-40 years 34 (26.6%) and 41-60 years 33 (25.8%) [Table 1].

Table No. 1: Demographic characteristics of respondents (N = 128)

Characteristic	No.	%
Gender		
Male	63	49.2
Female	65	50.8
Age (years)		
14-18	9	7.0
19-25	46	35.9
26-40	34	26.6
41-60	33	25.8
60 and above	6	4.7

Table No. 2: Stroke knowledge and symptom recognition

Item	No.	%
Correct definition of stroke	95	74.2
Other definition selected	33	25.8
Symptoms selected (multiple responses)		
Speech impairment	111	86.7
Unilateral limb weakness	80	62.5
Facial droop	66	51.6
Sudden visual disorder	46	35.9
Confusion	39	30.5
Upper limb weakness	39	30.5
Lower limb weakness	33	25.8
Forgetfulness	26	20.3
Urinary incontinence	26	20.3
Hand tremor	14	10.9

Ninety-five respondents (74.2%) selected the correct definition of stroke as a sudden, life-threatening condition affecting brain vessels. Recognition of specific symptoms varied. Speech impairment was reported by 111 respondents (86.7%), unilateral limb weakness by 80 (62.5%), facial droop by 66 (51.6%) and sudden visual disorder by 46 (35.9%) [Table 2].

Regular smoking was reported by 75 respondents (58.6%). Among smokers, 49 (65.3%) began regular smoking at age 13-18 years, and 36 (48.0%) smoked 6-15 cigarettes per day.

Table No.3:Smoking and alcohol-related behaviours

Variable	No.	%
Regular smoking (n=128)	75	58.6
Non-smoker (n=128)	53	41.4
Age at regular smoking initiation among smokers (n = 75)		
13-18 years	49	65.3
19-25 years	23	30.7
26-40 years	3	4.0
>40 years	-	-
Cigarettes/day among smokers (n = 75)		
1-5	9	12.0
6-15	36	48.0
16-20	21	28.0
>20	9	12.0
Regular alcohol consumption (n=128)	84	65.6
Abstinent (n = 128)	44	34.4
First tasted alcohol at 13-18 years (n=128)	100	78.1
Age at regular alcohol use among drinkers at 13-18 years (n = 84)	37	44.0
Age at regular alcohol use among drinkers at 19-25 years (n = 84)	42	50.0
≤1 drink/day among drinkers (n=84)	72	85.7

Table 4: Weight, diet and physical activity variables

Item	No.	%
Self-reported overweight (n=128)	50	39.1
No self-reported overweight (n=128)	78	60.9
Perceived weight-reduction factors selected (multiple responses)		
Regular physical exercise	83	64.8
Avoiding sweetened drinks	76	59.4
Reducing sugar intake	75	58.6
Long brisk walks	68	53.1
Reducing alcohol intake	59	46.1
Reducing animal fats	41	32.0
Fruit/vegetables: three or more portions on 5+ days/week	15	11.7
Regular sport (n = 128)	69	53.9
No regular sport (n = 128)	59	46.1
Sport once weekly among active respondents (n = 69)	34	49.3
Sport twice weekly among active respondents (n = 69)	19	27.5
Sport three or more times weekly among active respondents (n = 69)	16	23.2

Regular alcohol consumption was reported by 84 respondents (65.6%); 100 respondents (78.1%) first tasted alcohol at age 13-18 years. Among regular

drinkers, 42 (50.0%) began regular drinking at age 19-25 years and 37 (44.0%) at age 13-18 years (Table 3).
Self-reported overweight was present in 50 respondents (39.1%). In the fruit and vegetable item, only 15 respondents (11.7%) reported consuming three or more portions on five or more days per week. Regular sport was reported by 69 respondents (53.9%), but among these respondents, 34 (49.3%) exercised only once per week (Table 4).

DISCUSSION

The study supports the working assumption that respondents knew the general concept of stroke but had incomplete recognition of warning symptoms. The gap was most evident for sudden visual disturbances and facial droop, despite these being important symptoms for a timely emergency response. This pattern is consistent with recent public-awareness studies reporting variable recognition of stroke symptoms and risk factors across populations.[6-10]
The behavioral findings identify prevention priorities. The proportion reporting regular smoking was high, and most smokers started during adolescence. Recent INTERSTROKE evidence confirms that active tobacco use is associated with increased acute stroke risk, and public health messages should combine cessation support with prevention of youth initiation.[11] Regular alcohol consumption was also common, and most respondents had their first exposure during adolescence. Alcohol-related evidence is complex by dose and pattern, but moderate-to-high and heavy episodic intakes are important preventable risks, and current guidance emphasizes reducing alcohol-related harm.[12-14]

The lifestyle findings point to weight, diet and physical activity counselling. Self-reported overweight was common, while frequent fruit and vegetable intake and sport frequency were limited. Global data show increasing obesity and insufficient physical activity burdens, and both are central to stroke prevention strategies.[15-18] Diet advice should be practical and emphasize minimally processed foods, fruits and vegetables, lower salt and lower saturated fat intake, consistent with current prevention guidance.[19,20]
This study has limitations. It used a convenience sample, relied on self-report, did not measure body mass index objectively, and did not report the response rate, the exact study months, or detailed ethics information in the source document. The sample was relatively young, which limits generalizability. No inferential statistics were performed because the study's aim was descriptive. Nevertheless, the findings are useful for designing concise public education messages about stroke warning signs and modifiable behavioral risk factors.

CONCLUSION

The general understanding of stroke was relatively good, but recognition of key warning symptoms was incomplete. Smoking, alcohol exposure from adolescence, self-reported overweight, limited fruit and vegetable intake and low frequency of sport were important behavioral prevention targets. Public health action should combine rapid stroke-recognition education with practical prevention of smoking, harmful alcohol use, excess weight, unhealthy diet and physical inactivity.
Recommendations: Community and school-based programs should prioritize four concise messages: recognize stroke warning symptoms, avoid tobacco initiation and support cessation, reduce harmful alcohol use, and improve daily movement and diet quality. Primary care teams can use the same domains to screen adults briefly and refer high-risk individuals for cessation, weight-management, alcohol-advice or physical-activity support.

Author's Contribution:

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Drafting or Revising Critically:	Milan Luliak, Mathias Duesterhoeft
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Original Article

Spectrum of Acute Coronary Syndrome in Patients Presenting to Cardiac Care Unit of Tertiary Care Hospital, Abbottabad

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ABSTRACT

Objective: To study the clinical spectrum of Acute Coronary Syndrome in patients presenting to Cardiac Unit of a tertiary care hospital.

Study Design: Cross-Sectional Observational Study

Place and Duration of Study: This study was conducted at the Department of Medicine, Combined Military Hospital, Abbottabad, Pakistan from October 2025 to March 2026.

Methods: Patients of both genders age 20-70 years, admitted to CCU, diagnosed with ACS were included. The demographic information, clinical presentation, risk factors, electrocardiographic findings, coro-angiography findings and inferred arterial territory were noted. Data were stratified according to age, risk factors, and clinical spectrum of ACS and variables compared within sub-types and arterial territory involved.

Results: Three hundred seventy patients diagnosed with ACS were included with median age of 51.00 (17.00) years including 221 (59.7%) male and 149 (40.3%) female patients. STEMI was most common ACS subtype in 226 (61.1%) patients, followed by NSTEMI in 100 (27.0%) and unstable angina in 44 (11.9%) patients. The left anterior descending (LAD) artery was most frequently involved territory in 174 (47.0%) patients.

Conclusion: Typical presentation of ACS was associated with STEMI, chest pain, ST elevation and LAD involvement. However, atypical cases were linked to NSTEMI or USA, dyspnea, ST depression or LBBB on ECG and PDA or Multivessel involvement on coro-angiography.

Key Words: Acute Coronary Syndrome (ACS), Coronary artery disease, Non- ST Elevation Myocardial Infarction (NSTEMI)

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INTRODUCTION

Acute Coronary Syndrome (ACS), contributes to 16% of all global deaths.(1) ACS is attributed to ST Elevation Myocardial Infarction (50.4%), Non- ST Elevation MI (33.5%) and Unstable Angina (16.1%) with prevalence of 200-400 per 100,000 in developing countries like Pakistan.(2) The overall prevalence of coronary artery disease is reaching up-to 34.9% with slightly male predominance 36.7% vs 34.9%.(3) The reported prevalence of ACS found to be 36.9% in ER patients presenting with chest pain.(4)

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Apart from classical presentation, ACS can present in variety of subtle / silent ways posing a diagnostic challenge, especially in emergency settings.(5) The ACS clinical spectrum is influenced by multiple factors including age, gender, race, smoking, obesity, comorbidities, and physiological reserve.(6)

Elderly patients tend to present atypically with dyspnea, syncope, or confusion. Diabetic individuals often experience silent or minimally symptomatic ischemia due to autonomic neuropathy. Women usually report non-classic symptoms such as fatigue, nausea, or upper abdominal discomfort rather than chest pain.(7) Conversely, younger patients may lack traditional risk factors altogether, resulting in underdiagnosis due to lower clinical suspicion.(8) In critically ill, particularly sedated, mechanically ventilated, or in shock, ACS may go unrecognized without active surveillance or continuous ECG monitoring.(9) In some cases, ischemia may manifest predominantly as dyspnea, fatigue, or sense of impending doom, with minimal or no pain, further complicating the clinical picture. Recognizing these uncommon patterns is critical in avoiding misdiagnosis or inappropriate triage.(10)

The objective of this study was to study the clinical presentation patterns of patients diagnosed with ACS

and identify the atypical presentations in clinical subgroups. Understanding these patterns will not only help in refining local diagnostic algorithms but also support early intervention strategies.

METHODS

This cross-sectional study was conducted in the Cardiac Care Unit of Combined Military Hospital, Abbottabad, Pakistan from October 2025 to March 2026 over a period of six month following formal approval from hospital ethical review board (CPSP/REU/Med-2022-012-19044 dated 07 OCT 25). The sample size was calculated using Open-Epi online sample size calculator by keeping a 95% confidence interval, 5% margin of error, and the reported 36.9% prevalence of acute coronary syndrome (ACS) in patients presenting with chest pain as reported by Sher et al.[11] The estimated sample size came out to be 350 patients. Non-probability consecutive sampling technique was used.

Inclusion Criteria: Patients of both genders aged 20-70 years, admitted to the CCU within 24 hours of symptom onset and diagnosed with ACS, were included.

Exclusion Criteria: Patients with previous documented coronary revascularization (coronary artery bypass grafting or percutaneous coronary intervention), readmission cases during the same episode of ACS, patients with incomplete clinical data, or those who refused to participate were excluded.

Patients with acute coronary syndrome (ACS) admitted to the Coronary Care Unit (CCU) were identified through daily screening. After obtaining informed consent, demographic data, cardiovascular risk factors, clinical presentation, ECG findings, cardiac biomarkers, and coronary angiography findings (where available) were recorded. The involved coronary artery territory (LAD, RCA, or LCx) was determined using ECG and/or angiographic findings.

Data were analyzed using SPSS version 25. Quantitative variables were expressed as mean ± SD or median (IQR), while categorical variables were presented as frequencies and percentages. Normality was assessed using the Kolmogorov–Smirnov test. Data were stratified by age and risk factors, and Fisher's exact test was applied after stratification. Comparisons were made among ACS subtypes and presentation patterns, with $p \leq 0.05$ considered statistically significant.

RESULTS

Three hundred seventy patients diagnosed with ACS were included with median age of 51.00 (17.00) years including 221 (59.7%) male and 149 (40.3%) female patients. Most patients 240 (64.9%) presented with typical symptoms while atypical presentation was noted in 130 (35.1%) cases with chest pain being the most frequent presenting symptom (56.5%) patients, followed by dyspnea in (33.8%). STEMI was the most common ACS subtype, diagnosed in 226 (61.1%) patients, followed by NSTEMI in 100 (27.0%) and unstable angina in 44 (11.9%) patients. The coro-angiography was performed in 238 (64.3%) patients and the left anterior descending (LAD) artery was the most frequently involved territory, in 174 (47.0%) patients. (Table-I)

Table No.1: Baseline Demographic and Clinical Characteristics of Study Participants (n=370)

Variable		Results
Age, Median years [IQR]		51.00 (17.00)
Gender, n(%)	Male	221 (59.7%)
	Female	149 (40.3%)
BMI, Median kg/m^2 [IQR]		25.00 (3.00)
Hypertension, n(%)		244 (65.9%)
Dyslipidemia, n(%)		237 (64.1%)
Diabetes, n(%)		218 (58.9%)
Smoking, n(%)		218 (58.9%)
Time since onset of ACS, Median hours [IQR]		5.00 (4.00)
Presentation	Typical	240 (64.9%)
	Atypical	130 (35.1%)
ECG Pattern at presentation, n(%)	ST Elevation	226 (61.1%)
	ST Depression	99 (26.7%)
	T-wave Inversion	21 (5.6%)
	LBBB	17 (4.5%)
	Other	7 (1.8%)
ACS Classification, n(%)	STEMI	226 (61.1%)
	NSTEMI	100 (27.0%)
	USA	44 (11.9%)
Artery Territory involved, n(%)	LAD	174(47%)
	RCA	30 (8.1%)
	LCX	32 (8.6%)
	PDA	92 (24.8%)
	Multivessel	42 (11.3%)
Killip Class, n(%)	Class I	173 (46.7%)
	Class II	158 (42.7%)
	Class III	23 (6.2%)
	Class IV	16 (4.3%)
Hospital Stay, Median days [IQR]		6.00 (3.00)
In-Hospital Mortality, n(%)		16 (4.3%)

Age and time since onset of ACS were comparable between typical and atypical presentation groups whereas BMI was higher in atypical presentation ($p=0.002$) and gender distribution differed ($p<0.0001$). Diabetes, hypertension, dyslipidemia, and smoking were significantly more frequent in typical presentation ($p<0.05$). STEMI were observed in 226(61.1%) patients with typical presentation while NSTEMI and USA were more frequent in atypical group ($p<0.0001$). (Table-2).

Table No.2: Comparison of Variables between Typical and Atypical Presentation (n=370)

Variable		Typical Presentation (n=240)	Atypical Presentation (n=130)	p-value
Age, Median years [IQR]		51.00 (17.00)	50.00 (19.00)	0.835
Gender, n(%)	Male	168 (45.4%)	53 (14.3%)	<0.0001
	Female	72 (19.5%)	77 (20.8%)	
BMI, Median kg/m^2 [IQR]		25.00 (4.00)	26.00 (4.00)	0.002
Hypertension, n(%)		170 (45.9%)	74 (20%)	0.008
Dyslipidemia, n(%)		173 (46.8%)	64 (17.3%)	<0.0001
Diabetes, n(%)		162 (43.8%)	56 (15.1%)	<0.0001
Smoking, n(%)		156 (42.2%)	62 (16.8%)	0.001
Presenting Symptom, n(%)	Chest Pain	208 (56.2%)	0	<0.0001
	Dyspnea	9 (2.4%)	116 (31.4%)	
	Epigastric Pain	7 (1.9%)	7 (1.9%)	
	Syncope	15 (4.1%)	7 (1.9%)	
ECG Pattern, n(%)	ST Elevation	226 (61.1%)	0	<0.0001
	ST Depression	5 (1.4%)	94 (25.4%)	
	T-wave Inversion	4 (1.1%)	17 (4.6%)	
	LBBB	4 (1.1%)	13 (3.5%)	
	Other	1 (0.3%)	6 (1.6%)	
ACS Classification, n(%)	STEMI	226 (61.1%)	0	<0.0001
	NSTEMI	5 (1.4%)	95 (25.7%)	
	USA	9 (2.4%)	35 (9.5%)	
Artery Territory involved, n(%)	LAD	174 (47%)	0	<0.0001
	RCA	19 (5.1%)	11 (3%)	
	LCX	23 (6.2%)	9 (2.4%)	
	PDA	12 (3.2%)	80 (21.6%)	
	Multivessel	12 (3.2%)	30 (8.1%)	
Time since onset of ACS, Median Hours [IQR]		5.00 (4.00)	5.00 (4.00)	0.907
Troponin, Median ng/mL [IQR]		108.44 (171.00)	62.67 (145.90)	0.008
Hospital Stay, Median Days [IQR]		6.00 (2.00)	6.00 (3.00)	0.597
Killip Class, n(%)	Class I	135 (36.5%)	38 (10.3%)	<0.0001
	Class II	78 (21.1%)	80 (21.6%)	
	Class III	16 (4.3%)	7 (1.9%)	
	Class IV	11 (3%)	5 (1.4%)	
Outcome, n(%)	Improved	145 (39.2%)	39 (10.5%)	<0.0001
	Discharged	75 (20.3%)	79 (21.4%)	
	Referred	9 (2.4%)	7 (1.9%)	
	Expired	11 (3%)	5 (1.4%)	

Table No.3: Comparison of Parameters across ACS Sub-Categories (n=370)

Variable		STEMI (n=226)	NSTEMI (n=100)	USA (n=44)	p-value
Age, Median years [IQR]		50.50(17.00)	50.00(19.00)	51.50(17.00)	0.842
Gender, n(%)	Male	158(42.7%)	41(11.1%)	22(5.9%)	<0.001
	Female	68(18.4%)	59(15.9%)	22(5.9%)	
BMI, Median kg/m^2 [IQR]		25.00(4.00)	26.00(4.00)	25.00(5.00)	0.009
Hypertension, n(%)		160(43.2%)	59(15.9%)	25(6.8%)	<0.001
Dyslipidemia, n(%)		163(44.1%)	50(13.5%)	24(6.5%)	<0.001
Diabetes, n(%)		153(41.4%)	46(12.4%)	19(5.1%)	<0.001
Smoking, n(%)		145(39.2%)	51(13.8%)	22(5.9%)	0.017
Presentation, n(%)	Typical	226(61.1%)	5(1.4%)	9(2.4%)	<0.001
	Atypical	0	95(25.7%)	35(9.5%)	
Presenting	Chest Pain	200(54.1%)	2(0.5%)	7(1.9%)	<0.001

Symptom, n(%)	Dyspnea	7(1.9%)	86(23.2%)	32(8.6%)	
	Epigastric Pain	6(1.6%)	5(1.4%)	3(0.8%)	
	Syncope	13(3.5%)	7(1.9%)	2(0.5%)	
Artery Territory involved, n(%)	LAD	174(47%)	0	0	<0.001
	RCA	17(4.6%)	9(2.4%)	4(1.1%)	
	LCX	20(5.4%)	11(3%)	1(0.3%)	
	PDA	7(1.9%)	72(19.5%)	13(3.5%)	
	Multivessel	8(2.2%)	8(2.2%)	26(7%)	
Time since onset of ACS, Median Hours [IQR]		5.00 (4.00)	5.00 (4.00)	6.00 (4.00)	0.759
Troponin, Median ng/mL [IQR]		106.33 (170.50)	53.88 (137.40)	130.99 (189.6)	0.001
Hospital Stay, Median Days [IQR]		6.00(2.00)	5.50(4.00)	6.00(3.00)	0.824
Killip Class, n(%)	Class I	129(34.9%)	27(7.3%)	17(4.6%)	<0.001
	Class II	73(19.7%)	65(17.6%)	20(5.4%)	
	Class III	14(3.8%)	2(0.5%)	7(1.9%)	
	Class IV	10(2.7%)	6(1.6%)	0	
Outcome, n(%)	Improved	139(37.6%)	29(7.8%)	16(4.3%)	<0.001
	Discharged	72(19.5%)	61(16.5%)	21(5.7%)	
	Referred	5(1.4%)	4(1.1%)	7(1.9%)	
	Expired	10(2.7%)	6(1.6%)	0	

Table No.4: Binary Logistic Regression for Predictors of Atypical Presentation

Variable	Univariate Logistic Regression			Multivariate Logistic Regression		
	OR	95% CI	p-value	OR	95% CI	p-value
Gender	3.39	2.171 – 5.293	<0.001	5.453	1.892 - 15.714	0.002
BMI	1.124	1.043 – 1.212	0.002	0.921	0.805 - 1.054	0.234
Diabetes	2.745	1.768 – 4.261	<0.001	1.801	0.877 - 3.699	0.109
Hypertension	1.838	1.178 – 2.868	0.007	0.856	0.332 - 2.208	0.748
Smoking	2.037	1.319 – 3.145	0.001	0.776	0.341 - 1.767	0.546
Dyslipidemia	2.663	1.707 – 4.154	<0.001	1.488	0.543 - 4.074	0.44
Arterial Territory Involved	4.239	3.259 – 5.515	<0.001	4.711	3.484 - 6.372	<0.001

Age and time since onset of ACS were comparable across ACS categories (p>0.05), while BMI differed significantly (p=0.009). STEMI patients were predominantly male and had a higher burden of cardiovascular risk factors (p<0.05). Typical presentation, chest pain, ST elevation, and LAD involvement were observed almost exclusively in STEMI whereas NSTEMI and USA were more frequently associated with atypical presentation, dyspnea, ST depression, and PDA or multivessel involvement (p<0.001) (Table-3).

On univariate logistic regression, gender, BMI, diabetes, hypertension, smoking, dyslipidemia, and arterial territory involved were significant predictors of atypical presentation (p<0.05). On multivariate analysis, only gender [OR 5.453, 95%CI 1.892–15.714; p=0.002] and arterial territory involved [OR 4.711, 95%CI 3.484–6.372; p<0.001] remained independently associated with atypical presentation. (Table-4)

DISCUSSION

In this study, a wide spectrum of clinical presentations of acute coronary syndrome was observed, highlighting the heterogeneity with which ACS manifests in real-world settings. Although the majority of patients presented with typical symptoms (64.9%), many exhibited atypical presentations (35.1%), underscoring the diagnostic challenges of non-classical ACS. The study indicated a clear distinction between typical and atypical ACS presentation whether clinical, electrocardiographic, or angiographic. STEMI was observed to be the most common ACS spectrum in 61.1%, NSTEMI in 27.0% and USA in 11.9% patients. It was in accordance with other studies as Beza et al reported that among patients presenting to cardiac emergency, STEMI was diagnosed in 62.3% patients and NSTEMI in 38.5% of the patients.[12] Similarly, Koirala et al concluded that patients presenting with ACS, STEMI was diagnosed in 74.5% patients with predominantly male gender and mean age of 57.39 ± 2.3 years.[13]

HTN was found to be most prevalent in 65.9% patients, dyslipidemia in 64.8% and DM was present in 58.9% patients of ACS. Similarly, Abbas et al found HTN as risk factor of ACS in 57.4%, diabetes in 33.9% and smoking in 21.7% patients presenting to cardiac emergency.[14] However, Shahid et al reported patients presenting with acute chest pain, diabetes mellitus was

most common underlying risk factor in 53.3% followed HTN in 33.3%.[15]

Pre-hospital delay of median 5.00 [4.00] hours were noted in current study which was mostly in diabetics and elderly patents. Mohan et al observed that 42% patients of ACS presented to ER with > 6-hours delay, significantly higher among elder patients (p=0.01), diabetics (p=0.02) and patients from rural areas (p=0.04).[16] In another study, pre-hospital delay of 53.9 ± 18 hours was noted in patients presenting with acute chest pain and in those, ECG showed STEMI and NSTEMI in 54.1% and 45.9% patient respectively. It was also observed that 30.6% patients showed signs of LVF with Killip class I and II as reported by Marie et al.[17] Our study found that Killip class-I and II were frequent at presentation in 46.7 % and 42.7% patients respectively.

LAD found to be the most frequent involved arterial territory in 47.0% cases on Coro-Angiography. Malik et al concluded that TVCAD was found in 42.4%, DVCAD in 18.6% and SVCAD in 36.4% patients of ACS. The most common culprit artery was found to be left circumflex artery (LCx) in 65.3% patients, followed by left anterior descending (LAD) in 58.5% and right coronary artery (RCA) in 39.0% cases.[18]

In our study in-hospital mortality was noted to be 4.3% with 4.3% patients being referred to other cardiac setups. Gender, BMI, risk factors (DM, HTN, smoking, dyslipidemia) and territory involved were independent predictors of ACS and in-hospital mortality. This suggests that anatomical and biological factors may also play a role in shaping symptom presentation than comorbid risk factors alone. Nilsson et al reported that in ACS patients, coronary angiography done in 53.0% patients and in-hospital mortality was 3.2% with age > 80 years being strongest risk factor (OR: 4.8, p<0.001) along with smoking, diabetes, HTN and dyslipidemia.[19] Kim et al reported among STEMI patients, major adverse cardiac events (MACE) and in-hospital mortality were observed in 23.17% and 19.51% respectively.[20]

CONCLUSION

This study concluded that typical presentation of ACS was more associated with STEMI, chest pain, ST elevation on ECG, LAD involvement leading to timely coronary angiography. Diabetes, HTN, smoking and dyslipidemia were found to be independent risk factors of ACS clinical spectrum linked with higher in-hospital mortality.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Saman Javed Khan, Shehryar Khan, Saadia Ijaz
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Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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Original Article

Polycythemia in COPD

Frequency of Polycythemia in Chronic Obstructive Pulmonary Disease (COPD) Patients Presenting to Tertiary Care Hospital

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ABSTRACT

Objective: To determine the frequency of polycythemia among chronic obstructive pulmonary disease (COPD) patients and explore its clinical associations

Study Design: Cross-sectional Study

Place and Duration of Study: This study was conducted at the Department of Medicine, Combined Military Hospital, Abbotabad, Pakistan from September 2025 to April 2026.

Methods: All patients of either gender, age 40 - 80 years, with confirmed diagnosis of COPD based on post-bronchodilator spirometry were included. Spirometry was performed to determine FEV_1 % predicted and classify disease severity according to GOLD stages (1–4) and classified patients into GOLD treatment groups (ABE) according to COPD Assessment Test (CAT)**.** Polycythemia frequency was calculated and logistic regression analysis was performed to identify independent predictors of polycythemia in COPD patients.

Results: Two hundred COPD patients with mean age of 49.97 ± 8.20 years including 148 (74.0%) males and 52 (26.0%) females. The frequency of polycythemia was 18.0% with mean resting SpO_2 of 89.28 ± 2.53% in polycythemia group and 90.38 ± 2.71% in non-polycythemia group (p=0.027). The mean partial pressure of carbon dioxide ($PaCO_2$) was 47.36 ± 14.04 mmHg and 47.79 ± 14.00 mmHg in the polycythemia and non-polycythemia group respectively (p=0.866). In contrast, the mean partial pressure of oxygen (PaO_2) was higher in patients with polycythemia (72.94 ± 10.11 mmHg) compared to without polycythemia (68.50 ± 10.26 mmHg) (p=0.019).

Conclusion: Polycythemia is common hematological finding in COPD patients having resting hypoxemia with no significant association with age, gender, BMI or smoking duration. However, active smoking and lower resting SpO2 had somewhat influence in patients being polycythemic.

Key Words: Chronic obstructive pulmonary disease (COPD), **COPD Assessment Test (CAT),** GOLD Class, Polycythemia, Smoking

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INTRODUCTION

Chronic exposure to cigarette smoke and biomass fuel combustion is a major contributor to the development of chronic respiratory diseases, particularly in developing countries.(1) In regions where indoor air pollution from cooking and heating with wood, dung, or crop residues is prevalent, the burden of chronic obstructive pulmonary disease (COPD) is significantly heightened.(2)

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Tobacco smoking remains a primary risk factor, leading to progressive airway inflammation, alveolar destruction, and irreversible airflow limitation.(3) The pathogenesis of COPD involves a cascade of inflammatory responses triggered by noxious particles and gases. These responses cause structural remodeling of the airways, destruction of alveolar walls, and impaired mucociliary clearance.(4) As lung function declines, gas exchange becomes increasingly inefficient, leading to chronic hypoxemia and, in some cases, hypercapnia. Over time, this persistent hypoxia stimulates erythropoietin (EPO) production by the kidneys, resulting in increased red blood cell production.(5)

Polycythemia, while initially compensatory, can become pathologic. Elevated hematocrit levels increase blood viscosity, raising the risk of thrombotic events, stroke, and cardiovascular complications.(6) In COPD patients, this can further compromise oxygen delivery and exacerbate right heart strain, particularly in those with coexisting pulmonary hypertension.(7)

Despite these risks, polycythemia remains underrecognized in routine COPD management, especially in resource-limited settings.[8] In many developing countries, routine hematological monitoring is not standard practice in COPD follow-up, and the condition may go unnoticed until complications arise.[9] Identifying patients at risk can help mitigate long-term morbidity through appropriate monitoring and early intervention.

This aim of this study was to determine the frequency of polycythemia among COPD patients and explore its clinical associations in local population. Findings from this study can guide physicians in developing countries to adopt a more comprehensive approach in managing COPD, emphasizing the importance of regular blood count assessments and individualized care strategies.

METHODS

It was a cross-sectional study conducted at the Department of Medicine, Combined Military Hospital, Abbotabad, Pakistan a tertiary care hospital over a period of 8 months, from September 2025 to April 2026, following approval from hospital ethical review board (CMH-Atd-ETH-155-Med-24/dated13May2024). The sample size was calculated using the open source Open Epi Online sample size calculator taking confidence interval 95%, margin of error 5% and based on previously reported prevalence of COPD patients in Pakistan of 13.8% in the Pakistan Chest Society (PCS) Guidelines for the management of COPD.[10] The estimated sample size came out to be 183 patients. Non-probability consecutive sampling was used to recruit patients. All patients meeting the inclusion criteria and attending the outpatient clinic or admitted to the pulmonology ward during the study period were included after obtaining verbal informed consent.

Inclusion Criteria: All patients of either gender, age 40 - 80 years, with confirmed diagnosis of COPD based on post-bronchodilator spirometry (FEV_1/FVC <0.70), both stable COPD patients and those recovering from an exacerbation (≥4 weeks after resolution) were included in the study.

Exclusion Criteria: Known cases of primary polycythemia (polycythemia rubra vera) or other myeloproliferative disorders, patients with secondary polycythemia due to causes other than COPD (e.g., cyanotic heart disease, high-altitude residence, renal tumors), current use of long-term oxygen therapy initiated within the last 3 months and those with incomplete clinical or spirometry data were excluded from the study.

After enrollment, demographic data (age, sex, BMI, urban/rural residence), smoking history (pack-years), and biomass exposure were recorded. Spirometry was performed to determine FEV_1 % predicted and classify disease severity according to **GOLD stages (1–4)**. The **COPD Assessment Test (CAT)** questionnaire was administered, and exacerbation history over the past year was obtained to classify patients into **GOLD groups (A–D)**.[11] Resting oxygen saturation (SpO_2) was measured via pulse oximetry. Venous blood samples were analyzed for hemoglobin, hematocrit, and red blood cell counts. Polycythemia was defined as hematocrit >51% in males and >48% in females.[12]

Data were entered and analyzed using Statistical Package for Social Sciences (SPSS v25.00). Normality of the data was checked using its skewedness and kurtosis. Pack years were presented as median (interquartile range) while rest of the quantitative variables (age, BMI, SpO_2, PaO_2, $PaCO_2$) were presented as mean ± SD. Categorical variables (GOLD stage, GOLD class, polycythemia) were presented as frequencies and percentages. Associations between polycythemia and independent variables (demographics, GOLD stage, GOLD class, SpO_2, PaO_2) were assessed using Chi-square test for categorical variables and independent t-test or Mann–Whitney U test for continuous variables, as appropriate. Logistic regression analysis was performed to identify independent predictors of polycythemia in COPD patients. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

Table No.1: Baseline Characteristics of Study Population (n = 200)

Variable		**Value**
Age, years (mean ± SD)		49.97 ± 8.20
BMI, kg/m² (mean ± SD)		21.03 ± 2.51
Gender, n(%)	Male	148(74.0%)
	Female	52(26.0%)
Resident in, n(%)	Rural Area	82(41.0%)
	Urban Area	118(59.0%)
Smoking Status, (%)	Current	118 (59.0%)
	Ex-smoker	26 (13.0%)
	Non-smoker	56 (28.0%)
Smoking Exposure (pack-years), Median [IQR]		16.00(5.00)
Biomass Exposure, n(%)		78(39.0%)
Hemoglobin, mg/dL (mean ± SD)		14.45 ± 2.06
SpO_2, % (mean ± SD)		90.18 ± 2.71
PaO_2, mmHg (mean ± SD)		69.30 ± 10.34
PCO_2, mmHg (mean ± SD)		47.72 ± 14.00
Gold Stage, n(%)	1	59(29.5%)
	2	63(31.5%)
	3	28(14.0%)
	4	50(25.0%)
GOLD Class, n(%)	A	88(44.0%)
	B	53(26.5%)
	E	59(29.5%)
Polycythemia, n(%)		36(18.0%)

Two hundred COPD patients were included in the study with mean age of 49.97 ± 8.20 years including 148 (74.0%) males and 52 (26.0%) females. The mean BMI of participants was 21.03 ± 2.51 kg/m² and mean hemoglobin was found to be 14.45 ± 2.71 mg/dL. Regarding residence, 118 (59.0%) patients belonged to urban areas while 82 (41.0%) were from rural areas. Smoking status of participants was also noted that 118 (59.0%) were currently smoking, 26 (13.0%) were ex-smokers and 56 (28.0%) were non-smokers but had prolonged biomass exposure. inThe median (IQR) smoking exposure was 16.00(5.00) pack-years, and 78 (39.0%) patients had a history of biomass fuel exposure. The baseline characteristics of the study population are shown in Table 1.

The overall frequency of polycythemia among COPD patients was found to be 18.0% with gender distribution as 26 (17.6%) males had polycythemia compared to 10 (19.2%) females. On stratified analysis, no statistically significant association was observed between polycythemia and gender (p=0.788) or residence (p=0.510). Similarly, no significant association was found between polycythemia and biomass exposure (p=0.695). (Table-2)

Comparison of continuous variables between patients with and without polycythemia showed that mean age was 48.61 ± 8.39 vs 50.27 ± 8.15 years (p=0.273), BMI was 20.61 ± 2.65 vs 21.12 ± 2.47 kg/m² (p=0.272), and smoking exposure was 17.50(6.00) vs 16.00(5.00) pack-years (p=0.267) respectively. Similarly, mean SpO_2 was 89.28 ± 2.53% in the polycythemia group compared to 90.38 ± 2.71% in the non-polycythemia group (p=0.027). Comparison of arterial blood gas parameters between the two groups showed that the mean partial pressure of carbon dioxide ($PaCO_2$) was 47.36 ± 14.04 mmHg in the polycythemia group compared to 47.79 ± 14.00 mmHg in the non-polycythemia group (p=0.866), showing no statistically significant difference. In contrast, the mean partial pressure of oxygen (PaO_2) was significantly higher in patients with polycythemia (72.94 ± 10.11 mmHg) compared to those without polycythemia (68.50 ± 10.26 mmHg) (p=0.019). These findings are presented in Table-3.

Table No. 2: Association of Polycythemia with Categorical Variables (n = 200)

Variable		Polycythemia n(%)		p-value
		Yes	No	
Gender	Male	26(17.6%)	122(82.4%)	0.788
	Female	10(19.2%)	42(80.8%)	
Resident of	Urban	23(19.5%)	95(80.5%)	0.51
	Rural	13(15.9%)	69(84.1%)	
Smoking Status	Current	22 (61.1%)	96 (58.5%)	0.860
	Ex-smoker	4 (11.1%)	22 (13.4%)	
	Non-Smoker	10 (27.8%)	46 (28.0%)	
Biomass Exposure	Yes	13(16.7%)	65(83.3%)	0.695
	No	23(18.9%)	99(81.1%)	

Table No.3: Comparison of Presence of Polycythemia with Continuous Variables (n = 200)

Variable	Polycythemia (%)		p-value
	Yes	No	
Age, years (mean ± SD)	48.61 ± 8.39	50.27 ± 8.15	0.273
BMI, kg/m² (mean ± SD)	20.61 ± 2.65	21.12 ± 2.47	0.272
Pack-years, Median [IQR]	17.50(6.00)	16.00(5.00)	0.267
SpO_2, % (mean ± SD)	89.28 ± 2.53	90.38 ± 2.71	0.027
PaO_2, mmHg (mean ± SD)	72.94 ± 10.11	68.50 ± 10.26	0.019
PCO_2, mmHg (mean ± SD)	47.36 ± 14.04	47.79 ± 14.00	0.886

DISCUSSION

The present study evaluated the frequency of polycythemia among patients with chronic obstructive pulmonary disease (COPD) and explored its association with commonly assessed clinical and physiological parameters. This study showed frequency of polycythemia in COPD patients was 18% similar to other reported prevalence of polycythemia around 13.2% by Ullah et al and 10.8% in another study by Ullah et al.[13,14] The findings demonstrated that while polycythemia is present in a notable proportion of COPD patients, it may not show a statistically significant association with demographic factors, or smoking exposure. However, a small yet statistically insignificant difference was observed in markers of disease severity such as oxygen saturation, PaO_2 and PCO_2.

There was no significant relationship between resting SpO_2 and polycythemia in this study which could indicate that this relationship may be a complex one. Factors such as intermittent hypoxia, nocturnal

desaturation, and individual variability in response towards hypoxemia might be playing a role more important than oxygen saturation. This could explain why patients with comparable oxygenation status do not uniformly develop polycythemia.[15] Therefore, polycythemia in COPD may not be reliably predicted by routine clinical assessment if done alone. Polycythemia in COPD occurs as a compensatory response to chronic hypoxemia, leading to an increased erythropoietin production.

Polycythemia was major finding in patients with long standing COPD (18%), however, some patient also found to have anemia (8.5%) noted to be anemia of chronic disease likely due to COPD mediated systemic inflammation. This finding was in accordance with other studies as Sarkar et al concluded that COPD patients had 7.5% prevalence of anemia of chronic disease (ACD) with normal MCV.[16] Malik et al also observed this fact and reported 26% prevalence of anemia in COPD patients.[17] While Sharma et al also reported that prevalence of ACD is consistent in COPD patients along with frequency of polycythemia in 14.2% patients.[18]

In this study the mean resting oxygen saturation (SpO_2) in patients with polycythemia was 89.28 ± 2.53 as compared to 90.38 ± 2.71 in patients who didn't have polycythemia. This fact was also reported by Zhang et al that severe resting hypoxemia had higher odd of polycythemia (OR=3.50, 95% CI: 1.41-8.66).[19] It was observed that polycythemia was present in 22 (61.1%) of current smokers and 4 (11.1%) of ex-smoker whereas 10 (27.8%) non-smokers had polycythemia due to biomass exposure. Active smoking in COPD patients had somewhat higher odds (OR=2.55, 95% CI: 1.49-4.38) of developing polycythemia due to resting hypoxemia as observed by Zhang et al.[19]

The analysis of arterial blood gas parameters showed an interesting finding in this study that patients with polycythemia had higher PaO_2 levels compared to those without polycythemia. This is contrary to the usual understanding that lower oxygen levels lead to increased red blood cell production. This difference explained by the fact that a single measurement of PaO_2 may not reflect long-term oxygen status. Patients may have experienced chronic or intermittent hypoxia in the past, leading to polycythemia, even if their current oxygen levels appear relatively higher.

Cote et al also concluded that polycythemia was present in 5.3% COPD patients but it was not significantly related with resting SpO_2, partial pressure of oxygen and carbon dioxide as well as other clinical factors.[20] The lack of significant difference in PaO_2 and $PaCO_2$ further suggests that carbon dioxide levels do not have a major role in the development of polycythemia in COPD. Abdelfattah et al also explained statistically insignificant association of resting SpO_2 (OR=0.896, p=0.30), PaO_2 (OR=1.171, p=0.41) and PCO_2 (OR=1.188, p=0.23) with COPD patient having polycythemia.[21]

Furthermore, the lack of association with smoking exposure and other baseline characteristics in this study highlights the heterogeneous nature of COPD. The disease has many pathophysiological processes and pathways and thus systemic manifestations such as polycythemia may not the correspond to clinical and routine laboratory indicators of disease severity.[22] However, studies showed that extra-pulmonary features of COPD often follow independent trajectories and require targeted evaluation.[23]

This study therefore, underscores the importance of routine hematological assessment in COPD patients, regardless of apparent disease severity or symptom burden. Reliance solely on clinical staging, SpO_2 measurement or symptom-based classification may lead to under-recognition of polycythemia and its potential complications.

CONCLUSION

This study highlighted that polycythemia is common hematological finding in COPD patients having resting hypoxemia with no significant association with age, gender, BMI or smoking duration. However, active smoking and lower resting SpO2 had somewhat influence in patients being polycythemic. The lower SpO2 in polycythemic patients suggest chronic hypoxemia, a driving factor whereas paradoxical higher PaO2 reflect compensatory physiological adaptation as well as disease severity variability. Moreover, lack of significant differences in age, BMI, and smoking exposure underscores the fact that polycythemia in COPD is not merely consequence and associated with traditional risk factors but complex and manifestation of COPD-related mechanism and hypoxemia. Hence, early identification of polycythemia in COPD remains crucial, because unrecognized, can contribute to increased blood viscosity and associated cardiovascular risks.

Limitations: The authors are well aware of the limitation, single center and a limited sample size study are amongst the major limitations of the study. This study didn't focused on thrombotic and cardiovascular complications of polycythemia. This was done as a cross-sectional study which lack the longitudinal follow-up to observe and assess the progression of polycythemia. Comorbidities, altitude, profession, were not studied as potential confounding factors in this study. Thus, further studies including RCTs should be done with larger sample size including multicenter approach before implementing results on wider scale.

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Original Article

CSF Drainage in Sub Arachnoid Hemorrhage

Efficacy of Therapeutic CSF Drainage in Sub Arachnoid Hemorrhage Patients with Severe Headache in Tertiary Care Hospital

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ABSTRACT

Objective: This study was carried out with an aim of determining the effectiveness of the therapeutic cerebrospinal fluid (CSF) drainage in the reduction of severe headache in patients who had aneurysmal subarachnoid hemorrhage (SAH).

Study Design: Cross-sectional study

Place and Duration of Study: This study was conducted at the Department of Neurology at the Pak Emirates Military Hospital, Rawalpindi from 16 November 2025 till 16 May 2026.

Methods: 90 patients aged 18-70 years with non-traumatic aneurysmal SAH who present themselves with severe headache (Visual Analog Scale 7 or more) were selected using consecutive non-probability sampling.

Results: A total of 90 patients were included, with 52 males (57.8%) and 38 females (42.2%), and a mean age of 52.4 ± 10.8 years. Baseline headache severity was high (VAS 8.6 ± 0.9), with WFNS grades I–II observed in 38 patients (42.2%) and grades III–V in 52 patients (57.8%). Therapeutic CSF drainage led to progressive reductions in headache intensity, with mean VAS scores of 6.1 ± 1.3 at 24 hours, 5.2 ± 1.4 at 48 hours, and 5.0 ± 1.5 at 72 hours. By 48 hours, 63 patients (70.0%) achieved ≥30% reduction in VAS scores. Safety outcomes were acceptable, with 65 patients (72.2%) experiencing no complications.

Conclusion: It was found that therapeutic cerebrospinal fluid (CSF) drainage is a safe and efficacious intervention that can be applied to the reduction of the severity of headache in patients with aneurysmal subarachnoid hemorrhage, leading to the achievement of crucial changes in the severity of pain and overall clinical outcomes.

Key Words: Subarachnoid hemorrhage, Cerebrospinal fluid drainage, Severe headache, Lumbar drainage

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INTRODUCTION

Subarachnoid haemorrhage (SAH) is an emergency condition with life-threatening consequences that is caused by bleeding into the subarachnoid space between the arachnoid and pia mater[1]. It represents a small proportion of strokes (5–10%), but has a disproportionately large burden of mortality and disability[2].

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Most spontaneous SAH are caused by an aneurysmal rupture, and despite great progress in imaging, neurosurgery and intensive care, prognosis is still dismal and early mortality and long-term neurological deterioration remain significant[3]. Severe sudden headache is one of the most common presenting symptoms of SAH and is often referred to as the "worst headache of life"[4]. This is a thunderclap headache that typically peaks in intensity within seconds or minutes and can be accompanied by vomiting, headache sensitivity to light, neck stiffness, and altered consciousness[5]. The pain is due to the irritation of meninges by the blood in the cerebrospinal fluid (CSF) and activation of nociceptive pathways, inflammatory mediators and elevated ICP[6]. Blood products can also block the flow and absorption of CSF and lead to hydrocephalus, seen in 15-30% of SAH patients and which adds to the severity of the headache[7]. The main treatment is to repair the aneurysm early with either a clip or a coil, to prevent rebleeding[8]. Even after treatment of an aneurysm, however, sometimes the headache remains severe and can be poorly responsive to routine analgesics like acetaminophen, opioids and adjunctive medications[9]. Therapeutic CSF drainage

may thus be of some importance for symptom control. External ventricular drainage is routinely performed in those with hydrocephalus or elevated ICP, and lumbar drainage is sometimes used to obtain CSF with blood in it from the subarachnoid space[10].

By reducing ICP, improving CSF circulation and clearing inflammatory blood breakdown products, CSF drainage may decrease meningeal irritation, headache intensity and headache duration[11]. There is, however, little evidence that has specifically assessed its efficacy for the relief of severe headache in SAH patients. Further study should thus be conducted in tertiary care settings[12]. Recent research has explored the role of cerebrospinal fluid (CSF) drainage in patients with aneurysmal subarachnoid hemorrhage (SAH), particularly regarding headache management and long-term complications. Zhou et al[11] demonstrated that the method of CSF drainage used during the acute phase can influence the risk of chronic hydrocephalus, highlighting the importance of careful CSF management in SAH patients. Likewise, Maciel et al[12] conducted a survey of acute headache management in international healthcare providers, which revealed significant differences in management, with a need for standardisation to enhance pain control[13].

METHODS

This study was a cross-sectional study to assess the effectiveness of therapeutic CSF (tCSF) drainage in severe headaches caused by subarachnoid hemorrhage (SAH). The study was conducted in the department of Neurology at Pak Emirates Military Hospital (PEMH), Rawalpindi, a tertiary care hospital with neurological and neurosurgical services. The study was conducted from 16 November 2025 till 16 May 2026, after an ethical approval from the College of Physicians and Surgeons Pakistan and institutional review board for four months. The study involved a total of 90 patients. The sample size was estimated using one proportion formula with a 10% margin of error and a 95% confidence interval, assuming about 70% of patients would obtain a therapeutic CSF drainage at least 30% reduction in headache severity. To account for possible 10% drop out, a final sample of 90 patients was planned [9]. All eligible patients attending the Emergency or Neurology Departments on a first come-first-served basis during the study period were sampled using non-probability consecutive sampling.

The study included adults (18-70 years) who had had non-traumatic aneurysmal SAH and severe headache (study criterion: Visual Analog Scale (VAS) score of 7 or above). Patients who had either external ventricular drainage (EVD) or external lumbar drainage (ELD) were only included. Exclusion criteria for lumbar drainage were contraindications, coagulopathy, thrombocytopenia, compressed basal cisterns, active infection, pregnancy, inability to give consent, or being enrolled in another interventional trial. Data collection included screening of patients at admission for diagnosis of SAH and for baseline headache severity. Post-procedure assessment of headache intensity was performed 24–48 hours following CSF drainage; the primary outcome was the average change in VAS scores, and the percentage of patients that had a headache reduction ≥30%. Other information on WFNS grade, drainage method, drainage volume and the time of the intervention were also collected. Safety outcomes were assessed until discharge such as meningitis, rebleed, neurological impairments, and other complications. Demographic, clinical, procedural and outcome data were collected on standardized proformas.

The data was analyzed with SPSS 27.0. Data for continuous variables (age, VAS scores) were described as mean ± SD or median (IQR) as appropriate based on distribution. Categorical variables are presented as frequencies and percentages with 95% confidence interval. The VAS scores before and after drainage were compared using paired t tests and Wilcoxon signed-rank tests and the number of patients who reported significant headache reduction was compared using chi-square tests. Univariate analysis and multivariate logistic regression, adjusted for age, sex, WFNS grade, and baseline headache severity, were used to determine predictors of efficacy. Differential effects were evaluated in the subgroup analyses based on WFNS grade and drainage method.

RESULTS

A total of 90 respondents were included in the study, as summarized in Table 1, comprising 52 males (57.8%) and 38 females (42.2%), with a mean age of 52.4 ± 10.8 years. Baseline headache severity was very high (mean VAS 8.6 ± 0.9).

Table No.1: Baseline demographic and clinical characteristics

Variable	Category / Measure	Result
Age	Mean ± SD	52.4 ± 10.8 years
Sex	Male	52 (57.8%)
Sex	Female	38 (42.2%)
Baseline VAS score	Mean ± SD	8.6 ± 0.9
WFNS grade I–II	—	38 (42.2%)
WFNS grade III–V	—	52 (57.8%)
Hypertension	Yes	48 (53.3%)
Diabetes mellitus	Yes	19 (21.1%)
Smoking	Yes	27 (30.0%)

Thirty-eight respondents (42.2%) had WFNS grades I-II, while 52 respondents (57.8%) had WFNS grades III-V. Table 2 shows progressive reduction in headache severity following CSF drainage, with mean VAS scores decreasing to 6.1 ± 1.3 at 24 hours, 5.2 ± 1.4 at 48 hours, and 5.0 ± 1.5 at 72 hours. Table 3 shows that 70.0% (63/90) of the respondents reported ≥30% reduction in VAS by 48 hours.

Table No.2. Headache severity before and after therapeutic CSF drainage

Time point	Mean ± SD	Median (IQR)
Baseline	8.6 ± 0.9	9 (8–9)
24 hours	6.1 ± 1.3	6 (5–7)
48 hours	5.2 ± 1.4	5 (4–6)
72 hours	5.0 ± 1.5	5 (4–6)

Table No. 3. Comparison of pre- and post-drainage VAS scores / Efficacy

Comparison	Mean difference	95% CI	p-value	Responders ≥30% VAS reduction	n (%)
Baseline vs 24 hours	2.5	2.1–2.8	<0.001	—	—
Baseline vs 48 hours	3.4	3.0–3.8	0.002	63/90 (70.0%)	70%
Baseline vs 72 hours	3.6	3.1–4.0	<0.001	—	—

DISCUSSION

This study examined the use of therapeutic CSF drainage in patients with aneurysmal subarachnoid hemorrhage (SAH) who had severe headache. The results showed that CSF drainage was associated with a significant decrease in the severity of headaches. Baseline Visual Analog Scale (VAS) scores were 8.6 ± 0.9, indicating a very high level of headache. Mean VAS scores also were found to be reduced to 6.1, 5.2 and 5.0 at 24, 48 and 72 hours after CSF drainage, respectively, which suggested a progressive decrease in headache intensity. The difference was statistically significant at all follow-up time points ($p < 0.001$); of 90 patients, 63 (69%) achieved a clinically significant improvement of ≥30% in headache severity. Based on these observations, it can be concluded that CSF removal of blood-contaminated CSF and ICP reduction are important therapeutic principles in relieving symptoms.

Demographic characteristics were consistent with past SAH studies. Patients had a mean age of 52.4 ± 10.8 years, with 57.8% being male. Similarly, vascular risk factors, such as hypertension (53.3%) and smoking history (30%) were present, reflecting previous observations that these factors play a role in the incidence of SAH and rupture of aneurysms [14,15]. The reduction in the severity of the headache as observed confirms previous research. Wolf et al. [16] found that CSF drainage from the lumbar increased CSF flow, increased clearance of subarachnoid blood and lowered ICP with a better clinical outcome. In this study, Lee et al. [17] performed a systematic review and meta-analysis with lumbar CSF drainage demonstrating that CSF drainage is beneficial for clinical outcomes and helps to reduce complications like delayed cerebral ischemia and hydrocephalus, and that CSF dynamics in the brain are improved, supporting the favourable symptomatic relief observed in this study [18].

While these were some significant results, there were a number of limitations to the study. It was carried out at one tertiary care center that has a relatively small sample, thus limiting the ability to generalize the results. Furthermore, patients followed for a long period of time were not included in the cross-sectional study to obtain information on chronic headache or delayed neurological complications. The future studies should incorporate multicenter prospective studies with long follow-ups to assess again on the long term outcome of therapeutic CSF drainage and safety and the best time of administering therapeutic CSF in patients with subarachnoid hemorrhage.

CONCLUSION

This clinical trial found out that therapeutic cerebrospinal fluid (CSF) drainage is a viable treatment method in alleviating severe headache in patients with aneurysmal subarachnoid hemorrhage (SAH). These findings showed that the drainage of CSF was effective in reducing the severity of headache significantly and provided relief from the headache in most of the patients. The procedure allowed to improve the dynamics in the intracranial environment and enhance the comfort of patients by contributing to the elimination of blood-tinged CSF and decreasing the intracranial pressure. Furthermore, the safety of the intervention was good, and the level of complications was also relatively small. These findings underscore the possibility of CSF drainage as a significant supportive therapy measure in the management of SAH-related headache and could lead to higher overall clinical results in patients with this condition.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Syed Azaz Ali Shah, Jahanzeb Liaqat, Asif Hashmat
Drafting or Revising Critically:	Fawad Ahmad, Syed Haris Ali Shah, Syed Mujtaba Bacha
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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Original Article

Head & Neck Cancer Reconstruction with Flap: A Comparative Study of Restoration of Internal Lining VS No Restoration

Head & Neck Cancer Reconstruction with Flap

Gulshan Kumari[1], Ghulam Shabbir[2] and Muhammad Razzaq Dogar[3]

ABSTRACT

Objective: To compare surgical and functional outcomes of flap-based head and neck cancer reconstruction performed with versus without internal lining restoration.

Study Design: Comparative cross-sectional study

Place and Duration of Study: This study was conducted at the Departments of Surgical Oncology and Plastic and Reconstructive Surgery, Jinnah Postgraduate Medical Centre, Karachi from 10th November 2025 to 10th May 2026.

Methods: A total of 48 patients undergoing head and neck cancer resection followed by flap reconstruction were included through non-probability consecutive sampling. Patients were divided into two groups: internal lining restoration (n=24) and no internal lining restoration (n=24).

Results: Patients with internal lining restoration had fewer postoperative complications than those without restoration. Wound dehiscence occurred in 2 (8.3%) versus 5 (20.8%) patients, infection in 3 (12.5%) versus 6 (25.0%), flap necrosis in 1 (4.2%) versus 3 (12.5%), and fistula formation in 2 (8.3%) versus 7 (29.2%) patients. Good surgical outcome was observed in 19 (79.2%) patients with restoration compared with 14 (58.3%) without restoration. Functional outcomes were also better in the restoration group, including good swallowing in 18 (75.0%) versus 13 (54.2%), good speech in 17 (70.8%) versus 12 (50.0%), oral feeding in 20 (83.3%) versus 15 (62.5%), and good overall functional outcome in 18 (75.0%) versus 13 (54.2%) patients.

Conclusion: Internal lining restoration during flap-based head and neck cancer reconstruction was associated with lower complication rates and better functional recovery. Restoration of the mucosal lining should be prioritized whenever feasible to improve healing, swallowing, speech, and return to oral feeding.

Key Words: Head and neck cancer, flap reconstruction, internal lining restoration, mucosal reconstruction, fistula, functional outcome

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INTRODUCTION

Head and neck cancers (HNC) are a major global health problem with 935,000 new cases and 467,000 deaths worldwide annually, ranking them the seventh most common cancer[1]. In South Asia, however, HNCs are even more common and in Pakistan, oral cavity/oropharyngeal cancers are diagnosed in considerable numbers, often due to tobacco and betel nut use and/or exposure to smokeless tobacco[2,3]. When managed with curative intent for advanced stage disease, the "gold standard" for treatment remains surgical resection of the primary and possibly lymph node bearing areas, which results in "composite defects" that require reconstruction of both form and function[4]. The flap-based approach to neck defect reconstruction has greatly improved the chances of survival and recovery for patients with advanced neck disease. Good speech, swallowing and wound healing have become more important considerations[5]. The goal of neck defect reconstruction is two-fold: to restore the external cover and the internal lining of the neck defect. Failure to reconstitute the mucosal lining of the neck defect is one of the leading causes of pharyngocutaneous fistulae, wound breakdown, aspiration, and poor oral alimentation. Although pharyngocutaneous fistulae occur in 8% to 30% of

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patients undergoing major neck surgery, there are many situations in which the surgeon achieves excellent healing and acceptable outcome without a mucosal lining[6]. This is often seen in resource-poor countries but is not uncommon even in more developed countries in very large defects where the best approach is to reconstruct the neck defect without trying to reconstitute an adequate internal lining[7]. Although local and free flaps have become increasingly commonly used in head and neck reconstruction, there is little evidence that reconstruction achieves the goal of restoring an internal lining to the defect[8,9]. Some studies have reported improved function and fewer complications in a selected group of patients in whom an attempt was made to recreate an internal lining[10,11], whereas others have failed to support such an approach even after appropriate patient selection. Of particular note, there is no evidence as to how to reconstruct head and neck defects in low- and middle-income countries where the majority of head and neck surgery is performed. Decisions regarding the most appropriate surgical approach in such settings are influenced by considerations of health care resources available and by the burden of disease in the community[12].

METHODS

A Comparative cross-sectional study was conducted at Department of Surgical Oncology and Department of Plastic & Reconstructive Surgery at Jinnah Postgraduate Medical Centre (JPMC) for six months from 10th November 2025 to 10th May 2026. Patients of either gender aged 18 years or older having head and neck malignancies who needed surgical excision and patients with head and neck malignancies who had primary reconstructive surgery with regional, pedicled and free flaps following tumor excision were included. PASS version 2020 software was used for sample size calculation of two groups of patients via clinical trial. The two proportions to be compared were complication rate for internal lining restoration group (Group A) and no restoration group (Group B) which were 5% and 35% respectively. The confidence level and power of the study were 95% and 80% respectively. The sample size of both groups would be 24. So, sample size of the study would be 48. We included patients in the study using non-probability consecutive sampling. The patients were divided into two groups, i.e. Group A and Group B. Group A was comprised of the patients in whom flap reconstruction was done with restoration of the internal lining. Patients of Group B did not include internal lining restoration. Patients who had primary reconstructive surgery by regional, pedicled or free flaps after excision were offered to be part of the study. Those patients who had secondary or salvage reconstruction, recurrent or residual disease, had a systemic disease prohibiting surgery or had a follow up less than 6 weeks were excluded. Permission from College of the Physicians and Surgeons of Pakistan and Institutional Ethical Review Board was obtained before taking up the patients and informed consent obtained. Data was obtained from the operation notes, ward files and planned follow up. A proforma was designed and a uniform way of data collection was followed. Age and sex of the patient was taken. Additional details collected included the site of the tumor and flap covered. Reconstruction of the patients (with or without internal lining reconstruction) was the other independent variable. The outcome variables were surgical and functional outcomes. Surgical outcomes included complications of wound dehiscence, infection, flap necrosis and fistula. Functional outcomes were identified by swallowing function, speech intelligibility and return to oral intake at six weeks postoperative. Confounding variables were minimised by having all the patients operated on by the same surgical team and with the same perioperative nursing care protocol. Selection (publication) and observer biases were minimised by employing the same inclusion criteria for patient selection and having a single person recording the patient data. The analysis of data was done with statistical software (SPSS v25.0). Mean ±SD was used to present quantitative continued-level data including the age at time of surgery, time of surgery and the length of stay. The Shapiro-Wilk test was used to assess the possibility of non-normality of continued-level data. Qualitative data were described by frequency and percentage, and the Chi-square test was used to compare qualitative variables between groups. t-test for two groups (independent samples) was used for comparison of continued-level quantitative variables between groups if they were normally distributed, otherwise the Mann-Whitney U test was applied. p-value ≤ 0.05 was used as the significance level. The study was done ethically according to biomedical research guidelines for studies involving human subjects. Approval of the institution and privacy of the patients were guaranteed. Consent was obtained from the participants before collecting data.

RESULTS

In this study, we evaluated 48 patients, 24 patients in the internal lining restoration group and 24 in the no restoration group. The study population had a mean age of 52.8 ± 10.6 years, and was mostly male in both groups. There were no significant differences in patients' demographic and clinical profile (Table 1).

The rate of complications was lower in patients who had reconstruction with restoration of the internal lining compared to those who had no restoration. Wound dehiscence was observed in 2 (8.3%) versus 5 (20.8%) patients, surgical site infection in 3 (12.5%) versus 6 (25.0%), flap necrosis in 1 (4.2%) versus 3 (12.5%), and fistula formation in 2 (8.3%) versus 7 (29.2%) patients, respectively (Table 2).

Table No.1: Baseline Characteristics

Variable	With Internal Lining (n=24)	Without Internal Lining (n=24)	p-value
Mean age (years)	51.9 ± 9.8	53.7 ± 11.2	0.56
Male	16 (66.7%)	17 (70.8%)	0.76
Female	8 (33.3%)	7 (29.2%)	
Oral cavity	11 (45.8%)	10 (41.7%)	0.82

Table No. 2. Surgical Outcomes

Outcome	With Internal Lining	Without Internal Lining	p-value
Wound dehiscence	2 (8.3%)	5 (20.8%)	0.21
Infection	3 (12.5%)	6 (25.0%)	0.27
Flap necrosis	1 (4.2%)	3 (12.5%)	0.29
Fistula	2 (8.3%)	7 (29.2%)	0.06

Good surgical outcomes were reported in 19 (79.2%) patients with restoration and 14 (58.3%) without restoration. At six weeks, improved functional outcomes with good swallowing recovery, improved speech intelligibility and resumed oral feeding were observed in the restoration group (Table 3).

Table No. 3: Functional Outcomes

Outcome	With Internal Lining	Without Internal Lining	p-value
Good swallowing	18 (75.0%)	13 (54.2%)	0.13
Good speech	17 (70.8%)	12 (50.0%)	0.14
Oral feeding achieved	20 (83.3%)	15 (62.5%)	0.10
Good functional outcome	18 (75.0%)	13 (54.2%)	0.13

Favorable functional outcomes were observed in 18 (75.0%) of patients with internal lining restoration compared with 13 (54.2%) without restoration.

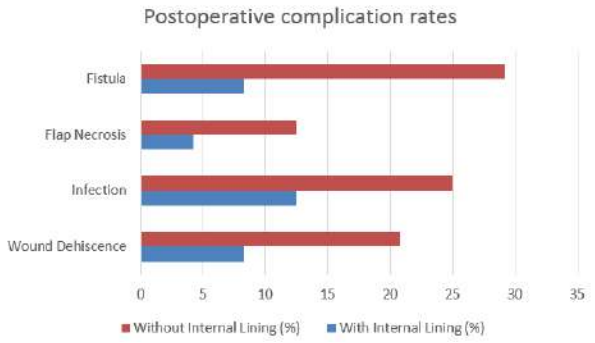

Figure No.1: Comparison of postoperative complication rates between head and neck cancer reconstruction with versus without internal lining restoration.

DISCUSSION

Flaps are commonly used for local tissue reconstruction of head and neck defects following cancer resection. A comparative analysis of defects reconstructed with local flaps with or without internal lining reconstruction showed patients with internal lining reconstruction of head and neck defects achieved better surgical and functional outcomes. This is in line with current reconstructive philosophy to promote wound healing, prevent contamination of surgical wounds by saliva and facilitate adequate swallowing and speaking by reconstructing a continuous mucosal surface. The evidence from previous studies showed that reconstructing an internal lining decreased the incidence of fistulae and wound complications and improved functional rehabilitation of patients with head and neck cancer[13–15]. The lower rate of complications associated with the internal lining restoration is due to a number of biological and clinical reasons. The vascularized mucosal or myocutaneous lining restores the blood supply, promotes re-epithelialization and provides a barrier to salivary fistulae to prevent infection. As surgical techniques have evolved, insufficient lining and tension at the pharyngeal closure have been identified as major risk factors for fistula and a delayed start of adjuvant treatment, which is potentially detrimental to patient outcomes. Finally, effective reconstruction permits early start of adjuvant treatment and results in better swallowing function and speech.[16,17] In keeping with previous observations, the majority of the patients in this study were able to commence oral alimentation and had a shorter hospitalisation following vascularised lining restoration of their vascularised tissue defects. Some series have reported little difference in outcome for patients with similar sized defects managed with or without an internal lining, although these studies have been largely on selected patients[18,19]. A number of patient variables such as size of surgical defect, type of flap used, comorbidity, nutritional status, as well as surgeon experience can affect patient outcome following major reconstructive surgery. The surgeon in developing countries would also consider the reconstructive procedure of choice in terms of being less time consuming and within his level of surgical expertise. In general, however, the data support the policy of lining reconstruction, whenever possible, for the patient with a 'composite' defect who is at high oncological risk. One of the principal strengths of this study is that both reconstructive approaches were evaluated in one center comparing outcomes in a directly comparable fashion using similar surgical techniques and perioperative protocols. The simultaneous evaluation of both surgical

and functional outcomes is another strength of this study as reporting merely complications rate does not provide a complete assessment of the reconstructive outcome.

CONCLUSION

Restoration of the internal lining during flap reconstruction for head and neck cancer was linked with improved surgical and functional outcomes, with reduced surgical complications and improved swallowing, speech and oral feeding. The study supports the reconstruction strategy of restoring mucosal linings when possible to promote healing and recovery. This may help improve outcomes and reduce complications in resource-poor environments where surgical options may be limited. While these results require further validation by larger multicenter studies, this study suggests that restoration of the internal lining should be an important reconstructive consideration for patients treated with head and neck cancer surgery.

Limitations: This study has several limitations. It is cross-sectional and comparative and was conducted on a relatively small sample of patients. It is a single centre study and as such its findings may reflect the practice of a single reconstructive centre and not that of other similar centres. Moreover, the study did not assess longer-term outcomes, such as quality of life and the durability of rehabilitation of speech and swallowing and oncologic outcomes. These important issues should be addressed in future studies, done on a larger scale and with a prospective design and on a multicentre basis. This study has several limitations; however, it does provide meaningful clinical information and can guide reconstructive surgery to maximize success. Future studies should be multicenter comparative studies, by flap type, or patient-based outcomes measuring functional outcomes and cost-effectiveness. The study demonstrates that the reconstruction of an internal lining should be a priority in flap-based head and neck reconstruction, potentially expediting healing and rehabilitation by facilitating an early return to oral intake through the prevention of fistulas and the establishment of healthy oral mucosa. The study adds further evidence to the increasingly appreciated importance of internal lining reconstruction.

Author's Contribution:

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Drafting or Revising Critically:	Gulshan Kumari, Muhammad Razzaq Dogar
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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Original Article

Association Between Anemia and Acute Lower Respiratory Tract Infection in Under-Five Children

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ABSTRACT

Objective: To determine the association of anemia with acute lower respiratory tract infection among children under 5 years of age.

Study Design: Case control study

Place and Duration of Study: This study was conducted at the Dept. of Pediatric Medicine of Ziauddin University Hospital, Karachi from 6th January 2024 till 6th July 2024.

Methods: Quantitative and qualitative data was collected, presented and analyzed. Effect modifiers were controlled through stratification to see the effect of these on the outcome variable. Post stratification chi square test was applied taking p-value of ≤0.05 as significant.

Results: A total of 62 patients (31 in case and control) who met the inclusion and exclusion criteria were included in this study. Stratification of anemia according to case and control group showed that 32.3% and 12.9% had and did not have anemia. P-value was 0.07. Odds ratio was 3.21.

Conclusion: Anemia was significantly associated with LRTI group compared to the control group proving it to be an independent risk factor for LRTI.

Key Words: Anemia and acute lower respiratory tract infection.

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INTRODUCTION

Anemia is a major public health problem frequently observed among pregnant women and young children, particularly those aged 0–5 years. Globally, the prevalence of anemia is increasing, currently affecting 29% of pregnant women, 38% of non-pregnant women, and 43% of children[1]. The effects of anemia range from mild fatigue to more severe symptoms like chest pain and dyspnea. Acute Lower Respiratory Tract Infections (LRTIs) are a leading cause of childhood mortality in children under five years, especially in developing countries[2]. This age group is particularly vulnerable to conditions like bronchitis, bronchiolitis, and pneumonia, with an average of 5–6 episodes of LRTI per year[3].

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LRTIs contribute significantly to morbidity and mortality, with an estimated 150 million episodes of childhood pneumonia reported annually, resulting in 3 million deaths, 90–95% of which occur in developing countries.[4]

Several risk factors increase susceptibility to LRTIs, including lack of breastfeeding, overcrowding, undernutrition, delayed weaning, pre-lacteal feeding, protein-energy malnutrition (PEM), infectious diseases, and secondary bacterial infections[5]. Evidence has shown a significant association between low hemoglobin levels and LRTIs. Studies conducted in Egypt and India support this evidence, demonstrating that iron-deficiency anemia is frequently found in children with LRTIs. Research also suggests that iron supplementation in children under five has a preventive effect against infections[6]. Anemic children are 3.59 times more likely to develop LRTIs, according to Yogesh Avhad et al., while another study found them to be 4.6 times more susceptible. Both anemia (mainly iron deficiency) and acute LRTIs are particularly common in developing countries like Bangladesh and Pakistan[7]. Correcting anemia may provide a cost-effective way to prevent LRTIs, thereby reducing morbidity and mortality in children under five. Nutritional supplementation and food fortification can improve immunity and enhance resistance to infections[8].

In Pakistan, anemia and acute lower respiratory tract infections (ALRTIs) are prevalent in children under five[9]. According to the Pakistan Demographic and Health Survey (PDHS), anemia affects 62.1% of children aged 6–59 months, and ALRTIs are a leading cause of mortality in this age group[10]. By creating a hypoxic environment in the respiratory circulation, anemia is likely a significant contributor to LRTIs in children under five. Addressing these issues through prevention and nutritional interventions could significantly improve child health outcomes in developing countries[11-13].

METHODS

This study was a case-control design conducted in the Department of Pediatric Medicine at Ziauddin University Hospital, Karachi from January 6, 2024, and concluding on July 6, 2024, following the approval of the research synopsis. The study included a total of 62 children, divided equally into two groups: 31 cases (children with ALRTI) and 31 controls (children without ALRTI). The sample size was calculated using the Open Epi Sample Size Calculator, ensuring a confidence level of 95%, a margin of error of 5%, and a power of 80%. These parameters were based on findings from the KM R et al. study, which provided the hypothetical proportions of exposure in cases and controls. Participants were selected using non-probability consecutive sampling technique.

Sample Selection: The inclusion criteria for the study comprised children under five years of age, with cases defined as children diagnosed with ALRTI and controls as children without ALRTI. Exclusion criteria included premature children, those with congenital chest wall malformations, children exposed to passive smoking, those taking iron supplements, children with malnutrition, and those with severe systemic illnesses such as congenital heart disease or tuberculosis.

Data Collection Procedure: After obtaining institutional ethical approval and CPSP endorsement, children meeting the inclusion criteria were enrolled in the study from the outpatient and inpatient departments. Informed consent was obtained from parents or guardians. Data collection involved the use of pre-structured questionnaires, which included socio-demographic details (age, gender), clinical symptoms (cough, noisy breathing, convulsions, vomiting, cyanosis, chest in-drawing), and results of blood investigations (hemoglobin, MCV, MCH, MCHC, RDW, serum iron, serum ferritin, TIBC). Anemia was defined as a hemoglobin level of less than 11 g/dL. Confidentiality was maintained by anonymizing the data, securing it with passwords, and discarding it after the completion of the project within a set timeframe.

Data Analysis: Data were analyzed using Microsoft Excel 2016 and SPSS v.21.0. Qualitative data, such as gender and symptoms, were expressed as frequencies and percentages, while quantitative data, including age and blood investigation results, were expressed as mean ± standard deviation or median/IQR for non-normal data, assessed using the Shapiro-Wilk test. The association between anemia and ALRTI was tested using the chi-square test, with stratification by age and gender to account for confounders and effect modifiers. Post-stratification analysis involved chi-square or Fisher's exact tests, and odds ratios were calculated to measure the strength of association. A p-value of ≤0.05 was considered statistically significant.

RESULTS

A total of 62 patients (31 in case and control) visiting Dept. of Pediatric Medicine of Ziauddin University Hospital, Karachi who met the inclusion and exclusion criteria were included in this study.

Table No. 1: Demographic data of patients

Variable	Mean ± SD	Standard Deviation	Min-Max
Age (Case) (Years)	3.14 ± 2.49	2.49	1–5
Duration of Symptoms (Case) (Hours)	18.72 ± 14.24	14.24	4–72
Hemoglobin (Case) (mg/dL)	10.41 ± 2.56	2.56	7–12
Iron (Case) (µg/L)	10.56 ± 4.28	4.28	9–13
Ferritin (Case) (µg/L)	18.98 ± 4.56	4.56	8–18
TIBC (Case) (%)	40.6 ± 10.87	10.87	35–55
Age (Control) (Years)	3.17 ± 1.98	1.98	1–5
Duration of Symptoms (Control)(Hours)	16.66 ± 18.31	18.31	4–72
Hemoglobin (Control) (mg/dL)	11.52 ± 2.33	2.33	8–12
Iron (Control) (µg/L)	11.69 ± 7.47	7.47	9–13
Ferritin (Control) (µg/L)	21.58 ± 6.87	6.87	8–18
TIBC (Control) (%)	42.9 ± 15.57	15.57	35–55

The results show that the mean age of children in both the case and control groups was comparable, with cases averaging 3.14 ± 2.49 years and controls averaging 3.17 ± 1.98 years. The duration of symptoms was slightly longer in the case group (18.72 ± 14.24 hours) compared to the control group (16.66 ± 18.31 hours). Hemoglobin levels were lower in the case group (10.41 ± 2.56 mg/dL) than in the control group (11.52 ± 2.33 mg/dL), indicating a trend of anemia among cases. Similarly, iron (10.56 ± 4.28 µg/L vs. 11.69 ± 7.47

μg/L) and ferritin levels (18.98 ± 4.56 μg/L vs. 21.58 ± 6.87 μg/L) were also lower in cases. The total iron-binding capacity (TIBC) was slightly reduced in cases (40.6 ± 10.87%) compared to controls (42.9 ± 15.57%), suggesting differences in iron metabolism between the groups.

The age distribution shows that a higher proportion of children in the case group (58.1%) were aged ≤2.5 years compared to 45.2% in the control group, while a greater proportion of children in the control group (54.8%) were aged >2.5 years compared to 41.9% in the case group. Regarding gender distribution, males constituted a larger proportion of the case group (58.1%) than the control group (38.7%), while females made up a greater proportion of the control group (61.3%) compared to the case group (41.9%).

Anemia was observed in 32.3% of cases compared to 12.9% of controls, with an odds ratio of 3.21 and a p-value of 0.07, indicating a trend towards significance. When stratified by age, anemia was more prevalent in children aged ≤2.5 years in both groups (27.8% in cases vs. 14.3% in controls), with an odds ratio of 2.30 (p-value = 0.90). For children aged >2.5 years, anemia was more frequent in cases (38.5%) compared to controls (11.8%), with an odds ratio of 4.68 (p-value = 0.10). Gender stratification showed that among males, anemia was observed in 27.8% of cases versus 16.7% of controls, with an odds ratio of 1.92 (p-value = 0.48). Among females, anemia was significantly higher in cases (38.5%) compared to controls (10.5%), with an odds ratio of 5.31 and a p-value of 0.07, suggesting a strong association in females. These results support the conclusion that anemia is a potential risk factor for lower respiratory tract infections, with variations based on age and gender.

Table No. 2: Age and Gender Distribution

Variable	Case Group (n=31)	Control Group (n=31)
Age Distribution		
≤ 2.5 Years	18 (58.1%)	14 (45.2%)
> 2.5 Years	13 (41.9%)	17 (54.8%)
Gender Distribution		
Male	18 (58.1%)	12 (38.7%)
Female	13 (41.9%)	19 (61.3%)

Table No. 3: Anemia Distribution

Variable	Case Group (n=31)	Control Group (n=31)	P-Value	Odds Ratio
Anemia Distribution				
Yes	10 (32.3%)	4 (12.9%)	0.07	3.21
No	21 (67.7%)	27 (87.1%)		
Anemia According to Age				
≤ 2.5 Years - Yes	5 (27.8%)	2 (14.3%)	0.90	2.30
≤ 2.5 Years - No	13 (75.2%)	12 (85.7%)		
> 2.5 Years - Yes	5 (38.5%)	2 (11.8%)	0.10	4.68
> 2.5 Years - No	8 (61.5%)	15 (88.2%)		
Anemia According to Gender				
Male - Yes	5 (27.8%)	2 (16.7%)	0.48	1.92
Male - No	13 (72.2%)	10 (83.3%)		
Female - Yes	5 (38.5%)	2 (10.5%)	0.07	5.31
Female - No	8 (61.5%)	17 (89.5%)		

DISCUSSION

In developing countries, lower respiratory tract infections (LRTIs) are a significant cause of mortality in children. Various risk factors, including low birth weight, malnutrition, vitamin A deficiency, lack of breastfeeding, poor socioeconomic conditions, large family size, young age, and air pollution, contribute to the development of LRTIs. Among these, anemia is frequently identified as a key cofactor for LRTIs[14]. In our study, we analyzed 62 participants (31 cases and 31 controls) meeting the inclusion and exclusion criteria. Anemia was observed in 32.3% of cases compared to 12.9% of controls, with an odds ratio of 3.21, indicating that anemic children were over three times more likely to develop LRTIs. Although the p-value of 0.07 indicated a trend toward significance, the findings align with other studies highlighting anemia as a major risk factor for LRTIs[15-17].

In another study, the majority of cases were children aged 1–3 years, with a male-to-female ratio of 1.27:1, showing a slight male preponderance. Anemia was present in 74.67% of cases and 34.67% of controls, confirming anemia as a significant risk factor for LRTI. The study found that the mean hemoglobin level was significantly lower in anemic children (9.99 ± 0.62 g/dL) compared to non-anemic children (11.99 ± 0.92 g/dL), with a p-value of 0.001[18]. History of recurrent chest infections was significantly higher among anemic children and hospitalized cases compared to non-anemic and healthy controls, further emphasizing the

association between low hemoglobin levels and LRTIs[19].

Another study reported a male preponderance of 57.3% in the study group and 59.1% in the control group. The majority of children in both groups were between 3 and 23 months old (80.9% in the study group and 81.8% in the control group). In this study, anemia was defined as a hemoglobin level <11 g/dL. The mean hemoglobin level in the study group was 8.8 g/dL compared to 11.6 g/dL in the control group [20]. Anemia was present in 64.5% of cases and 28.2% of controls, with an odds ratio of 4.63, indicating that anemic children were 4.6 times more susceptible to LRTIs (p-value <0.01). Additionally, iron deficiency anemia was found in 78.9% of the anemic cases in the study group, with significantly lower serum iron levels compared to non-anemic cases and controls (p-value <0.01). These studies consistently demonstrate that anemia, particularly iron deficiency anemia, significantly increases the risk of LRTIs in children. Preventive interventions, such as addressing nutritional deficiencies and improving access to iron supplementation, could substantially reduce the morbidity and mortality associated with LRTIs in children under five in developing countries.

CONCLUSION

This study clearly demonstrates that anemia is a significant risk factor for lower respiratory tract infections (LRTIs) in children aged 6 months to 5 years. Early detection and timely management of anemia can play a crucial role in reducing the risk of LRTIs. Preventive strategies such as improving dietary iron intake and implementing deworming programs can serve as effective interventions to mitigate this risk, thereby protecting healthy children from becoming victims of LRTIs.

Author's Contribution:

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Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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Original Article

Inoue Balloon Mitral Commissurotomy Using Percutaneous Transvenous Approach in Babylon, Iraq

Inoue Balloon Mitral Commissurotomy

Shokry Faaz Alsaad

ABSTRACT

Objective: Immediate outcomes of percutaneous transvenous approaches to inoue balloon mitral commissurotomy.
Study Design: A single-center observational study
Place and Duration of Study: This study was conducted at the Shaheed Almihrab Cardiac Center in Babylon, Iraq from 1st January 2021 to 31st December 2025.
Methods: 86 patients with severe rheumatic mitral stenosis (mitral valve area ≤1.5 cm^2 and Wilkins score ≤8) who underwent inoue balloon mitral commissurotomy were included. Pre- and post-procedural transthoracic echocardiography was performed on all patients. Mean mitral pressure gradient , mean mitral valve area, pulmonary artery systolic pressure post-transcatheter pulmonary valve replacement, and mitral regurgitation (MR) severity were primary clinical end points. Procedural success was defined as mitral valve area >1.5 cm^2 without severe mitral regurgitation (MR ≥3+).
Results: The mean age was 38.4 ± 11.2 years. The majority of the patients were females (74.4%). Procedural success was 94.2%. Baseline mitral valve area was 0.91±0.18 cm^2, increasing to 1.79±0.24 cm^2, P<0.001. Mitral mean gradient decreased from 14.2±4.6 mmHg to 5.1±2.3 mmHg, P<0.001, and pulmonary artery systolic pressure decreased from 48.6±14.2 mmHg to 31.4±10.8 mmHg, P <0.001. Severe mitral regurgitation occurred in 3.5%, cardiac tamponade in 1.2%, but no deaths were procedure-related.
Conclusion: Inoue balloon mitral commissurotomy via the percutaneous transvenous approach for rheumatic mitral stenosis performed in Babylon, Iraq, achieves a hemodynamic improvement and procedural success rate similar to the global data.

Key Words: Inoue balloon. Mitral commissurotomy; Percutaneous transvenous, Rheumatic mitral stenosis, Transseptal puncture, valvuloplasty

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INTRODUCTION

Rheumatic heart disease (RHD) remains a leading cause of potentially cardiovascular morbidity and mortality in low- and middle-income countries (LMICs), with mitral stenosis (MS) accounting for the most frequent valvular complication.[1-3] Furthermore, the burden of RHD is disproportionately higher in Iraq, particularly in central provinces such as Babylon, due to a combination of overcrowding, poverty, a lack of access to prophylactic, and high rates recurrent streptococcal pharyngitis, which allows for a high frequency of acute rheumatic fever (ARF) relapse with progressive valvular scarring.[4-6]

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In stenosis, the mitral valve leaflets and subvalvular apparatus gradually-thicken and fuse together, causing persistent obstruction of left ventricular filling. Untreated, this may lead to increased left-atrial pressure, pulmonary hypertension, right heart failure, atrial fibrillation and systemic thromboembolism. In untreated cases, severe MS is associated with a five-year mortality rate exceeding 40%.[7-9]

For decades, the treatment of choice for symptomatic severe was OMC, which required the use of cardiopulmonary bypass and the associated with major open-heart surgery. This changed in 1984 Dr. Kanji Inoue introduced the percutaneous transvenous inoue balloon mitral commissurotomy (IBMC).[10-13] This intrusive catheter procedure could be performed in the cardiac catheterization laboratory (CCU) using local anaesthesia via a catheter inserted through the femoral vein, and mechanically splitting the fused commissures using a balloon. In appropriately selected patients, IBMC has become the preferred approach over OMC, and the procedure is endorsed by international cardiac guidelines.[12,14]

Wilkins morphology score using echocardiography used to select which patient to treat remains a central

aspect of procedure success: a score of ≤8 means the valve is relativelyand non-calcified, and is associated with improved outcomes.[8,15] This procedure is associated with immediate and sustained increases in mitral valve area, decreased transmitral gradient, symptomatic improvement, and delay in the need for surgical intervention.[13]

Internationally, IBMC is widely used, but there is no report of outcome data for regional Iraqi cardiac centers, other than Baghdad. There are over 2 million people in Babylon Governorate, with a large population for RHD, but cardiac catheterization only became available at the tertiary care level in Babylon recently. Greater understanding of procedural performance, hemodynamic outcomes, and the complication profile in this previously neglected and high-burden setting will inform health care planners, training of the workforce, and evidence-based clinical practice in Iraq.

METHODS

This observational study was carried out at Cardiology Department of Shaheed Almihrab Cardiac Center, Babylon Governorate, Iraq from 1st January 2021 to 31st December 2025 vide letter No. BHD-2019-IRB-0147/QM/Approval/JSDJNEHU dated 19th July 2019. The patients with severe symptomatic rheumatic MS, preoperative selection criteria included symptomatic MS with New York Heart Association (NYHA) functional class II to IV, MVA ≤1.5 cm^2 by planimetry or pressure half-time, Wilkins morphology score ≤8, absence of important MR (grade ≤1+), and absence of LA thrombus on TEE. Patients with important concomitant aortic or tricuspid valve disease requiring surgical intervention, previous surgical commissurotomy or mitral valve replacement, severe subvalvular disease that cannot be treated safely with balloon dilatation, pregnancy, or contraindications to systemic anticoagulation were excluded.

All patients underwent clinical history and physical examination, 12-lead electrocardiogram, posteroanterior chest radiography, and standard blood test investigations, including complete blood count, coagulation profile, renal function tests, and fasting blood glucose. Two-dimensional and Doppler TTE was performed using a Philips CX 50 system. All patients underwent TEE 24-48 hours pre-procedure to exclude LA thrombus. Echocardiographic parameters assessed included MVA by planimetry and PHT, MMG by CW Doppler, MR grade (0-4+), tricuspid regurgitation (TR) for PASP estimation, LA antero-posterior diameter and LVEF obtained by Simpson's biplane method. Mitral valve morphology was scored using the Wilkins score: leaflet mobility, leaflet thickening, subvalvular thickening, and calcification (1-4 each, total 4-16).

All procedures were performed in the cardiac catheterisation laboratory under fluoroscopic and continuous echocardiographic guidance by an experienced interventional cardiologist. Following steps were involved:

Step 1: vascular access: right femoral vein was cannulated under local anaesthesia (2% lidocaine) and an 8 French (8F) introducer sheath was placed via a Seldinger technique.

Step 2: The Mullins sheath and Brockenbrough needle assembly were advanced carefully to the fossa ovalis under biplane fluoroscopic guidance, and the localization was confirmed by pressure monitoring and echocardiographic visualization of the transseptal puncture.

Step 3: Anticoagulation: Systemic heparinisation (100 IU/kg IV) was undertaken after successful transseptal access with a target ACT of >250 seconds.

Step 4: Inoue balloon catheter delivery. The Inoue balloon catheter (Toray Medical; 24-30 mm diameter; selected by height in cm ÷ 10 + 10 mm) was passed through the transseptal sheath and into the left atrium. A coiled metallic guide wire was then used to thread the partially inflated balloon catheter across the mitral valve orifice.

Step 5: Stepwise inflation. The balloon was inflated stepwise starting from 2 mm less than the calculated maximum diameter of the balloon. Echocardiographic assessment of MVA and MR grade was performed after each inflation. Inflations were repeated, stepwise increasing the diameter until MVA >1.5 cm2 was achieved or MR grade ≥2+ was induced.

Step 6: Post-inflation assessment: Hemodynamic (LAP, PCWP) and echocardiographic (MVA, MMG, and MR grade) data were recorded after every dilation attempt. The catheter was removed once the procedure has achieved the required end-point and hemostasis was confirmed.

Procedural success was defined as one of three: (1) post-procedural MVA >1.5 cm^2, (2) increase in MVA of >25% from baseline, or (3) absence of severe MR (grade <3+). All patients underwent repeat TTE at 24 h post-procedure. Prospective recording of complications included severe MR (grade ≥3+), cardiac tamponade, ischaemic stroke or systemic thromboembolism, emergency surgical intervention, and in-hospital mortality.

Statistical analysis was performed using SPSS-26. Paired t-tests were used to compare echocardiographic values before and after the procedure. Categorical variables are presented as counts and percentages. Subgroup comparisons were performed using an independent samples t-test, with statistical importance defined as a two-tailed p-value <0.05.

RESULTS

The mean age of patients was 38.4±11.2 years. The majority of patients enrolled in the program were women 64 (74.4%). The majority of the patients were

NYHA functional class III 58 (67.4%) and IV 26 (30.2%). Two patients (2.3%) were in functional class II. Atrial fibrillation was present in 29 (33.7%) patients (Table 1). The mean Wilkins score was 6.8±1.2, confirming overall favourable valve morphology across the cohort. Severe pulmonary hypertension (PASP >50 mmHg) was present in 34 patients (39.5%) [Table2].

IBMC induced meaningful improvements in all the primary hemodynamic parameters. MVA was increased from 0.91±0.18 cm^2 to 1.79±0.24 cm^2 (+0.88 cm^2; +96.7%; p <0.001), and MMG was reduced from 14.2±4.6 mmHg to 5.1±2.3 mmHg (−64.1%; p <0.001). Post-PCI mean PASP decreased from 48.6±14.2 mmHg to 31.4±10.8 (−35.4%; p<0.001) and there was no meaningful change in LVEF (pre: 62.4±5.8%; post: 62.1±5.9%; p=0.72). Overall procedural success was achieved in 81 of 86 patients (94.2%) [Table 3].

Characteristic	Value	%
Age (years)	38.4±11.2	
Gender		
Female	64	74.4
Male	22	25.6
NYHA Class II	2	2.3
NYHA Class III	58	67.4
NYHA Class IV	26	30.2
Atrial Fibrillation	29	33.7
Sinus Rhythm	57	66.3
Prior history of acute rheumatic fever	71	82.6
Hypertension	18	20.9
Diabetes Mellitus	11	12.8
Previous cardiac intervention (none)	86	100

Table No. 1: Baseline Demographic and Clinical Characteristics (n = 86)

Table No. 2: Baseline echocardiographic parameters (n = 86)

Echocardiographic Parameter	Mean±SD	Range
Wilkins Score	6.8±1.2	5 – 8
Mitral valve area - planimetry (cm^2)	0.91±0.18	0.6 – 1.4
Mitral valve area - pressure half-time (cm^2)	0.93±0.20	0.6 – 1.4
Mean mitral gradient (mmHg)	14.2±4.6	7 – 28
Pulmonary artery systolic pressure (mmHg)	48.6±14.2	28 – 90
Left atrial diameter (mm)	48.2±7.4	34 – 68
Left ventricular ejection fraction (%)	62.4±5.8	50 – 74
Mitral regurgitation grade 0-1+ (n, %)	86 (100%)	-

Table No. 3: Pre- and post-procedural hemodynamic parameters (n = 86)

Parameter	Pre-IBMC	Post-IBMC	Change	p-value
MVA - planimetry (cm^2)	0.91±0.18	1.79±0.24	+96.7%	<0.001
Mean mitral gradient (mmHg)	14.2±4.6	5.1±2.3	-64.1%	<0.001
PASP (mmHg)	48.6±14.2	31.4±10.8	-35.4%	<0.001
Left atrial diameter (mm)	48.2±7.4	44.6±6.9	-7.5%	0.003
LVEF (%)	62.4±5.8	62.1±5.9	Stable	0.72
Procedural success rate	-	94.2% (81/86)	-	-
Maximum balloon diameter used (mm)	26.8±1.4	-	-	-
Number of balloon inflations	3.2±0.9	-	-	-
Procedure duration (minutes)	52.4±18.6	-	-	-
Fluoroscopy time (minutes)	18.2±6.4	-	-	-

Table No. 4: Procedural complications (n = 86)

Complication	No.	%	Management
Severe MR (grade ≥3+)	3	3.5	2 urgent surgery; 1 conservative
Cardiac tamponade	1	1.2	Bedside pericardiocentesis
Ischaemic stroke/embolism	-	-	-
Procedural mortality	-	-	-
Emergency surgery (total)	2	2.3	Mitral valve replacement
Any major complication	4	4.7	-

Improvements in functional class were also dramatic. Before the procedure, 2.3% were class II according to NYHA criteria while 67.4 and 30.2% were class III and IV respectively. After the procedure, 69.8% of patients

improved to NYHA class I, 23.3% to class II and 4.7% to class III, leaving 2.3% (2 patients) with no improvement, corresponding to failure of the procedure. Before the procedure, the mean NYHA class was 3.28±0.52; after the procedure, it was 1.35±0.58 ($p<0.001$).

Major complications occurred in 4 patients (4.7%) [Table 4]. Three patients (3.5%) had severe MR (grade ≥3+) due to tearing of the non-commissural leaflet on echocardiography. Two of these patients were immediately scheduled for surgical mitral valve replacement. The remaining case was managed conservatively with the intention of surgery at a later date. Transseptal puncture-related cardiac tamponade occurred in 1 patient (1.2%) requiring bedside pericardiocentesis, and no deaths, ischaemic strokes (IS), or systemic thromboembolic complications (STE) related to the procedure were reported. In patients with AF (n=29) the procedural success rate was lower than in those in SR (n=57), 89.7% versus 96.5%, p=0.04, and PASP reduced less (p=0.03) possibly because they had more severe disease, with more advanced and irreversible pulmonary vascular remodelling. Since gain in MVA (p=0.21) and reduction in MMG (p=0.18) were not markedly different between both groups, it confirms the meaningful hemodynamic benefit of the IBMC in both rhythm subsets 4.

DISCUSSION

In the present study, safety, efficacy and reproducibility in a high RHD-burden population showed the success rates of 94.2%, MVA increase of 96.7%, MMG reduction of 64.1%, and PASP reduction of 35.4%, with no procedural mortality, seems comparable to high-volume international centres. This study showed that mostly young women with advanced symptomatic MS (mean age 38.4 years; 74.4% female) are similar to what would be expected from the epidemiologic features of rheumatic MS in Middle East and developing world. The bias towards female sex in RHD is established, and thought to result from differential immune responsiveness to Group A Streptococcus infection, and putative hormonal effects on the rheumatic inflammatory cascade.[9] The majority (97.7%) of patients present in NYHA class III/IV, similar to late presentation in systems with poor access to cardiological services, as is well recognizedLMICs.[16]

The success rate of the present study 94.2% compares very favorably with the published international experience because, Zhang et al[3] report a 90.3% rate for their multicentre Chinese experience. Reported rates 90-98% in the general population 11) and 91-97% in selected patients 15, 2021 ESC/EACTS guidelines) closely matched our single-centre experience. Our good results may reflect the favorable morphology of our patient population (mean Wilkins score 6.8): patients with a Wilkins score <8 have pliant, mobile leaflets, which tend to respond to balloon dilatation with commissural splitting rather than leaflet tearing 16; Palacios et al.[13]

In fact, the average gain in MVA in our series (0.91→1.79 cm^2; +96.7%) was at the high end of that previously reported worldwide. The 2020 ACC/AHA guidelines cite a gain of 85-100% in subsets of patients eligible for PBMV 13, exactly in line with our results. Moreover, the post-procedural MVA of 1.79 cm^2 exceeds the threshold of 1.5 cm^2 for haemodynamic success and approaches the post-procedural MVA of 2.0 cm^2 associated with the best long-term durability, published by Palacios et al[13] and Chmielak et al.[5] Thus, the 64.1% reduction in MMG led to near-normalization of the transmitral pressure gradient. The echocardiographic change corresponded with patient improvement, with 93.1% of patients improving by one or more NYHA classes and 69.8% improving to NYHA class I, from severely symptomatic disease to functionally normal.

A 35.4% reduction in the PASP (48.6→31.4 mmHg) confirms the systemic hemodynamic effect of successful IBMC. Relieving the mitral obstruction produces rapid reductions in left atrial pressure that are transmitted in a retrograde fashion to the pulmonary circulation. Residual mild pulmonary hypertension in our cohort is consistent with the fact that after chronic pulmonary artery pressure elevation PASP usually does not normalize completely in the short term and takes weeks to months for remodeling to bring it back to baseline levels and follow-up is likely to show continued PASP reduction.[2,14]

In the non procedural adverse events, no deaths were seen for the tricuspid procedures, and 4.7% of patients experienced a major complication. Severe MR occurred in 3.5% of patients, which was within the 2-9% reported worldwide.[1,14] Calcified and morphologically difficult valves may predispose to this complication. One patient (1.2%) had cardiac tamponade, which occurred at transseptal puncture and was resolved with no other sequelae. Operator experience is important. The lack of ischaemic stroke is consistent with the effectiveness of the heparinisation protocol and TEE screening.

The outcome of IBMC is less favorable in AF (89.7% vs 96.5%). AF has been shown to be an independent predictor of poor outcome with IBMC due to longer duration of disease, subvalvular involvement, and dilated left atrial size.[4,5] The MVA and MMG results from the AF subgroup were similar, confirming the IBMC is appropriate in a higher risk population. This study showed that high-quality IBMC can be delivered at a regional Iraqi cardiac center for a population with meaningful barriers to access to cardiac surgical services. A dedicated IBMC program at Shaheed Almihrab Cardiac Center is an important structural advance for cardiovascular care in the Babylon region

of Iraq. Prior to this, patients had to be referred to Baghdad, about 100 km away or abroad at a cost, a longer time, and more complicated treatment.

CONCLUSION

Inoue balloon mitral commissurotomy by percutaneous transvenous approach for patients with severe rheumatic mitral stenosis in a regional tertiary care hospital in Babylon, Iraq, is a safe, effective, clinically relevant, and practical procedure, with a success rate of 94.2% and a mean increase in MVA of 96.7%, MMG reduction of 64.1%, and PASP reduction of 35.4% in well-selected patients. Acceptable complication rates emerged, with no procedural deaths, low rates of moderate to severe MR and cardiac tamponade, and an important proportion of patients ending up in NYHA functional class I to II.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Shokry Faaz Alsaad
Drafting or Revising Critically:	Shokry Faaz Alsaad
Final Approval of version:	The above author
Agreement to accountable for all aspects of work:	The above author

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Original Article

Primary Headache with Relapsing Remitting Multiple Sclerosis

Prevalence of Primary Headache in Iraqi Patients with Relapsing Remitting Multiple Sclerosis

Saif Mohammed Tawfeeq Algburi[1], Raed M. Kathim[1], Wahab Ebdan[2] and Mustafa Makki Ajam[1]

ABSTRACT

Objective: To find out how many multiple sclerosis patients experienced headaches.
Study Design: A cross-sectional study
Place and Duration of Study: This study was conducted at the Neurology Clinic located in Al-Sadiq Teaching Hospital in Babylon Governorate, Iraq from 15th September 2025 to 28th February 2026.
Methods: 151 multiple sclerosis patients were included. The demographic data and multiple sclerosis information such as age, sex, Expanded Disability Status Scale score, time of diagnosis, number of lesions, and type(s) of headache(s).
Results: Majority of the patients 105 (69.5%) were females and rest were males 46 (30.5%). Most patients had an Expanded Disability Status Scale score of zero (69, 45.7%) i.e. 1 (63, 41.7%) at scores of 1, 2 (13, 8.6%), or three; of the patients; 89 (58.9%) had a history of chronic headache but 62 (41.1%) did not. Most patients were 69 reported migraine as the type of headache they had the most often (highly significant), although tensions and/or unspecified headaches were reported to occur less frequently than migraines. It is important to note that (i.e, sensory deficits) were the most frequent presenting signs at the time of diagnosis. The largest number of multiple sclerosis patients was in the 15-25 years age range (86, 57%) followed closely by 25-35 years (39, 26%) and 35-45 years (26, 17%).
Conclusion: The prevalence of headaches in multiple sclerosis patients. The two most commonly reported headaches by patients were migraine and tension-type headaches. This indicates that focused education on the recognition and management of headache in multiple sclerosis patients may improve their quality of life.
Key Words: Multiple sclerosis patients, Headache characteristics, Pain management

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INTRODUCTION

Multiple sclerosis (MS) is a persistent inflammatory, demyelinating, neurodegenerative, and autoimmune disease of the central nervous system (CNS), resulting in gliosis and plaque formation in many parts of the brain and spinal cord.[1] Globally, 2,860,000 people were affected with MS in 2020.[2] Female MS patients are three times more common than male MS patients; the majority of new MS diagnoses are between the ages of 20 and 40.[3]

Its cause is unknown, but numerous factors contribute to its development including immune dysregulation, family genetics, geographic location, viral infections and stress.[4] The manner in which MS presents to patients varies widely from benign forms to rapidly progressing, debilitating MS diseases.[5,6]

Headache is one of the most frequently seen conditions seen in clinical medicine.[7] Overall, approximately 89% of people will experience at least one headache or headache disorder sometime during their lives.[8] While migraine has been classified as a neurological condition that causes repeated episodes of severe unilateral headache with vomiting, nausea, photophobia and phonophobia, it is further defined as beginning as the culmination of a series of processes occurring within the CNS that increase a person's susceptibility to environmental stimuli. Migraine has also been linked to increased activity of the trigeminal nerve and unexplained amounts of calcitonin gene-related peptide (CGRP) released from the trigeminovascular system.[9]

In order to understand the high rates of migraine seen in patients with MS, many different mechanisms have been suggested. To begin with, histological evidence from postmortem samples suggests that inflammation of the meninges may play a role in the development of migraine headaches through the presence of lymphoid follicle-like structures located within the meninges and gyri.[10] Cortical demyelination secondary to

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inflammatory processes may act as an explanation for migraines, as it is known to result in faster cortical spreading depression in rodent models of migraine.[11] Furthermore, the location of the lesions may also be a factor; one retrospective study demonstrated that patients displaying MS lesions in the midbrain periaqueductal gray area are more likely to develop migraine.[12] Similar demographic and epidemiological patterns exist between MS and migraine, as both are more prevalent among women, young adults and Caucasians.[1] Patients with MS and migraine comorbidity are more likely to experience significant neurological impairment, fatigue, depression and stress than those without migraine.[13] The headaches, especially migraines and tension-type headaches, are a frequent occurrence among MS patients and have been reported to have a prevalence higher than 50%.[14] A retrospective review indicated that 55.6% of MS patients reported experiencing headaches. Among those, 61.7% experienced migraine headaches, 25.3% tension-type headaches, and 13% mixed-type headaches.[15] Due to the conflicting rates reported concerning migraine among individuals with MS, along with the increasing incidence of MS patients being identified in the Babylon governorate of Iraq, the current study will investigate the prevalence of headaches amongst MS patients in the Babylon region.

METHODS

This was a cross-sectional study took place at Neurology Clinic at Al-Sadiq Teaching Hospital, Iraq from 15th September 2025 to 28th February 2026 vide letter No. 3439/QM/Approval/JSDJNEHU Dated 07.07.2025 and 151 patients were enrolled. Initially, a list was made of patients with multiple sclerosis (MS). All patients who participated had a definitive MS diagnosis and met the revised McDonald Criteria 2017. Each participant had provided informed consent to participate in the study. Any patients who were unable to provide adequate cooperation for study purposes or suffered from other causes of headache were excluded from the study. Each patient underwent a comprehensive clinical history examination where data were collected on the patient's age, sex, and whether they were taking MS-related medications or antidepressant medications. Statistical analyses were performed via the SPSS-27. An independent sample T test was used to evaluate the differences between two independent means. The associations between categorical variables were evaluated using both the Pearson chi-square test and Fisher's exact probability test. A statistical significance level for each analysis was established at $p \leq 0.05$.

RESULTS

The average age of patients was 30.00±9.07. Less than half of the patients were within 20-30 years old age group (N=68; 45%). The average age of diagnosis was 25.74±7.21. More than half of the patients (N=79; 52.3%) were diagnosed between 20-30 years. The majority of the patients were females (N=105; 69.5%). According to figure 1 (sensory, motor, cerebellar, optic, and trigeminal), sensory symptoms were the most frequent initial presentation for less than half of the patients (N=69, 45.7%). For motor symptoms, there were 19 patients (12.6%); for cerebellar symptoms (13 patients, 8.6%); for optic nerves (44 patients, 29.1%) and trigeminal involvement was present in six patients (4%) [Table 1].

Less than half of patients (N=69, 45.7%) presented with a normal neurological exam and no disability (score 0). The remaining 63 patients (41.7%) had no disability but minimal signs in one functional system (FS), (i.e. score 1), 13 patients (8.6%) presented with minimal disability in one FS (i.e. score 2), and there were only six patients (4%) who had moderate disability in one FS but mild disability in three or four FS with no impairment to their ability to walk (i.e. score 3) [Table 2].

Finally, regarding primary headaches (i.e. presence or absence) and type of primary headache (i.e. migraine vs. tension type), 89 patients (58.9%) with multiple sclerosis (MS) reported the presence of a primary headache, with less than three-quarters of these patients (N=64, 71.9%) suffering from migraines (Table 3). The mean current ages of MS patients with and without headaches had no statistically significant difference. Whereas a statistically significant difference was found in the mean age of MS patients reporting primary headaches (24.55±5.83 years) versus those that did not report primary headaches (27.35±8.39 years) at the time of diagnosis (Table 4).

In females, 65.1% developed primary headaches compared to less than half (49.34%) of males. Of patients presenting to the doctor with optic symptoms (i.e. visual disturbance due to optic neuritis), 95% developed primary headache, as well as all patients who had presented initially with trigeminal symptoms. In contrast to this, only 2 out of the 7 (28%) of patients who initially presented to the doctor with motor symptoms developed primary headaches. With respect to EDSS scores, the majority of patients with a score of 0 (i.e. no disability) and those who with a score of 1 both developed primary headaches (63.8% and 68.3%, respectively), whereas all patients with EDSS scores of 3 were headache-free (Table 5).

Patients with migraine (i.e. primary recurrent headache disorder) exhibited both a statistically significant reduction in the mean current age and a statistically significant reduction in the mean age at diagnosis versus those who developed tension-type (i.e. secondary headache disorder) headache. The majority of females (77.9%) developed migraines, whereas less than 50% of males (n=47.5%) developed tension-type headache. Of the patients presenting with optic and

trigeminal symptoms as their first presentation of MS, 95.56% developed migraines, while 0% developed tension-type headache.

Table No. 1: Distribution of patients with multiple sclerosis according to sociodemographic characteristics (N=151)

Sociodemographic characteristics	No.	%
Age (years)		
10 – 20	17	11.3
21 – 30	68	45.0
31-40	39	25.8
40 – 50	22	14.6
> 50	5	3.3
Age at diagnosis (year)		
10 – 20	25	16.5
21 – 30	79	52.3
31-40	46	30.5
> 40	1	0.7
Gender		
Male	46	30.5
Female	105	69.5

Table No. 2: Distribution of patients with multiple sclerosis according to expanded disability status scale (N=151).

Expanded Disability Status Scale	No.	%
Normal neurological exam, no disability in any FS (score 0)	69	45.7
No disability, minimal signs in one FS (score 1)	63	41.7
Minimal disability in one FS (score 2)	13	8.6
Moderate disability in one FS, or mild disability in three or four FS. No impairment to walking (score 3)	6	4.0

Table No. 3: Distribution of patients with multiple sclerosis according to primary headache

Variable	No.	%
Primary headache		
Present	89	58.9
Absent	62	41.1
Type of headache		
Migraine	64	71.9
Tension headache	25	28.1

Table No. 4: The mean differences of age of patients (years) and age of diagnosis (years) according to primary headache (N=151)

Variable	Primary headache	No.	Mean±SD	P-value
Age (years)	Present	89	30.00±9.34	1.000
	Absent	62	30.00±8.75	
Age at diagnosis (years)	Present	89	24.55±5.83	0.023
	Absent	62	27.45±8.59	

Patients with a score of 0 and score of 3 on the expanded disability status scale were the most likely to develop migraine headaches (84.1%) while one patient (i.e. 50%) with a score of 2 developed tension-type headaches (Table 5).

Table No. 5: The association between primary headache among patients with multiple sclerosis and study variables (N=151)

Variable	Primary headache		P value
	Present (n-89)	Absent (n=62)	
Gender			
Male	21 (45.7%)	25 (54.3%)	0.028
Female	68 (64.8%)	37 (35.2%	
First presentation			
Sensory	33 (47.8%)	36 (52.2%)	<0.001
Motor	2 (10.5%)	17 (89.5%)	
Cerebellar	6 (46.2%)	7 (53.8%)	
Optic	42 (95.55)	2 (4.5%)	
Trigeminal	6 (100%)	-	
EDSS			
Score 0	44 (63.8%)	25 (36.2%)	<0.001
Score 1	43 (68.3%)	20 (31.7%)	
Score 2	2 (15.4%)	11 (84.6%)	
Score 3	-	6 (100%)	

Table No. 6: The comparison between types of primary headache among patients with multiple sclerosis that developed headache according to study variables (N=89)

Variable	Types of primary headache		P value
	Migraine (N=64)	Tension headache (N=25)	
Age of patient (years)	28.69±9.19)	33.36±9.03)	0.033
Age of diagnosis (years)	22.75±2.44	29.16±8.84	0.001
Gender			
Male	11 (52.4%)	10 (47.6%)	0.023
Female	53 (77.9%)	15 (22.1%)	
First presentation			
Sensory	21 (63.6%)	12 (36.4%)	<0.001
Motor	-	2 (100%)	
Cerebellar	1 (16.7%)	5 (83.3%)	
Optic	36 (85.7%)	6 (14.3%)	
Trigeminal	6 (100%)	-	
EDSS			
Score 0	37 (84.1%)	7 (15.9%)	0.019
Score 1	26 (60.5%)	17 (39.5%)	
Score 2	1 (50%)	1 (50%)	

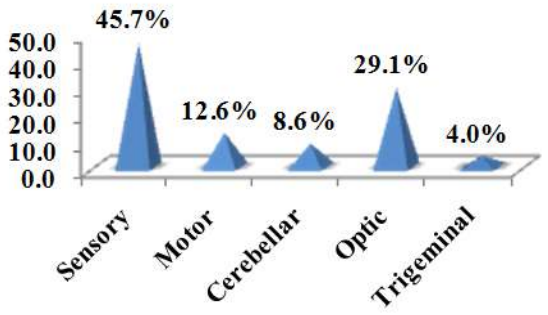

Figure No. 1: Distribution of patients with multiple sclerosis according to first presentation

DISCUSSION

This study showed a statistically significant association between having multiple sclerosis (MS) and experiencing migraine headaches, which indicates that people with MS are more likely to experience migraine headaches versus individuals who do not have MS. In the past 15 years, there has been a dramatic increase in MS, largely due to advances in understanding the basic pathophysiology of MS and the introduction of the first disease modifying therapies (DMTs) to treat this complicated disorder.[16,17] Because of the concerted effort over the last 20 years to create comprehensive longitudinal databases of MS patients, researchers now have the ability to study the effects of inherited (genetic) and non-inherited (environmental) factors on MS susceptibility and disease progression; thus improving individualization of risk assessment for persons at risk for developing MS, as well as evaluating the potential for implementing prevention strategies. Additionally, factors have been identified that provide guidance for treatment decisions; such as predicting individual responses to specific medications.[18]

Mirmosayyeb et al[19] performed a meta-analysis, which included 11,372 MS patients, and reported a total incidence of migraine headache of 31%. In addition, there was an enormous range of studies (2–67%) on how many people suffer from migraine throughout different countries with considerable differences between continents. In another meta-analysis by Wang et al[20] that analysed 3560 people with MS, the overall estimated prevalence of migraine was 27% with each individual study varying from 16.7% to 47%. Lastly, in a recent study of 18955 MS patients reviewed from a national inpatient sample database, the prevalence of migraine was 7%.[21] One reason for the variations in the frequency of the prevalence of migraine is due to case mix differences relating to age, sex, ethnicity, body mass, co-morbidities and other demographic and clinical factors.

Numerous hypotheses have been developed to explain the increased incidence of headache in MS patients, including decreased serotonin levels in the cerebrospinal fluid (CSF), decreased sympathetic nervous system activity, alterations in cytokine production and the development of B-cell (follicular) structures in the meninges and/or along the cerebral gyri.[22,23] Other studies have demonstrated a relationship between demyelinating lesions within the central nervous system (CNS). Multiple studies have correlated MS lesions by the brainstem, dorsal C2 horn, and peri-aqueductal gray matter to severe migraine headache.[24,25] The headache associated with the development of migraines in MS are due to some combination of shared genetic or environmental factors affected by hormonal fluctuations. This has been supported by studies showing that both disease activity of MS and the frequency of migraine attacks decrease in pregnancy.[26] It has been demonstrated a decrease in T8+ lymphocytes, which are believed to be among the primary cells associated with the immune response in both MS patients and headache patients, which could suggest an alteration of immunity is an additional factor.[11,15,19]

CONCLUSION

Multiple sclerosis patients have a more than 2-fold increased chance of experiencing headaches compared to the general population and may benefit from early intervention and the avoidance of known headache triggers during the initial stages of their multiple sclerosis diagnosis.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Saif Mohammed Tawfeeq Algburi, Raed M. Kathim
Drafting or Revising Critically:	Wahab Ebdan, ustafa Makki Ajam
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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Original Article

Inferior Vena Cava Filters in High-Risk Patients: Indications and Outcomes with Emphasis on Trauma Cases

Osamah Obaid Ibrahim

ABSTRACT

Objective: To evaluate the safety and efficacy of inferior vena cava filter.
Study Design: Retrospective study
Place and Duration of Study: This study was conducted at the Nasiriyah Teaching Hospital in Dhi Qar Governorate from 15th February 2025 to 30th September 2025.
Methods: This study involved 20 patients with inferior vena cava filters. The data was obtained age, gender, morbidities and signs of filter placement.
Results: There were 12 (60%) males and 8 (40%) females with male to female ratio 1.5:1 and 8 (40%) patients were between 39-50 years old. Eleven (55%) of patients were trauma with high risk of venous thromboembolism, 4 (20%) patients non-traumatic with high risk of recurrent pulmonary embolism, 3 (15%) of patients with poorly responded to anticoagulant therapy and only 2 (10%) of patients were contraindicated to anticoagulant. Eleven (55%) of patients had filter inserted via femoral vein access, 7 (35%) of them with jugular access, and 2 (10%) patients with subclavian vein access.
Conclusion: All accesses of inferior vena cava filter are feasible but still jugular or subclavian route are superior on femoral access especially in cases of bilateral lower limbs deep vein thrombosis. Most of the patients that required inferior vena cava filter were high risk of venous thromboembolism patients who were trauma patients.

Key Words: Inferior vena cava filters, Deep vein thrombosis, Pulmonary embolism, Venous thromboembolism, Interventional radiology, Trauma, Anticoagulation

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INTRODUCTION

Thromboembolic disease is also one of the major causes of morbidity and mortality. A filter placed in the inferior vena cava (IVC) is one of the strategies that can be used to prevent the severe pulmonary embolism (PE) caused by deep vein thrombosis (DVT). Nowadays, this is usually done with radiologic guidance through the femoral or jugular venous access[1] and it may be safely performed in office practices in patients with low to moderate procedural risk.[2,3] This paper focuses on our experience with the use of IVC filters. The absolute reasons of the placement of IVC filters entail the presence of DVT or PE in patients who are unable to take anticoagulants, patients who develop PE despite anticoagulant use, or patients who get complications associated with taking anticoagulants.

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Nonetheless, a meta-analysis study by Jiang et al[4] and found no significant difference at 3 months of anticoagulation between the addition of IVC filter to anticoagulation and anticoagulation alone. Relative indications are free-floating thrombus in the IVC or iliofemoral veins, PE in patients with limited cardiopulmonary reserve, prophylaxis in high-risk populations (i.e., major trauma, spinal cord injury, or paraplegia), preoperative protection in patients with DVT, non-compliance with anticoagulation, and use during thrombolytic therapy. There is limited evidence on the use of prophylaxis in cancer patients but a study by Balabhadra indicated better PE-free survival among cancer patients with DVT and high risk of bleeding after IVC filter placement. The contraindications are absolute (impossibility to reach the IVC) and relative (coagulopathy, complete IVC thrombosis, bacteremia or sepsis, a caval diameter smaller than 15 mm).[5] Neurocritical Care Society discourages a common practice of using IVC filters as first-line prophylaxis against VTE in patients with external ventricular drains.[6] In the same manner, the American College of Chest Physicians does not favor the use of filters in patients with acute DVT or PE who is properly anticoagulated.[7] Inferior vena cava filters are generally divided into permanent (non-retrievable) and temporary (retrievable) ones. Permanent filters cannot be reused or taken off but retrievable filters can be moved or taken

off within a specific period of time. With time, filters can be entrenched into the caval wall making it hard to recover them. In 2014, the US Food and Drug Administration published a safety communication where issues with low retrieval of temporary filters were raised and it was advised to remove them once they no longer protect against PE, and after a thorough risk-benefit evaluation.[8]

Nonetheless, the retrieval rates are still suboptimal and methods of enhancing them are under development.[16] Also, the installing IVC filters has been linked to the enhanced likelihood of malpractice lawsuits.[9] In terms of insertion methods, IVC filters come in different designs and can be inserted by using jugular or femoral access. Iliofemoral thrombosis would favor the jugular route. Other filters cannot be implanted through the left jugular vein because of rigidity of the device. The majority of filters can be used with IVC diameters below 3 cm, whereas bigger filters (megacava) might need special ones.[10]

The placement is usually determined using fluoroscopy or ultrasound, but computed tomography (CT) guidance could be beneficial in some instances, including morbid obesity.[11] Prophylaxis IVC filter placement in bariatric surgery patients with high risk of VTE has been linked to low DVT and PE postoperative rates (3 and 1, respectively), and no life threatening PE was reported. The success rates of retrieval were high, and the complications were low. Prophylactic filter placement has been shown to be associated with an increased incidence of DVT and nonfatal PE, and increased ICU stay, but not with regard to in-hospital mortality in patients with severely injured trauma. Prophylactic IVC filters could save lives in patients with severe head injuries, but not in patients with less severe head injuries.[12] The tools needed to put the IVC filters are ultrasound with a linear probe, fluoroscopy, antiseptic (chlorhexidine or povidone-iodine) and heparinized saline.[13] The use of local anesthesia is usually done to about 5 mL of 1% lidocaine and sedation is not mandatory but varies according to the practice of the patients and the institutions.[14] The patients lie on their backs and in order to access the jugular, the head can be turned opposite to the side of access.[15]

Venous puncture is done under ultrasound guidance and the access site is sterilized. With a small skin incision, a micropuncture or 18-gauge needle is used to reach the vein. Placement of guide wires is fluoroscopically verified and a sheath and catheter are then inserted. Venography is done to assess the IVC patency, size, placement of the renal vein and anatomical anomalies.[16] When satisfactory results are achieved, the sheath of the introducer is inserted and the filter is delivered beneath the renal veins as directed by the manufacturer. Depending on the need, the filter can be repositioned prior to final discharge. This is followed by completion cavography to ensure that they are correctly placed.[17,18] Other precautions are not to manipulate catheters via thrombus to avoid embolization and to make sure that there is correct imaging during the procedure. Suprarenal filters can be an option in IVC thrombosis. The majority of IVC filters can be used with MRI up to 3 Tesla, and imaging in the future will not be limited.[19-21]

METHODS

This retrospective study was conducted at Nasiriyah Teaching Hospital in Dhi Qar Governorate from 15th February 2025 to 30th September 2025 vide letter No. 33434/QM/Approval/dvdvdv dated February 7, 2025 and involved 20 patients with inferior vena cava filters. The selection of patients to be placed on IVC filters was done through physician or surgeon referrals in various specialties. Informed consent was taken and renal functioning was checked before the procedure. Every procedure made use of Denali™ Vena Cava Filter (Bard Peripheral Vascular, Inc) jugular, subclavian, or femoral delivery kits. The use of standard sterile methods with chlorhexidine or povidone-iodine solution, as well as 2% lidocaine as a local anesthetic, was used. Doppler-guided venous access was done through a 19-gauge needle via the right internal jugular, or subclavian or femoral vein. The 0.035- or 0.038-inch guide-wire was inserted with the fluoroscopic guidance into the IVC, and the filter sheath was inserted. To identify the best place of deployment, a venogram was done. The filter was then installed as per the instructions of the manufacturer and a confirmatory venogram was done. Lastly, the delivery system was discontinued and hemostasis was done by hand. The operations were done in an operating theatre or a catheterization laboratory. The data was analyzed through SPSS-25.

RESULTS

The average was 54.5 years and 12 (60%) males and 8 (40%) females with male: female ratio 1.5:1 (Fig. 1). Indications for placement of filters were trauma patient with high risk of VTE in 11 (55%) patients, massive PE with residual DVT in 4 (20%) patients, propagation and/or progression of DVT during therapeutic anticoagulation in 3 (15%) patients and contraindication to anticoagulation in 2 (10%) [Table 1].

Table No. 1: Indications for IVC filter placement

Indication	No.	%
Trauma patient with high risk of VTE	11	55.0
Massive PE with residual DVT in a patient at risk for further PE	4	20.0
Propagation and/or progression of DVT during therapeutic anticoagulation	3	15.0
Contraindication to anticoagulation	2	10.0

The site of insertion was femoral vein in 11 patients 55%, jugular vein in 7 patients 35% and subclavian vein in 2 patients 10%. There were no complications related to the placement of the IVC filter (Table 2).

Table No. 2: site of venous access of IVC filter

Venous access	No.	%
Femoral vein	11	55.0
Jugular vein	7	35.0
Subclavian vein	2	10.0

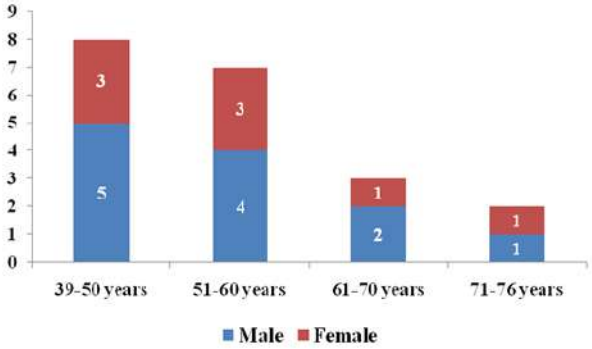

Figure No. 1: Gender distribution according to age

DISCUSSION

The installation of IVC filters and their recall have been increasing within the FDA accreditation period of 2010 onwards. However, there is yet to be little evidence to support its use. The rate at which patients are getting the IVC filter is on the rise.[22] In the present study, mean age was 54.5 year olds with most of them being of middle age and above. This may be as a result of high incidence of accidents and comorbidities. The male patients were more than female patients. The most common indication to place IVC filter was trauma patient at high risk of VTE (55%), comparable to Kaufman et al[23], where prophylactic indication was used to place all the filters and over a half of all indications. One out of ten of our patients were contraindicated to anticoagulation (acute hemorrhagic stroke). Regarding the site of the selected venous access, most of our patients had the femoral vein access because of unilateral DVT, patients with bilateral extensive DVT, the IVC filters were implanted using the jugular vein access in 7 patients, and patients with the jugular vein thrombosis and inaccessible access had the subclavian vein access. This finding similar to Kalva et al[24], the most frequent site of insertion was in the femur. In our study, there were no complications with the insertion of the IVC filter as compared to Nazzal et al[25] who had complications (access site hematoma, ipsilateral DVT, migration, pulmonary embolism) with varying percentage.

CONCLUSION

All access routes to the inferior vena cava filters are possible, but the jugular access or subclavian access is better than the femoral access, especially when there is bilateral lower limb deep vein thrombosis. Majority of patients requiring to be put on inferior vena cava filters are high-risk trauma patients who are likely to develop venous thromboembolism. Overall, inferior vena cava filter insertion is a non-invasive procedure, and it could be performed in the operating room, and not limited to the catheterization lab under fluoroscopy.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Osamah Obaid Ibrahim
Drafting or Revising Critically:	Osamah Obaid Ibrahim
Final Approval of version:	The above author
Agreement to accountable for all aspects of work:	The above author

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Original Article

Effectiveness of an Instructional Program on Nurses' Skills Regarding the International Pediatric Early Warning Scoring System in Mosul Hospitals: A Randomized Controlled Trial

Istabraq Taha Hamad[1] and Mohammed Ahmed Sultan Al-Wily[2]

ABSTRACT

Objective: To evaluate the effectiveness of an instructional program in improving nurses' skills related to the International Pediatric Early Warning Scoring System (IPEWS) in pediatric wards.

Study Design: Randomized controlled trial study

Place and Duration of Study: This study was conducted at the Pediatric Wards of Five Major Governmental Hospitals in Mosul City, Iraq, from 23 February to 23 April 2026.

Methods: Mosul General Hospital, Ibn Al-Atheer Teaching Hospital, and Al-Khansa Teaching Hospital were assigned to the experimental group, while Al-Salam Teaching Hospital and Ibn Sina Teaching Hospital served as the control group.

Methods: Registered nurses were randomly allocated to either an experimental group or a control group. The experimental group received a structured instructional program consisting of four educational sessions on the International Pediatric Early Warning Scoring System (IPEWS), while the control group received routine practice. Nurses' skills were assessed before and after the intervention using a researcher-developed observational questionnaire. Content validity was established by a panel of 20 experts, and reliability was confirmed through a pilot study (Cronbach's $\alpha = 0.810$). Data was analyzed using descriptive statistics, independent and paired *t*-tests, and analysis of variance (ANOVA), with statistical significance set at $p \leq 0.05$.

Results: The instructional program produced a significant improvement in nurses' IPEWS skills in the experimental group. The proportion of nurses with unacceptable skill levels declined from 60.0% at baseline to 0% after the intervention, while 56.7% achieved an excellent level of performance. In contrast, the control group demonstrated minimal changes between pretest and posttest assessments. Statistical analyses confirmed significant improvements in the experimental group ($p \leq 0.05$), whereas no significant differences were observed in the control group.

Conclusion: The structured instructional program was effective in significantly enhancing nurses' skills related to the International Pediatric Early Warning Scoring System. Incorporating similar educational interventions into continuing nursing education programs may strengthen pediatric patient assessment and contribute to improved quality of care.

Key Words: Instructional Program, Nurses' Skills, International Pediatric Early Warning Scoring System, Pediatric Nursing, Educational Intervention, Randomized Controlled Trial.

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INTRODUCTION

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The International Pediatric Early Warning Scoring System (IPEWS) is a standardized assessment tool designed to facilitate the early recognition of clinical deterioration in hospitalized children. It evaluates key physiological parameters, including respiratory rate, heart rate, temperature, circulatory status, and level of consciousness, to generate scores that guide timely clinical intervention and escalation of care. [1]

Pediatric Early Warning Systems (PEWS) were developed in response to the limitations of early adult warning tools in pediatric populations. Since their introduction in the early 2000s, PEWS have become widely used to identify children at risk of serious clinical deterioration and to improve patient safety and outcomes.[2] IPEWS has been implemented across

various pediatric settings, including hospital wards, emergency departments, and intensive care units, demonstrating effectiveness in predicting adverse events such as respiratory failure, cardiac arrest, and unplanned PICU admissions.[3,4]

Despite these benefits, successful implementation of IPEWS depends on accurate assessment, score calculation, and appropriate clinical response. Nurses play a critical role in this process, and evidence suggests that educational programs significantly improve nurses' competence, confidence, and adherence to IPEWS protocols. [5,6]

In Iraq, the use of standardized pediatric early warning systems remains limited, with patient monitoring often relying on subjective clinical judgment. Furthermore, few studies have examined IPEWS implementation within the Iraqi healthcare context. Therefore, this study aimed to assess nurses' skills regarding IPEWS and evaluate the effectiveness of an instructional program in improving their competencies. The study also explored the relationship between selected demographic characteristics and post-intervention skill levels. [7]

METHODS

Study Design: A randomized controlled trial (RCT) was conducted to evaluate the effectiveness of an instructional program on nurses' skills regarding the International Pediatric Early Warning Scoring System (IPEWS). The study was carried out between 23 February to 23 April 2026, in selected pediatric wards of hospitals in Mosul, Iraq.

Study Setting: The study was conducted in the pediatric wards of five public healthcare institutions in Mosul City, Iraq. Mosul General Hospital, Ibn Al-Atheer Teaching Hospital, and Al-Khansa Teaching Hospital were assigned to the experimental group, while Al-Salam Teaching Hospital and Ibn Sina Teaching Hospital served as the control group. These hospitals provide specialized pediatric healthcare services and employ registered nurses responsible for monitoring and managing hospitalized children.

Participants and Sampling: The study population comprised registered nurses working in pediatric wards of selected hospitals in Mosul, Iraq. Participants were recruited using a probability sampling method and were eligible if they had at least six months of pediatric nursing experience and provided informed consent. Nurses who had previously received formal IPEWS training, were on leave, or were unavailable during data collection were excluded.

Eligible participants were randomly assigned to either an experimental group, which received the IPEWS instructional program, or a control group, which continued routine clinical practice without intervention during the study period.

Instructional Program: The instructional program was developed based on an extensive review of the literature and international IPEWS guidelines to improve nurses' knowledge and skills in pediatric assessment and early recognition of clinical deterioration. The program consisted of four structured sessions covering IPEWS principles, scoring criteria, score interpretation, clinical decision-making, and escalation of care. Educational strategies included lectures, group discussions, case-based learning, practical examples, and the use of printed materials and presentation slides.

Study Instrument: Data were collected using a researcher-developed questionnaire designed to assess nurses' skills regarding the International Pediatric Early Warning System. The questionnaire consisted of two sections:

Section I: Demographic Characteristics: This section included information related to participants' demographic and professional characteristics such as age, gender, educational level, years of nursing experience, years of pediatric nursing experience, and previous participation in training courses.

Section II: Nurses' Skills Related to IPEWS

This section contained items measuring nurses' practical skills concerning the assessment, calculation, interpretation, and application of the International Pediatric Early Warning Scoring System. Responses were scored according to predetermined criteria, with higher scores indicating better skill performance.

Data Collection Procedure: Baseline data were collected from both experimental and control groups before implementation of the instructional program (pretest). Following completion of the educational intervention, posttest assessments were conducted for both groups using the same instrument to evaluate changes in nurses' skills related to IPEWS. Data collection was performed under standardized conditions to ensure consistency and minimize measurement bias.

Statistical Analysis: Data was coded and analyzed using SPSS version 28. Descriptive statistics (frequencies, percentages, means, and standard deviations) summarized participant characteristics and studied variables. Paired-samples t-tests assessed pre–post changes within groups, while independent-samples t-tests compared differences between the experimental and control groups. ANOVA was used to examine associations between demographic characteristics and IPEWS skill scores. Statistical significance was set at $p \leq 0.05$.

RESULTS

Participants' Demographic Characteristics (Table 1).

A total of 60 nurses participated in the study, with 30 assigned to the experimental group and 30 to the control group. Most participants were aged 20–29 years, female, and held a bachelor's degree. The majority had 1–5 years of nursing experience and 1–3

years of pediatric ward experience. None had previously received IPEWS training. No significant demographic differences were observed between the groups, confirming baseline comparability.

Table No. 1. Distribution of Nurses According to Their Total Skills Regarding the International Pediatric Early Warning Scoring System (IPEWS) at Pretest

Skill Level	Experimental Group F (%)	Control Group F (%)
Failed	10 (33.3)	6 (20.0)
Non-acceptable	18 (60.0)	18 (60.0)
Acceptable	2 (6.7)	5 (16.7)
Good	0 (0.0)	1 (3.3)
Excellent	0 (0.0)	0 (0.0)
Total	**30 (100.0)**	**30 (100.0)**

Table No. 2. Distribution of Nurses According to Their Total Skills Regarding the International Pediatric Early Warning Scoring System (IPEWS) at Posttest

Skill Level	Experimental Group F (%)	Control Group F (%)
Failed	0 (0.0)	8 (26.7)
Non-acceptable	0 (0.0)	18 (60.0)
Acceptable	2 (6.7)	2 (6.7)
Good	11 (36.7)	2 (6.7)
Excellent	17 (56.7)	0 (0.0)
Total	**30 (100.0)**	**30 (100.0)**

At baseline, nurses in both groups demonstrated inadequate IPEWS skills, with most participants classified as "failed" or "non-acceptable" across all assessment domains. Following the instructional program, the experimental group showed substantial improvement, with over 80% achieving "good" or "excellent" performance levels, whereas the control group showed minimal change and largely remained in the lower performance categories.

Table No.3. Comparison of Pretest and Posttest Total Skill Scores Using Paired Samples t-Test

Group	Comparison	Mean Difference	SD	t-value	P-value	Significance
Experimental Group	Pretest vs. Posttest	-2.967	0.669	-24.300	0.000	Highly Significant
Control Group	Pretest vs. Posttest	0.100	1.125	0.487	0.630	Not Significant

Before the intervention, most nurses in both the experimental (93.3%) and control (80.0%) groups demonstrated failed or non-acceptable IPEWS skill levels. After the instructional program, the experimental group showed marked improvement, with 93.4% achieving good or excellent performance and no participants classified as failed or non-acceptable. In contrast, the control group showed minimal improvement, with 86.7% remaining in the failed or non-acceptable categories.

DISCUSSION

The findings of the present study demonstrate that the instructional program was effective in improving nurses' skills related to the International Pediatric Early Warning Scoring System (IPEWS). The significant improvement observed among nurses in the experimental group, compared with the minimal change in the control group, indicates that structured educational interventions can substantially strengthen pediatric nurses' clinical assessment competencies. These findings are consistent with previous studies demonstrating that educational interventions improve nurses' knowledge, clinical skills, and adherence to pediatric early warning systems, ultimately facilitating earlier recognition of patient deterioration and improving patient safety.[12-15]

Regarding demographic characteristics, females represented slightly more than half of the participants in both groups, reflecting the gender distribution commonly observed within the nursing workforce. Most participants were aged 20–29 years and had one to five years of clinical experience, indicating a relatively young workforce still developing professional competencies. Similar demographic profiles have been reported among pediatric nurses in previous educational intervention studies.[8,9] Importantly, none of the participants had previously received formal training on IPEWS. This finding highlights an important educational gap and suggests that standardized pediatric early warning systems have not yet been routinely incorporated into continuing professional development programs in Iraqi hospitals.[10]

At baseline, nurses in both the experimental and control groups demonstrated inadequate IPEWS-related skills across all assessment domains, including respiratory assessment, cardiovascular assessment, temperature monitoring, neurological assessment, and theoretical

understanding. These findings suggest that many nurses rely on routine clinical observation rather than standardized evidence-based assessment tools when evaluating hospitalized children. Similar deficiencies have been reported internationally, where insufficient education and lack of standardized pediatric early warning protocols were identified as major barriers to timely recognition of clinical deterioration.[10,11,16]

A major finding of this study was the substantial improvement observed following participation in the instructional program. After the intervention, most nurses in the experimental group achieved good or excellent performance across all skill domains. This improvement is likely attributable to the structured educational strategy, which integrated theoretical instruction with practical application and reinforced systematic clinical assessment using IPEWS. According to adult learning theory, educational programs that combine active participation, repeated practice, and clinically relevant scenarios facilitate knowledge retention and skill acquisition.[20] Previous investigations similarly demonstrated that structured educational interventions significantly improve nurses' competence in pediatric assessment, clinical reasoning, and early detection of patient deterioration.[12,13,17]

Conversely, nurses in the control group demonstrated minimal improvement throughout the study period. Most participants remained within the failed or non-acceptable performance categories after the posttest assessment. This finding indicates that routine clinical experience alone is insufficient for developing competency in specialized assessment systems such as IPEWS. Similar results have been reported in controlled educational studies, where participants receiving routine practice without structured training showed little or no improvement compared with intervention groups.[13,18]

The remarkable improvement in total skill scores among nurses in the experimental group further confirms the effectiveness of the instructional program. More than half of the participants achieved an excellent level of performance following the intervention, whereas none of the nurses in the control group reached this level. These findings support previous evidence demonstrating that implementation of Pediatric Early Warning Score education enhances nurses' confidence, assessment accuracy, escalation of care, and responsiveness to clinical deterioration.[14,16,19]

The paired-samples *t*-test demonstrated highly significant improvements between pretest and posttest scores in the experimental group, whereas no significant changes were observed in the control group. Likewise, ANOVA confirmed a highly significant intervention effect. These statistical findings provide strong evidence that the observed improvements resulted directly from the instructional program rather than from routine clinical exposure or natural progression over time. Similar outcomes have been consistently reported following structured nursing education programs in pediatric and acute care settings.[15,20-21]

Analysis of demographic variables revealed only limited associations with nurses' performance. Years of service were significantly associated with baseline skill levels, whereas duration of employment in pediatric wards was associated with post-intervention performance. These findings suggest that accumulated clinical exposure may facilitate the acquisition and application of newly learned competencies. Similar relationships between professional experience and educational outcomes have been reported in previous nursing education research.[17,18] However, age, sex, and educational qualification were not significantly associated with skill outcomes, indicating that the instructional program was effective regardless of participants' demographic characteristics.

Overall, the present study provides strong evidence that a structured instructional program can substantially improve nurses' competence in applying the International Pediatric Early Warning Scoring System. Integrating standardized IPEWS education into orientation programs, continuing professional development, and routine competency assessments may strengthen nurses' ability to recognize early clinical deterioration, promote timely intervention, and ultimately improve the quality and safety of pediatric healthcare.[14,16]

CONCLUSION

The study found that pediatric nurses in Mosul hospitals had inadequate baseline IPEWS skills. The instructional program significantly improved nurses' competencies across all assessed domains, while no significant improvement was observed in the control group. These findings confirm the effectiveness of the program in enhancing nurses' ability to assess, interpret, and apply IPEWS. Demographic characteristics had minimal influence on outcomes, suggesting the intervention was effective across different participant groups.

Recommendations: IPEWS should be integrated into routine pediatric nursing practice to support early recognition of clinical deterioration and improve patient safety. Ongoing education through training programs, workshops, and competency assessments is recommended to enhance nurses' knowledge and skills. Incorporating IPEWS into nursing curricula may further strengthen evidence-based pediatric care.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Istabraq Taha Hamad
Drafting or Revising Critically:	Mohammed Ahmed Sultan Al-Wily

Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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Original Article

Assessment Nurses' Knowledge Toward Relapse Prevention Related to Addict Patients after Treatment

Hatem Kareem Mansoor[1] and Muna A. Khaleel[2]

ABSTRACT

Objective: To assess the level of a relapse prevention on nurses' knowledge related to addicted patients after treatment.

Study Design: Descriptive study

Place and Duration of Study: This study was conducted at the teaching hospitals in Al-Hilla City Iraq from 15th March 2025 to 14th November 2025.

Methods: A non-probability (convenience) sampling technique was used to reflect the general characteristics of the nurses and 50 nurses were enrolled.

Results: Overall nurse's knowledge toward relapse prevention related to addict patients, 48% of them poor and moderate level of knowledge and 48% of them have moderate level of knowledge too.

Conclusion: Poor and moderate level of knowledge that related to relapse prevention knowledge.

Key Words: Assessment, Nurse's knowledge, Relapse prevention, Addict patients

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INTRODUCTION

Substance use disorders (SUDs) continue to be a health issue in many parts of the world, and the high rate of relapse after treatment presents a significant burden to healthcare organizations.[1] Also states that about 35 million individuals throughout the world experience drug use disorders, and only 1 of every 7 individuals obtains the necessary treatment. Although some people show recovery, the relapse rates are still too high, and according to research, 40-60 percent of people relapse in the first year of treatment.[2] Nonetheless, the research indicates that a lot of nurses do not have sufficient training and knowledge skills to deal with the intricacies of addiction recovery. Recent cross-sectional research in Ethiopia also revealed that only a proportion of 48.3% of nurses were also good in terms of their knowledge on substance use care.[3,4]

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Substance use disorder is a chronic, relapsing disease that has a huge burden on people, families, and medical systems all over the globe.[5] Although treatment is effective, the problem of relapse following treatment is an insurmountable obstacle to lasting recovery. Research has revealed that most patients receiving addiction treatment relapse in the first year, and in most cases, it is because of insufficient psychosocial support and relapse prevention measures.[6] Since addiction is a complicated issue with a multifaceted nature, relapse is no longer considered an act of moral failure but a certain predictive aspect of the process of recovery that needs specific interventions and qualified healthcare assistance.[7]

The concept of relapse is used to describe the re-emergence of substance use in people with SUD who have abstained or cut down on substance use. It is well known as a normal and clinically relevant phenomenon in the recovery process and not as a sign of moral failure or unsuccessful treatment. The Diagnostic and Statistical Manual of Mental Disorders defines substance use disorder by problematic pattern of substance use that causes clinically significant impairment or distress. In this context, relapse can be used to indicate the recurrence of symptoms and functional deficiency following an improvement in status, which is indicative of the chronic and relapsing fact of addiction.[8]

Nurses operate at the leading line in the addiction recovery indicating medical and psychosocial assistance to the individuals after discharge. Nevertheless, research has shown that a lot of nurses are not well trained in the management of addictions and prevention of relapse. To illustrate, a recent report

on Ethiopia indicated that only 48.3 per cent of nurses were knowledgeable enough when it comes to substance use care, and over 50 per cent showed misconceptions or negative views towards patients with SUDs.[3,9]

METHODS

This descriptive study was carried out at teaching hospitals in Al-Hilla City Iraq from 15th March 2025 to 14th November 2025 vide letter No. 85 dated 2nd June 2025. The non-probability (convenience) samples of 50 nurses were who employed in the addict care units of teaching hospitals. The information from the nurses about knowledge of them about relapse prevention related to addiction that is where all parts part fill by the nurses. The 1uestionnaires composed of six parts:

Part one include the demographical data of the nurses like age of the nurse who share in the study, sex, marital status, educational level, years of employment, and years of work in the psychiatric care unit.

Part two includes 13 questions that is used to assessment the level of knowledge of nurses regarding addiction and relapse, each question has four choices and the question was scored that one grade for correct answer and zero grade for incorrect answer.

Part three includes 14 question and information regarding the nurse knowledge related to assessment to prevent relapse each question has four choices and the question was scored that one grade for correct answer and zero grade for incorrect answer.

Part four includes 14 questions and information regarding the nurse knowledge related to assessment to prevent relapse each question has four choices and the question was scored that one grade for correct answer and zero grade for incorrect answer

Part five includes 12 questions and information regarding to psychosocial support, nurse-patient communication, and therapeutic relationships to prevent relapse each question has four choices and the question was scored that one grade for correct answer and zero grade for incorrect answer

Part six includes 26 questions and information regarding to clinical training plan for addiction-related relapse prevention each question has four choices and the question was scored that one grade for correct answer and zero grade for incorrect answer.

Rating and scoring of instrument of the study: 0-26 scores as grade of poor knowledge, 27-53 scores as grade of moderate knowledge and 54-79 scores as grade of good knowledge.

Reliability and validity of the instrument: The validity of the instrument of study had been achieved by experts from different scientific branches having at least 5 years of experience in their field of work mean of experiences. The validity of the study consists of (11 (expert that distributed as follow (experts of faculty of nursing university of Babylon, experts of Faculty of Nursing University of Kirkuk, experts of faculty of nursing university of Al-Mustaqbal university, experts of faculty of nursing university of Baghdad, Consultant physician from Babylon Health Department. All observation of the experts was taken in consideration to show the questionnaire in better status. The reliability of questionnaire is obtained questionnaire that include knowledge of nurses without demographical data the reliability of questionnaire includes 0.81 by used Cronbach's alpha test. The data was analyzed through SPSS-25.

RESULTS

There were approximately half of the females 54% and males 46%. Majority of participants 54% were aged between 25–30 years with mean age was 27.08±3.511 years. There were 52% of the nurses were married, 54% of the nurses graduated from a college of nursing. It was also found that 72% of the participants had 5 years or less of nursing experience. About 62% of nurses had less than one year of experience in the psychiatric unit (Table 1). The mean scores are moderate in all domains (7.800, 7.960, 8.84, 9.08, 11.40, 42.0800). In overall, so moderate level assessment (Table 2).

Table No. 1: Sociodemographic characteristics of sample (n=50)

Characteristics	No.	%
Gender		
Male	23	46.0
Female	27	54.0
Age (years)		
20-24	16	32.0
25-30	27	54.0
31-35	7	14.0
Marital status		
Single	24	48.0
Married	26	52.0
Widow	-	-
Divorced	-	-
Educational level		
Nursing School Graduated	-	-
Nursing Institute graduated	13	26.0
College of Nursing Graduated	37	64
Years of experience in nursing		
< 5	36	72.0
6-10	10	20.0
> 11	4	8.0
Years of experience in psychiatric units		
< 1	31	62.0
< 2	11	22.0
2-3	7	14.0
≥ 4	1	2.0

48% of the participants had a poor level of knowledge, while another 48% had a moderate level of knowledge (Table 3). Regarding nurses' knowledge and sex, there

is no significant difference between nurses' knowledge and sex (p=0.53) at the level of significance (p≤0.05). With respect to age, there is no significant difference between age and nurses' knowledge (p=0.632) at the level of significance (p≤0.05). However, the study results indicate a significant difference between nurses' knowledge and educational level (p=0.02) at the level of significance (p≤0.05) [Table 4]. Concerning years of experience in nursing, the results show that there is no significant difference between nurses' knowledge and years of experience in nursing (p=0.162) at the level of significance (p≤0.05).

Table No. 2: Descriptive statistics for study

Domain	Mean±SD	Assessment
Concept of addiction and relapse (range 5-10)	7.800±1.732	Moderate
Comprehensive assessment for relapse prevention (range 6-11)	7.9600±1.813	Moderate
Nursing interventions and relapse prevention strategies (range 4-12)	8.84±1.929	Good
Psychosocial support, nurse–patient communication, and the therapeutic relationship (range 7-12)	9.08±1.7058	Moderate
Clinical training plan for addiction-related relapse prevention (range 7-12)	11.40±3.662	Moderate
Overall (range 25-45)	42.0800±6.90	Moderate

Table No. 3: Overall nurse's knowledge study toward relapse prevention related to addict patients

Variable	Classes	Control	
		No.	%
Nurse's knowledge	Poor	24	48.0
	Moderate	24	48.0
	Good	2	4.0
	Minimum	25.00	
	Maximum	45.00	
	Mean ± SD	42.0800±6.90	
	Assessment	Moderate	

Poor = 0-26, Moderate = 27- 52, Good = 53-79

Table No.4: Difference between demographic characteristics among study and nurse's knowledge toward relapse prevention related to addict patients

Socio-demographic characteristics		p. value	Statistic Test
Gender	Male	0.53	Mann-Whitney
	Female		
Age (years)	20-24	0.632	Kruskal-Wallis
	25-30		
	31-35		
Marital Status	Single	0.149	Kruskal-Wallis
	Married		
	Widow		
	Divorced		
Educational level	Nursing School Graduated	0.02	Kruskal-Wallis
	Nursing Institute graduated		
	College of Nursing Graduated		
Years of experience in nursing	≤ 5	0.162	Kruskal-Wallis
	6-10		
	> 11		
Years of experience in psychiatric unit	< 1	0.04	Kruskal-Wallis
	1-2		
	2-3		
	≥ 4		

DISCUSSION

In the present study, 48% of the participants had a poor level of knowledge, while another 48% had a moderate level of knowledge. This finding is consistent with that reported by Fisher et al[10] and Storm et al[11], which emphasizes that more interactive training methods should be implemented, as knowledge retention and

practical skills are significantly improved through interactive teaching approaches such as role-playing.

The results of the present study show a significant difference between nurses' knowledge and years of experience in the psychiatric unit (p=0.04) at the level of significance ($p \leq 0.05$). Barry et al[12] and Selby & Trinkoff[13] demonstrated that a higher level of education is associated with greater knowledge retention during addiction training. However, the researchers also found that a large proportion of participants (64%) had less than five years of nursing experience, and this factor did not have a significant influence on the results (p=0.162).

This study explained the psychiatric setting, 64% of participants had less than one year of experience, which showed a significant association (p=0.04). This highlights the importance of practical experience and is consistent with Chen et al[14], who suggested that limited experience in specialized fields may hinder the effective transfer of training knowledge. In contrast, Andersson and Nilsen[15] argued that knowledge can be effectively developed regardless of experience level, and that comprehensive training can help overcome knowledge gaps caused by limited experience.

CONCLUSION

Poor and moderate level of knowledge that related to relapse prevention knowledge.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Hatem Kareem Mansoor, Muna A. Khaleel
Drafting or Revising Critically:	Hatem Kareem Mansoor, Muna A. Khaleel
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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Original Article

Evaluating the Effectiveness of Cognitive Behavioral Sessions in Enhancing Psychological Wellbeing among Patients with Cancer

Abbas Abdul-Hussein Hassan and Abdul Mahdi A. Hasan

ABSTRACT

Objective: To determine the effectiveness of an educational program grounded on cognitive behavioral sessions in improving the psychological health of cancer patients.

Study Design: Quasi-experimental study

Place and Duration of Study: This study was conducted at the National Hospital of Oncology and Blood Diseases, Al-Najaf, Iraq from 1st May 2025 to 31st October 2025.

Methods: The sociodemographical data, and another with the use of the Psychological Wellbeing Scale (9 items) were recorded. The responses were recorded during pre-test, post-test 1 and post-test 2.The intervention was on four-part 40 minutes group sessions which were administered by the researcher who was also a trained practitioner in Cognitive Behavioral Therapy. To guarantee that the treatment has been faithful, the researcher followed the standardized protocols of Cognitive Behavioral Therapy throughout the delivery. They were measured at two stages; the first, the immediate post-test that included the evaluation of results immediately after the intervention, and the second one, the follow-up post-test that involved the assessment of results two months after the intervention.

Results: There were mostly males 84% within age 31-40 years 38%. Majority of the participants were under chemotherapy 54%. The post-intervention were statistically significant ($p<0.05$) in all dimensions. The positivity towards others went up by 1.92-4.36, purpose in life grew by 1.24-4.01 and self-acceptance grew by 1.40-3.34

Conclusion: Cognitive behavioral therapy is very effective in improving psychological wellbeing of cancer patients and able to move patients out of the poor to the good level of wellbeing.

Key Words: Effectiveness, Cognitive behavioral sessions, Enhancing psychological wellbeing, Cancer

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INTRODUCTION

Cancer is among the top causes of death, and poses one of the most significant roadblocks to enhancing life expectancy in every nation in the world. In 2019, estimates reported by the World Health Organization (WHO) indicated cancer was the 1st or 2nd leading cause of death before the age of 70 years in 112 of 183 countries, and the 3rd or 4th leading cause of death in an additional 23 countries.

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The increased ranking of cancer as a leading cause of death reflects in part, marked declines in the mortality rates of stroke and coronary heart disease, relative to cancer, in many countries.[1]

The malignant injuries reported by the Iraqi Cancer Council reported that cancer cases in Iraq increased from 1991 and 2016 of 5,720 cases, and a 31.05 percent population rate in 1991, to 25,556 cancer cases in 2016, or a rate of 67.4% per 100,000 of the population in that year. According to most recent reports by the Cancer Council in Iraq, the governorate of Baghdad, and Basra, report the highest numbers of afflicted individuals, while Muthanna report the least. Lung cancer is recognized as the most common cancer, and the top cause of death among those cases, although it boasts a mortality rate that is extraordinarily high.[2]

METHODS

This quasi-experimental research (one-group pretest-posttest) was carried out in the National Hospital of Oncology and Blood Diseases, Al-Najaf, Iraq from 1st May 2025 to 31st October 2025 vide letter No. 90 dated 21st April 2025. The two-part questionnaire, one with

sociodemographical data, and another with the use of the Psychological Wellbeing Scale (9 items) was used. The non-probability (purposive) samples composed of 50 patients with cancer with stage 0, 1 and 2 were enrolled. The patients who do not attend the centre, with stage 3 and 4 cancer, patients who refuse to participate and do not read and write were excluded. The demographical data of the patient age of the patients, sex, monthly income, residency, type of treatment, occupation and stage of cancer.

The psychological wellbeing scale was used to measure psychological wellbeing.[3] The psychological wellbeing scale consist of 18 items. these items are measured on a (5) point Likert-type scale of 1 (strongly agree), 2 (somewhat agree) , 3 (neither agree or disagree), 4 (somewhat disagree), 5 (strongly disagree). The total score is computed by summing scores of all items.

The responses were recorded during pre-test, post-test 1 and post-test 2. The intervention was an four -part 40 minutes group sessions which were administered by the researcher who was also a trained practitioner in Cognitive Behavioral Therapy (CBT). To guarantee that the treatment has been faithful, the researcher followed the standardized protocols of CBT throughout the delivery. The results were measured at two stages; the first, the immediate post-test that included the evaluation of results immediately after the intervention, and the second one, the follow-up post-test that involved the assessment of results two months after the intervention.

Session 1: Developing the awareness and self-acceptance. Goal was familiarize the cognitive model and to start reconciling with the self after diagnosis. Overview of CBTs effectiveness in improving psychological health and coping with distress stemming out of chronic disease was mentioned. Specifically, addressing the Self-Acceptance (e.g, reducing self-blame and increasing self-image despite physical changes). Education on the connection of thoughts, feelings and actions, with the focus being on the identification of those thoughts that are referred to as self-critical were briefed. Discussion of how negative self-perception affects emotional distress and withdrawal.

Session 2: Cognitive restructuring and stress management. To contradict negative thoughts that makes it difficult to accept one-self and to maintain emotional stability. Discovering and invalidating automatic negative thoughts of self-worth and the burden of illness. Rehearsing and challenging problematic thoughts that impact Self-Acceptance and confidence. Writing and analyzing daily thoughts with the goal of identifying patterns that either negate or affirm a positive image of the self. Training in deep breathing and progressive muscle relaxation to control the physiological stress that disturbs the mental clarity were mentioned.

Session 3: Engaging purpose in life and behavioral development. To rediscovers the purpose of life and fight against a sense of hopelessness or boredom. The fighting withdrawal and idleness by scheduling activities that is consistent with the values and purpose in life of the patient. The shifting an emotional emphasis to positive aspects of life and strengths, in order to promote existential well-being outside of the cancer diagnosis were exercised. Becoming familiar with personal successes and in-house resources in order to restore a sense of competence and meaning was mindfulness and health habits. Mindfulness meditation to enhance present-moment awareness and sleep hygiene to ensure the energy required to work towards life goals.

Session 4: Enhancing positive relations and sustainability. Promote social support networks and provide psychological resilience in the long term of outcome. Group discussions or approaches to establishing a support network and sharing common experiences to isolate. Through structured processes, practical and emotional barriers to social relationships and interpersonal relationships are overcome. Coming up with an individualized strategy to sustain self-acceptance, purpose, and positive relations in future health-related predicaments was relapse prevention. Reflecting on the progress that has been made in all three dimensions and discussing the future needs to sustain well-being. The data entered and analyzed through SPSS-25.

RESULTS

Table 1 indicates that the highest percentage of respondents was aged 31-40 years (38%), 41-50 years (28%), and only 4% of the participants were aged 61-70 years. This implies that the sample is dominated by young and middle-aged adults, which tend to be more psychologically impacted by cancer because of life pressure issues like work and family.

Table 2 indicate a positive change in positive relationship with others in all items between pre-test and post-test 1 and post-test 2. As an example, the item Maintaining close relationships has been difficult went up in its level (Mean=1.92 to 4.36) which reflects an increased interpersonal functioning. Likewise, the perceived emotional support rose (Mean 1.94 to 4.26) and this is a significant increase in the degree of social connectedness.

Table 3 showed a positive change in the sense of purpose in life of the participants. The product I have clear goals despite health challenges upgraded the pre-test (Mean = 1.24) to post-test 2 (Mean = 4.01).

Table 4 indicated a positive in self-acceptance. As an example, the score of the item I like most aspects of my personality rose by (Mean = 1.40) to (Mean = 3.34), whereas satisfaction with life advanced by (Mean = 1.58) to (Mean = 3.67). These results show that CBT is effective in enhancing positive self-perception and decreasing negative self-assessment.

Table No. 1: Distribution of study sample related to sociodemographical characteristics (n=50)

Characteristics	No.	%
Gender		
Male	42	84.0
Female	8	16.0
Age (years)		
20-30	9	18.0
31-40	19	38.0
41-50	14	28.0
51-60	6	12.0
61-70	2	4.0
Occupation		
Private sector employee	5	10.0
Self-employed	19	38.0
Unemployed	6	12.0
House wife	6	12.0
Monthly income		
Sufficient	8	16.0
Somewhat sufficient	24	48.0
Insufficient	18	36.0
Residency		
Owned	28	56.0
Other wise	22	44.0
Stage of cancer		
Stage 0	2	4.0
Stage I	19	38.0
Stage II	29	58.0
Type of treatment		
Chemotherapy	27	54.0
Surgical intervention	13	26.0
Immunotherapy	4	8.0
Radiotherapy	6	12.0

Table No. 2: Comparison between pre test and post test regarding positive relation with others

Item	Pre		Post 1		Post 2		P value*
	Mean	SD	Mean	SD	Mean	SD	
Maintaining close relationships has been difficult and frustrating for me	1.92	0.853	3.50	0.505	4.36	0.693	0.00
People would describe me as a giving person, willing to share my time with others	2.10	0.814	3.16	0.792	4.24	0.485	0.00
I receive adequate emotional support from those around me during treatment	1.94	1.018	3.28	0.730	4.26	0.646	0.00

Kruskal Wallis Test*

Table No. 3: Comparison between pre test and post test regarding purpose in life

Item	Pre		Post 1		Post 2		P value*
	Mean	SD	Mean	SD	Mean	SD	
I have clear goals that I strive to achieve despite health challenges	1.24	0.431	3.35	0.594	4.01	0.530	0.00
I live life one day at a time and don't really think about the future	1.46	0.706	3.69	0.469	3.90	0.614	0.02
I sometimes feel as if I've done all there is to do in life	1.70	1.111	3.50	0.505	3.98	0.667	0.00

Kruskal Wallis Test*

Table No. 4: Comparison between pre test and post test regarding self acceptance

Item	Pre		Post 1		Post 2		P value*
	Mean	SD	Mean	SD	Mean	SD	
I like most parts of my personality	1.40	0.553	2.78	0.737	3.34	0.572	0.00
When I look at the story of my life, I am pleased with how things have turned out so far	1.58	0.609	3.36	0.693	3.67	0.675	0.00
In many ways I feel disappointed about my achievements in life	1.72	0.809	3.22	0.583	3.46	0.676	0.00

Kruskal Wallis Test*

DISCUSSION

The results of the present study is similar to that of Haller et al[4], who noted that younger cancer patients are more prone to psychological distress and more willing to engage in psychological interventions, including cognitive behavioral therapy (CBT). The sex distribution is skewed towards males (84%) and against females (16%). Such an imbalance can affect psychological outcomes because its gender differences in cancer coping have been extensively documented. Hegarty et al[5] detected that female patients tend to exhibit greater emotional distress, and male-dominated samples might not be able to estimate the psychological burden. In terms of marital status, most of the participants were married (82%), which could potentially have a positive effect on psychological well-being via social and emotional support. Akechi et al[6] support this and highlighted the protective effect of marital support on the improvement of coping and distress reduction among cancer patients. Most respondents were workers (38%), then government employees (28%). This implies that people who have good or mobile employment can be more involved in treatment and psychological programs. This observation is in agreement with Paredes et al[7], who reported that employment, especially flexible or self-directed work, is related to a higher level of psychological adaptation in cancer patients. Regarding income, almost half of the respondents had somewhat sufficient income (48%), and 36% had insufficient income. Psychological well-being has been known to be adversely influenced by financial strain. Kim et al[8] established that anxiety and depression among cancer patients are highly dependent on financial difficulties. The findings of residency indicate that 56% of individuals owned their houses and this could be a factor of psychological stability. According to Brown et al[9], the process of homeownership is linked to reduced stress and better mental health outcomes. In terms of the disease characteristics, most patients were at the secondary phase of cancer (58%), then primary stage (38%). This means that the vast majority of participants had to deal with comparatively developed disease, which can contribute to psychological distress. This observation aligns with Mahnert et al[10], who indicated that with increased cancer stages, there is an increased level of anxiety, fear, and emotional burden. The predominant type of treatment was chemotherapy (54%), then surgical (26%). Psychological distress is normally linked to chemotherapy because of its side effects and vagueness. Lopez et al[11] affirmed the common use of emotional distress by patients receiving chemotherapy.

This study indicated that CBT is critical in the improvement of social relationships and perceived support among cancer patients. This is corroborated by Kelley et al[12] who established that social support plays a crucial role in enhancing psychological adjustment and alleviating isolation among cancer patients. Also, a clinical study by Carlson et al[13] showed that the CBT-oriented group interventions can positively affect the interpersonal relationships and emotional sharing, resulting in better mental health outcomes.

The meaning of life implies that CBT can assist patients who have lost their sense of meaning and purpose in life despite the illness. Such results are in line with the findings of Park et al[14] who also found that CBT improves meaning-making and existential well-being in cancer patients. In addition, the enhancement in the future orientation is indicative of less hopelessness and more optimism. This is in line with the findings of Chagpar et al[15], who established that CBT plays a significant role in reducing depressive symptoms and improving the purpose of life in cancer patients.

Faller et al[16] have provided evidence to support this claim by discovering that CBT has a significant positive impact on self-esteem and has a negative effect on self-criticism in cancer patients. In line with this, Hofmann et al[17] emphasized that CBT is the technique that helps to restructure thinking to help individuals to dispute negative perceptions and build a more positive self-image.

CONCLUSION

Cognitive behavioral therapy is very effective in improving psychological wellbeing of cancer patients and able to move patients out of the poor to the good level of wellbeing.

Author's Contribution:

Concept & Design or acquisition of analysis or	Abbas Abdul-Hussein Hassan, Abdul Mahdi A.

interpretation of data:	Hasan
Drafting or Revising Critically:	Abbas Abdul-Hussein Hassan, Abdul Mahdi A. Hasan
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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Original Article

Cone Beam Computed Tomography-Guided Implant Surgery: Radiological Evaluation of Accuracy and Safety

Ali Hakiem Tawfieq

ABSTRACT

Objective: To assess the radiographic accuracy, angular deviation, longitudinal deviations and clinical safety in digital volumetric computed tomography-guided implant inserted cases.

Study Design: Prospective cohort study

Place and Duration of Study: This study was conducted at the Department of Oral and Maxillofacial Surgery, Baquba Teaching Hospital, Iraq from 1st April 2025 to 31st December 2025.

Methods: 50 patients with 60 implant sites. All patients had digital volumetric computed tomography-guided planning and surgery with computer-aided design/computer-aided manufacturing-based surgical guides. Differences in implant positions (coronal, apical, and angular) between planning and the actual postoperative situation were evaluated by digital volumetric computed tomography. Safety results and clinical complications were documented.

Results: Average differences in length were within clinically relevant levels. Angular deviations remained within the safety range. Surgical precision was in line with previous literature, with the normal deviations of implant position <1 mm, and angular deviation <5°. No significant neurovascular injury occurred.

Conclusion: The high radiological accuracy and safety of cone beam computed tomography-guided implantation surgery make it possible using a standard procedure.

Key Words: Surgical guide, Dental implant, Cone beam computed tomography

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INTRODUCTION

Appropriate placing of dental implants is one of the fundamental principles which could contribute to successful long-term implants and reduce biological and mechanical complications. Failure to position it appropriately may cause damage to important anatomical structures (as the inferior alveolar nerve, maxillary sinus perforation or poor prosthesis result). Standard radiographic technology in two dimensions captures only limited space and introduces the risk of positioning errors when implanting implants.[1,2]

The advent of cone-beam computed tomography (CBCT) has transformed implant treatment planning by providing three-dimensional images of bony structures at a fraction of the radiation dose than that delivered by conventional computed tomography.[3]

Cone-beam computed tomography provides the opportunity to accurately evaluate bone volume, bone shape and proximity to vital structures, which are important for implant planning. CBCT directed to measurement also the dimensions of temporomandibular joint components, counting (glenoid fossa, mandibular condyle and articular eminence) and all bony component in maxillofacial area.[4,5]

By merging CBCT data with digital implant planning software the prosthesis can be driven on implant placement.[6,7] The adoption of a digital workflow aids computer-aided placement and positioning of the implant according to anatomical and restorative factors resulting in greater predictability while minimizing surgical risks.[6] The better diagnostic value of CBCT compared to panoramic radiography in implant treatment planning.[8,9]

Cone-beam computed tomography-guided implant placement utilizes CAD/CAM milled guides to guide the virtual treatment plan to the clinical reality.[10] These guidance limit drilling direction and depth of implantation which decreases the operator´s influence thought to have an impact on bone mineral density. The reduction of linear deviations and angular errors has been significantly recoded in clinical studies if implantation is guided compared to the freehand procedure.[11,12]

Although guided implant surgery offers benefits, however small discrepancies between planned and realised implant locations will occur even when all possible errors are minimised (guide stability,

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fabrication tolerances of the surgical template, surgical access and patient's movement). Hence, the radiological assessment of implant precision through postoperative CBCT images is mandatory in order to evaluate both the feasibility and safety of guided surgical procedures.[13,14]

The purpose of this study is to assess the radiological accuracy and safety of CBCT-guided implant placement at Baqubah Dental Teaching Hospital, Diyala, Iraq by comparing linear and angular differences between planned implants positions with that of those placed in addition to documenting surgical complications.

METHODS

This was a prospective cohort study was carried out at Department of Oral and Maxillofacial Surgery, Baquba Teaching Hospital, Iraq from 1st April 2025 to 31st December 2025 vide letter No. 338353QM/Approval/SFHP dated March 19, 2025. Fifty patients (28 males and 22 females) requiring dental implant therapy were enrolled, with a total of 60 implant sites included. The partially edentulous patients aged 25-65 years requiring guided implant placement were included. Uncontrolled systemic diseases, pregnancy, and poor oral hygiene were excluded.

Postoperative CBCT scans were acquired within 1 week after surgery. Deviations between planned and placed implant positions were measured in coronal linear deviation (mm), apical linear deviation (mm) and angular deviation (degrees). Clinical follow-up assessed as neurovascular complications, maxillary sinus perforations, soft tissue injuries and adverse events were recorded during surgery and up to 6 months postoperatively.

All patients received preoperative CBCT scans (Planmeca ProMax 3D) with standardized settings (FOV 10 × 10 cm, voxel size 0.2 mm), and intraoral scans for prosthetic planning. CBCT DICOM data were imported into guided implant planning software. Surgical guides were CAD/CAM fabricated with fully guided drill sleeves. Implants were placed via flapless or minimal flap approach. Postoperative CBCT scans were acquired within after surgery. Radiological accuracy was evaluated by measuring coronal deviation, apical deviation, and angular deviation between planned and actual implant positions using CBCT superimposition techniques. Measurements followed protocols validated in previous accuracy studies (Figs. 1-2). Intraoperative and postoperative complications, including neurovascular injury, sinus perforation, and infection, were recorded during a 6-month follow-up period. The data was analyzed through SPSS-25. t-test and ANOVA were used to compare deviations by arch, guide type, and surgical approach. Significance was set at $p<0.05$.

RESULTS

There were 30 (50%) males and 30 (50%) females (Table 1). Table 2 showed the ages of the patients who underwent dental implant. There were 21 (47.6%) females and 52.38% males in age group 25-35, 20 in age group 35-45, 50% females and 50% males, 10 in age group 45-55, 50% females and 50% males, and 9 in age group 55-65, 55.5% females and 44.4% males. Table 3 shows the number of dental implants in each jaw and in which region. The Mandible had 40 implants, 20 in the posterior region and 20 in the anterior region (50%). The maxilla had 20 implants, 10 in the posterior region and 10 in the anterior region (50%).

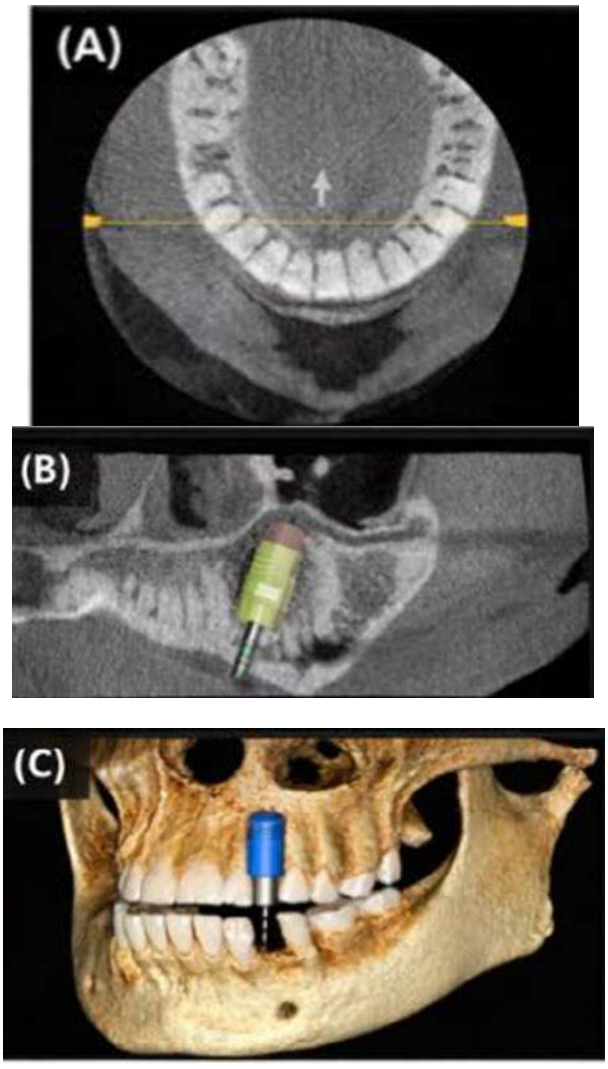

Figure No. 1: Preoperative CBCT images showing (A) axial view (B) Cross sectional view (C) 3D reconstructed with virtual implant plan

Figure No. 2: Surgical guide in place during implant insertion

Table 4 showed the postoperative complication, it was clarified that there is no problem after the implantation in 56 out of 60 cases, while there is a problem in 4 cases, representing a percentage of 93.3%. The post-transplant problems were manifested as sinus perforation Mild inflammation soft tissue injury.

Table No. 1: Gender of implant patients (n=60)

Gender	No.	%
Males	30	50.0
Females	30	50.0

Table No. 2: Age of implant patients (n=60)

Age (years)	Total	Females	Males
25 – 35	21	10 (47.6%)	11 (52.38%)
36-45	20	10 (50%)	10 (50%)
46-55	10	5 (50%)	5 (50%)
56-65	9	5 (55.5%)	4 (44.4%)

Table No. 3: Number of implant in each jaw and regions (n=60)

Jaw	Total	Posterior Region	Anterior Region
Mandible	40	20 (50%)	20 (50%)
Maxilla	20	10 (50%)	10 (50%)

Table No. 4: Postoperative Complications (n=60)

Complication	No.	%
No	56	93.3
Yes	4	6.7
Type of complication		
Sinus perforation	1	25.0
Mild inflammation	1	25.0
Soft tissue injury	2	50.0

DISCUSSION

The findings of this study could confirm that CBCT-guided implant surgery reached good radiological outcome with mean coronal and apical deviations equal or lower than 1.5 mm, as well as angular deviation lower than 5°. These results are within the clinically acceptable safety margin and compare favorably with results from previous prospective clinical studies.[15-17]

A few systemic reviews have demonstrated that guided implant surgery provides better position accuracy than freehand in terms of anatomically challenging areas such as the posterior maxilla and mandible. The slopes obtained in this study are similar to those reported by Tahmaseb et al[7] and Vercruyssen et al[15] corroborating the reproducibility of directed routines.

The tendencies in maxillary sites, with slightly higher variation than in mandibular regions, could be explained by the differing bone density and cortical width.[18] Low bone density in the posterior maxilla has been previously recorded as a parameter related with guide stability and accuracy of drilling possibly explaining these findings.[19,20]

From the safety point of view, no neurovascular injury and very few perforations into the sinus were seen in this study which underlines the protective effect of CBCT-based planning.[20] The precise display of the inferior alveolar canal and the maxillary sinus helps the operator maintain safe zones during virtual planning.[21]

However, guided implant surgery is not to be error-free also. Accuracy may be compromised due to factors such as incorrect guide seating, manufacturing tolerances and lack of mouth opening. Thus, caregivers should continue to have a high level of suspicion and clinical judgment when using guided systems. CBCT-guided implant surgery should be acknowledged as standard of care for advanced cases or in anatomically challenging anatomic sites. Although comparable accuracies can be achieved using the traditional method under specific conditions, the guided one allows reproducible planning and intervention with lesser human error.

The results of this study similar to those reported elsewhere suggested that CBCT guided implant surgery can be regarded as an accurate and safe procedure.[13,17,21] Yet long-term comparisons between radiological accuracy on one hand, and implant survival as well as prosthetic success, on the other are required. Future longitudinal studies should investigate long-term functional outcomes and cost-effectiveness in diverse populations.

CONCLUSION

Cone beam computed tomography-guided implant surgery demonstrates high radiological accuracy and a strong safety profile, supporting its role as an effective and predictable modality for implant placement.

Author's Contribution:

Concept & Design or acquisition of analysis or	Ali Hakiem Tawfieq

interpretation of data:	
Drafting or Revising Critically:	Ali Hakiem Tawfieq
Final Approval of version:	The above author
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Original Article

The Association Between Family Functioning and Intention to Avoid Drug Abuse among Secondary Schools Students in Al-Hilla City, Iraq

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ABSTRACT

Objective: To examine the association between family functioning and the intention to avoid drug abuse among secondary school students.

Study Design: Descriptive correlational study

Place and Duration of Study: This study was conducted at the Babylon Education Directorate, Al Hilla Iraq from 15th October 2024 to 30th June 2025.

Methods: This descriptive correlational study was among 600 secondary school students. Family functioning was measured using a Thai family function scale, while intention to avoid drugs abuse was assessed through Intention to Drug Avoidance Scale.

Results: 70% of students reported high family functioning. The majority of 95.3% demonstrated a high intention to avoid drug abuse. Statistically significant but weak positive correlation was found between family functioning and intention to avoid drug abuse($r = .110$, $p<0.05$).

Conclusion: Most participants reported high levels of family function suggesting strengthening communication, parental involvement, and emotional support within families can contribute to higher preventive behaviors against drug abuse among youth. Statistically significant association was found between family function and intention to avoid drug abuse however, the magnitude of this association was weak.

Key Words: Adolescents, Drug abuse, Family functioning, Intention to avoid drug abuse

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INTRODUCTION

Adolescence is a very critical stage where there is an excessive growth and development in social, psychological and biological aspects. It is also a phase that accompanied with heightened susceptibility to different risky behaviors, such as substance abuse and the ensuing adverse effects. At this age, adolescents are also prone to drug experimentation because of curiosity, need to feel independent, vulnerable to peer pressure, authority disadvantages, and low self-esteem.

Consequently, long-term negative effects of substance abuse in adolescence include have mental disorders, low academic achievement, addiction disorders to substances and high risk of alcohol and marijuana abuse.[1,2]

Drug abuse can be taken to mean the self administration or usage of drugs in a way that is not within the medically or socially accepted norms of a given culture and involves the repetitive consumption of illicit drugs or the misuse of prescribed drugs. Drug abuse is a common phenomenon during the adolescence stage, which is an intermediate stage in an individual that involves puberty, rapid physical growth and psychological transformations. The physiologic and psychological impact of drugs on the maturing adolescence brain makes the risk even more dangerous to substance misuse during this period in life.[3-5]

The intention to stay out of such risky activities especially drug use is one of the most effective psychological influences on the involvement of adolescents in risky behavior. Intent gives a distinct connection between knowledge and real actions, which is a clear willingness of not using drugs and knowing that these are harmful. Theory of planned behavior and the social cognitive theory are some of the behavioral theories believe that intention is a determining factor of behavior and is influenced by both external and internal factors.[6,7]

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Family functioning is among the external factors that affect the intentions and behaviors of adolescents. Family functioning is the capacity of the family to remain stable, to adjust to change of life, to settle conflicts, to ensure emotional attachments, effective discipline, respecting of individual boundaries, and observance of collective values and norm.[8] It has been established that a healthy family environment with warm and supporting conditions, healthy communication, and parental involvement can decrease the involvement of adolescents in smoking and substance use. The family leisure time and the development of a coherent environment at home can greatly reduce the risks of substance abuse among adolescents and later in life.[9]

Families can be defined as one of the essential elements of drug prevention programs as they have a powerful impact on the personality, attitudes, and choice of behavior among adolescents. Family members can assist adolescents to learn the skills of self-regulation, peer pressure resistance, and positive health behavior, through guidance, emotional support, and problem-solving support. Proper functioning of the family has been linked to the increased intentions of adolescents to never use drugs and to participate in protective behaviour.[10]

Although it is established that family functioning is important in determining the behavioral intentions of adolescents, the relationship between family functioning and the intention to avoid drug abuse among secondary school students has not been done especially in the Iraqi context. Thus, the current study is meant to explore the relationship between family functioning and the intention to abstain drugs in adolescents among secondary school students.

METHODS

This descriptive correlational study was carried out at Babylon Education Directorate, Al Hilla Iraq from 15th October 2024 to 30th June 2025 vide letter No. 3434/QM/Approval/EFEF3 dated October 2, 2024 among 600 secondary school students who were sampled through multistage non-probability sample. Students in the fourth and fifth grade were selected because they represent a critical developmental stage of mid-to-late adolescence, during which intentions and attitudes toward risk behaviors such as drug abuse become more clearly formed and willing to participate were included. Students with cognitive or communication difficulties that could affect questionnaire completion were excluded.

The study instruments for data collection were structured, self-administered questionnaire designed to comprehensively explore the research variables and gather relevant information. The instruments were put in Iraqi Arabic language through a forward-back translation technique. A panel of experts in the fields of community health nursing and psychology reviewed the translated version to make sure that it has cultural relevance and clarity. The questionnaire consisted of three main sections:

Demographic characteristics form consist of sociodemographic variable for the students and their family such as (age, sex, educational grade and family economic status) and for family (father educational level, mother educational level, and parental marital status).

Family functioning domain assessed the level of family function measured by using Thai Family Function Scale (TFFS) it composed of 30 items and divided in sub-domain Communication (1) Problem solving include 8 items statements and (2) Cohesion include 13 items statement

Based on a three-point Likert scale (3=Always, 2=Sometime, 1=Never). In order to make sure that the higher total score, indicating high level of family function. The scores of the Family Functioning Scale (TFFS) are categorized into three levels using the equal interval method. The total possible score range (30 to 90) is divided into three equal intervals (Low=30-50, Moderate=50.1-70, High=70.1-90).

Intention to avoid drugs abuse domain to evaluate the participants intention to avoidance drug abuse in secondary schools students by used Intention to Drug Avoidance Scale [IDAS], consists of 22 item, and divided into 2 factors: (1) desire and commitment to avoid drugs: consist of 15 Items and (2) readiness to avoid drugs consist of 7 items

Based on a three-point Likert scale: (1=True, 2=Sometimes true, 3=Not true). In order to make sure that the higher total score, indicating high level of intention to avoid drug abuse. The scores of the Intention to Drug Avoidance Scale are categorized into three levels using the equal interval method. The total possible score range (22-66) is divided into three equal intervals (Low=22-36.66, Moderate=36.67-51.33, High=51.34-66).

The internal consistency method was used to determine the reliability of questionnaire in current study; internal consistency reliability measures the consistency between different items of the instrument. The internal consistency between items was determined by using Cronbach`s alpha coefficient. Cronbach's alpha was 0.84 for the family function scale and 0.87 for the Intention to Avoid Drug Abuse Scale).

In the study tool dispensation, the uniform instructions on the study objective and how the questionnaire should be filled. Given the sensitive nature of drug-related questions, participants were informed that the questionnaire was administered solely for research purposes and that all responses would be treated with strict confidentiality. No names or identifying information were collected, which helped encourage honest responses. Data were analyzed using SPSS-26.0.

Spearman's rank correlation coeffcient was used to examine the association between family functioning and students' intention to avoid drug abuse.

RESULTS

Majority of students are between 15 and 17 years old with mean age was 16±1 years and female student's more than male student. The sample is composed of students from a greater proportion in the fifth grade. The highest proportion of the students was considered their family's financial situation as sufficient (Table 1).

Table No. 1: Distribution of secondary school students according to their sociodemographics (n=600)

Variable	No.	%
Age (years)		
15 – 17	456	76.0
18 – 20	144	24.0
Gender		
Male	274	45.7
Female	326	54.3
Education grade		
Fourth	250	41.7
Fifth	350	58.3
Family economic status		
Sufficient	350	58
Sufficient to some extent	198	33
Insufficient	52	8.7

Table No. 2: Distribution of secondary schools students according to their parents' sociodemographics (n=600)

Variable	No.	%
Father's education		
Un able to read & write	16	2.7
Read & write	124	20.7
Primary school	162	27
Secondary school	164	27.3
Diploma/Bachelor and above	134	22.3
Mother's education		
Un able read & write	50	8.3
Read & write	204	34
Primary school	136	22.7
Secondary school	106	17.7
Diploma/Bachelor and above	104	17.3
Parental marital status		
Living together	520	86.7
Separated	14	2.3
Divorced	32	5.3
Deceased father or mother	34	5.7

The major proportion of student fathers holds either a primary or secondary school education. While mother's education levels show the largest segment of mothers can read and write without formal education. Regarding parental marital status most of students were living with together parents (Table 2).

Table 3 exhibits that the majority of students reported high intention to avoid drug abuse indicating a generally strong and consistent tendency among students to resist drug use. More of students reported high family functioning level (Table 4).

A statistically significant but weak positive correlation was observed between these findings suggest that better family functioning are associated with a stronger intention to avoid drug use among students (Table 5).

Table No. 3: Overall assessment of intention to avoid drug abuse among secondary schools students

Intention to avoid drug abuse	No. (%)	Mean±SD	Assess-ment
Low	10 (1.7%)	62.66±6.31	High intention
Moderate	18 (3.0%)		
High	572 (95.3%)		

Table No. 4: Overall assessment of family functioning among secondary schools students

Family functioning	No. (%)	Mean± SD	Assess-ment
Low	16 (2.7%)	77.83±9.35	High family functioning
Moderate	164 (27.3%)		
High	420 (70%)		

Table No. 5: Correlation among family functioning, and intention to avoid drug abuse among secondary schools students

Spearman's rho		FFn	InADA
Family Functioning (FFn)	Correlation coefficient	1.000	.110
	Sig. (2-tailed)	.	.058
Intention to avoid drugs abuse (InADA)	Correlation coefficient	.110*	1.000
	Sig. (2-tailed)	.048	.

DISCUSSION

The demographic characteristics of the study students showed that as three quarters are aged between 15-17 years which is consistent with the typical age range for secondary school education. This finding align with study in Nigeria that founded more than half 54.6% of the participants were between aged 14-16 years.[11] The current study revealed a more than half representation of females participants 54.3%, this finding align with study conducted in Jordan and deals with high-school students and drug addiction, their findings presented that greater than fifty of the study samples, constituted 52.2% were female.[12] While contrast with another study which reported a higher proportion of participants(52%)

were male.[13] Concerning educational grades the sample greater proportion more than half in the fifth grade. These findings are align with study Ahmad et al[14] that indicated more than two thirds of participants reflecting senior secondary school. The findings show that the family economic status, more than half proportion 58% of the students consider their family's financial situation as sufficient. The result consisted with the study conducted in Karbala City in Iraq, which revealed that more than half 55% sufficient economic status.[15] Regarding father's education current study offered a relatively balanced distribution is observed across different educational levels. A majority of fathers hold either a primary 27% or secondary school education 27.3%, this finding inconsistent with another study that founded largest proportion of fathers were high education[16] while mother's education levels in this study show a higher prevalence of lower educational attainment. The One third of mothers 34% can read and write without formal education. This result disagrees with study conducted by Ajibola et al[16] that demonstrated that more than half of mother have secondary school. Majority of students about status parental marital, living with families where both parents are living together, this result go in line with the study that conducted in Norwegian, showed that the three quarter of adolescents living with both parents.[17,18]

In the current study, the percentage of students with high level of intention to drug avoidance is the biggest 95.3%. The result is in line with research in Pinlaung Township, that identified that most adolescents reported high predisposition to avoid drug abuse.[13] This finding is also similar to the one in Saudi Arabia where high percentage 71.7% of intermediate and secondary students intended to quit smoking.[19]

According to the results of this research, over two thirds 70% of secondary school students stated that the level of family functioning was high. These findings follow suit with the research study carried out among the high school students in Iran, which reveals that mean family function was high.[20] In addition, this finding is consistent with the results of Dundar & Kaplan[21] who reported that high quality of family relationships existed between teenagers and their parents. This study share similarity in various contexts which implies that strong family functioning is perceived by adolescents in a similar pattern.

This study given determined that family functioning had a significant statistical association with the intent of adolescents to avoid drug abuse. The strength of this association was however weak, which indicates that although family processes might have some influence on the intentions of adolescents, peer influence, personal characteristics of an individual, and surrounding conditions may have an important role in the behavior of adolescents. This highlights the need for a more comprehensive approach when examining the factors that influence adolescents' decision-making regarding drug use. This research is consistent with, Silva et al, stated that the disorganized family dynamics and the inability of parents to monitor their offspring was found to be strongly linked to the increased risk of substance use in adolescents, this research highlights that the functioning of the family is a key factor that defines the behavioral outcomes of teenagers, as supportive family environments, as well as structured and cohesive ones, help to minimize the risk of substance use, but dysfunctional family dynamics may lead to the increase of susceptibility to drug abuse.[22]

It is recommended to implement programs aimed at enhancing family functioning, particularly in communication, emotional support, and parental involvement, as these factors play a important role in shaping teenagers intentions to avoid drug abuse. Additionally, further research should be conducted to explore other factors influencing adolescent behavior, and schools, along with community organizations, should collaborate to raise awareness about the importance of a healthy family environment in preventing drug misuse

CONCLUSION

Most students were highly intending to avoid drug abuse and most of them reported high family functioning. It was also found that there was a positive correlation of a high level between intention to avoid drug abuse and family functioning.

Author's Contribution:

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Drafting or Revising Critically:	Rawaa Talib Sekeb, Salma Kadhim Jihad
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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Original Article

Molecular Signatures of Bisphenol A Mediated Sperm Dysfunction and the Mitigating Role of Ashwagandha in an Experimental Model

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ABSTRACT

Objective: To evaluated the effects of chronic Bisphenol A exposure and the protective role of Withania Somnifera (Ashwagandha).

Study Design: Experimental study

Place and Duration of Study: This study was conducted at the Jabir Ibn Hayyan University for Medical & Pharmaceutical Sciences, Najaf, Iraq from 1st January 2026 to 31st March 2026.

Methods: The forty adult male Wistar rats was divided into four groups included control, Bisphenol A (50 mg/kg/day, intraperitoneally), Ashwagandha (300 mg/kg/day, orally), and Bisphenol A + Ashwagandha for 60 days. At the end of study sperm parameters, DNA fragmentation, and testicular expression of Ahr, Adgb, Arl2bp, Dnali1, Qrich2, and Cfap157was assessed

Results: The Bisphenol A reduced significantly in sperm motility, morphology, concentration, and viability, increased DNA fragmentation, and down regulated spermatogenesis that related genes while the Ashwagandha markedly improved sperm quality, which reduced DNA damage, and restored gene expression toward normal levels.

Conclusion: Ashwagandha protects against Bisphenol A induced sperm dysfunction by reducing oxidative/genotoxic stress and supporting transcriptional pathways essential for spermatogenesis.

Key Words: Bisphenol A, Ashwagandha, Sperm motility, Gene expression, Oxidative stress, Aryl hydrocarbon receptor

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INTRODUCTION

The Bisphenol A (BPA) is a widely used in polycarbonate plastics and epoxy resins and is well recognized as an endocrine disruptor associated with male reproductive toxicity moreover the previous studies illustrated that BPA causes disrupts in the hypothalamic pituitary gonadal axis, steroidogenesis, and testicular redox balance, that sequentially leading to destroy the spermatogenesis and reduced sperm fertilizing capacity.[1] Furthermore, exposure to BPA lead to hormonal disruption, which that linked to mitochondrial dysfunction, oxidative stress, and epigenetic alterations that disturb spermatogenic processes.[2,3]

At the molecular level, the BPA exposure that disrupted the transcription of genes involved in sperm structure, motility, and flagellar formation which that due to downregulation of Ahr, Adgb, Arl2bp, and Dnali1cause flagellar stability, energy regulation, and intramanchette transport, resulting in sperm tail abnormalities.[4] Similarly, altered expression of Qrich2 and Cfap157, are associated with axonemal organization, and linked to asthenoteratozoospermia and sperm flagellar defects.[5] Oxidative stress represents a central mechanism of BPA-induced reproductive damage, promoting apoptosis, lipid peroxidation, mitochondrial dysfunction, DNA fragmentation, and chromatin instability in spermatozoa.[6]

The BPA also affect male fertility indirectly through gut microbial dysbiosis, which increased lipopolysaccharide translocation, systemic inflammation, and disruption of the gut–testis axis.[7] In addition, transcriptomic and proteomic evidence showed that BPA suppress the INSL3 expression, destroyed the Leydig cell function, and interfere with

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the RNA splicing and meiotic progression, further compromising spermatogenesis.[8]

On other hands the natural antioxidants and adaptogenic phytochemicals have gained attention as protective agents against BPA-induced reproductive toxicity which the previous study showed that Withania Somnifera (Ashwagandha) has demonstrated as antioxidative, androgenic, and anti-apoptotic effects on male fertility.[9] The Antioxidant roles Ashwagandha due to its bioactive constituents, which including with anolides and sitoindosides, may enhance antioxidant enzyme activity, reduce oxidative injury, preserve seminiferous epithelial integrity, support Leydig cell function, and improve sperm quality.[10]

Thus the present study aimed to evolution the functional and molecular alterations that induced by BPA exposure in adult male rats and to evaluate the protective efficacy of Ashwagandha supplementation which focused on sperm motility, morphology, viability, chromatin integrity, and the expression of fertility-related genes, including Adgb, Arl2bp, Dnali1, Qrich2, Cfap157, and Ahr.

METHODS

This experimental study was conducted at Jabir Ibn Hayyan University for Medical & Pharmaceutical Sciences, Najaf, Iraq from 1st January 2026 to 31st March 2026 vide letter No. 1007A/JBU/Approval/ JSDJNEHU dated December 25, 2025. A total of forty healthy, sexually mature male Rattusnorvegicus (Wistar strain), weighing 180–220 g, were procured from a certified animal facility (Abugrab Animal House, Baghdad, Iraq) and the animals were acclimatized for two weeks under standard laboratory conditions with ad libitum access to standard pellet diet and filtered water.

The present study was conducted to elucidate the molecular and functional alterations in sperm quality induced by BPAss and to evaluate the potential protective effects of Ashwagandha in adult male Wistar rats. The animals were randomly divided into four equal groups (n=10 each) and treated orally for 60 consecutive days as follows: Group I, the control (C) received vehicle only (corn oil), Group II (BPA) received Bisphenol A intraperitoneally at a dose of 50 mg/kg body weight/day.[11] Group III (ASH) received Ashwagandha extract orally at a dose of 300 mg/kg body weight/day[12], and Group IV (BPA + ASH) received a combination of BPA intraperitoneally at a dose of 50 mg/kg and Ashwagandha orally at a dose of 300 mg/kg concurrently.[12]

To prepare the BPA solution, the amount of BPA was weighed and dissolved normally to dose at 50 mg/kg body weight. The prepared BPA solution was stored in an amber container at room temperature until administration via intraperitoneally injection. Ashwagandha (Withania somnifera) root powder was obtained from Sigma-Aldrich (St. Louis, MO, USA; Catalog No. USP 1043309; CAS No.: 90147-43-6; EC No.: 290-434-9). The product, listed as Ashwagandha Root Powde, was derived from authenticated plant roots and standardized according to the manufacturer's specifications. The material was stored in airtight containers at room temperature, protected from light and moisture, and handled in accordance with the supplier's recommendations until use in the experiment. They were euthanized at the end of experimental at the 60-day experimental period by intramuscular overdose with a mixture of Xylazine (Micopite, USA; 40 mg/kg) and Ketamine (Alpha Than, Netherlands; 90 mg/kg). Blood samples (approx 5 mL) once again collected through cardiac-puncture, scrotal area properly washed with sterile normal saline followed by removal of bilateral testis and epididymal tissues.[13] The epididymal tail was incubated with 2 mL normal saline at 37°C followed by anatomical micro-scissors to segment the tissue and extract spermatozoa for further analysis including an assessment of motility, concentration, morphology, and DNA Integrity according to protocol already standardized in the investigation.

Sperm motility, morphology, viability, concentration, and DNA fragmentation were assessed using standard microscopic methods. Eosin–Nigrosin staining was used to evaluate sperm morphology and viability, while Acridine Orange staining was used to assess sperm chromatin integrity. Progressive motility was examined under a light microscope at 400× magnification using a pre-warmed slide. For morphology and viability, sperm smears were prepared with Eosin–Nigrosin stain and examined microscopically, where stained spermatozoa were considered non-viable or abnormal. Sperm concentration was determined after dilution of the epididymal sperm suspension according to the method of Smith and Mayer.[13]

For DNA fragmentation assessment, sperm smears were fixed in methanol:glacial acetic acid solution (3:1), stained with Acridine Orange, and examined under a fluorescence microscope.[14] Sperm heads showing green fluorescence were considered to have intact and condensed DNA, whereas orange to red fluorescence indicated denatured or fragmented DNA and impaired chromatin integrity.[13]

Molecular Gene Expression Analysis by qPCR: Testicular tissue samples were stored at −80°C until molecular analysis. Total RNA was extracted using TRIzol reagent (Trans®, China; Cat. No. ET101-01), and RNA concentration and purity were assessed spectrophotometrically. cDNA was synthesized using a One-Step RT-PCR Premix Kit (Promega, USA) according to the manufacturer's instructions. Quantitative real-time PCR was performed using GoTaq® qPCR Master Mix and SYBR Green-based detection to assess the relative expression of target genes. Specific primers for Ahr, ADGB, ARL2BP, DNALI1, QRICH2, CFAP157, and Gapdh were

designed based on NCBI GenBank sequences and synthesized by Integrated DNA Technologies, Inc. (IDT, USA). Relative mRNA expression was normalized to Gapdh, and primer sequences with accession numbers (Table 1). Data were analyzed by SPSS-26. The normality of data distribution was verified using the Shapiro-Wilk test and mixed-model two-way analysis of variance (ANOVA) was employed to assess the differences among treatment groups. Differences were considered statistically significant at $P < 0.05$.

RESULTS

The adverse effects of BPA exposure and the protective influence of Withania somnifera (Ashwagandha) root extract on sperm quality and testicular gene expression in adult male rats. BPA exposure caused a highly significant reduction in progressive sperm motility 52.8% compared with the control group 81.5% (P<0.0001). In contrast, Ashwagandha alone maintained sperm motility at a high level (85.7%), while co-administration of BPA with Ashwagandha markedly restored motility (81.1%) to values comparable with the control group (P>0.05) (Fig. 1). Regarding sperm morphology, Figure 3 showed that BPA significantly reduced the percentage of morphologically normal spermatozoa (80.0%) compared with the control group (97.8%) [P<0.0001]. However, rats treated with Ashwagandha alone showed normal sperm morphology (98.21%) comparable to the control group. Similarly, the BPA+ASH group showed a marked improvement in sperm morphology (98.16%) compared with the BPA group (P<0.0001), with no significant difference from the control group (P>0.05).

Figure 2 showed the epididymal sperm concentration was significantly decreased in the BPA-treated group (4.21×10^8 sperm/g) compared with the control group (8.96×10^8 sperm/g) (P<0.0001), indicating impaired spermatogenesis and reduced sperm production. Conversely, Ashwagandha treatment increased sperm concentration in the ASH group (9.24×10^8 sperm/g) and restored it in the BPA+ASH group (8.65×10^8 sperm/g), with both groups showing values comparable to the control group (P>0.05).

Sperm viability was presented in the Figure 3 showed BPA exposure significantly reduced the percentage of live spermatozoa (61.1%) compared with the control group (83.5%) (P<0.0001) in while the Ashwagandha alone increased sperm viability to 86.6%, which co-treatment with BPA and Ashwagandha restored

Table No. 1: Primers obtained from the National Center for Biotechnology Information (NCBI) platform

Gene		Primer	NCBI Accession No.
	Direction	5′ → 3′	
Ahr v1	Forward	GTCAGCCATGGTCAGTCCTCAG	NM_013149.3
	Reverse	GCTCGGACTCTGAAACTTGCT	
ADGB	Forward	GCCTCAGGCATGACTTCCAA	NM_001432028.1
	Reverse	ACCAGGTGGCACATTGTCTT	
ARL2BP	Forward	TTCGCGCTGTCCTTAAAACAC	NM_001024906.2
	Reverse	GCAGAGGAGCTGAAAACACAT	
DNALI1	Forward	TCAGCAACTGAAGGCCCAAC	NM_001031647.1
	Reverse	CATGACACGGGGACAACAGT	
QRICH2	Forward	CAGCCTGACCAAGATCACCG	NM_001416895.1
	Reverse	TCCAGGTATTCGTCTCGGCT	
CFAP157	Forward	GCCTATCCAAAGACAGCCGA	NM_001100869.1
	Reverse	GGTGGGATGTGGACCTGAAG	
Gapdh	Forward	ATGAAGGGGTCGTTGATGGC	NM_017008.4
	Reverse	AGAGACAGCCGCATCTTCTT	

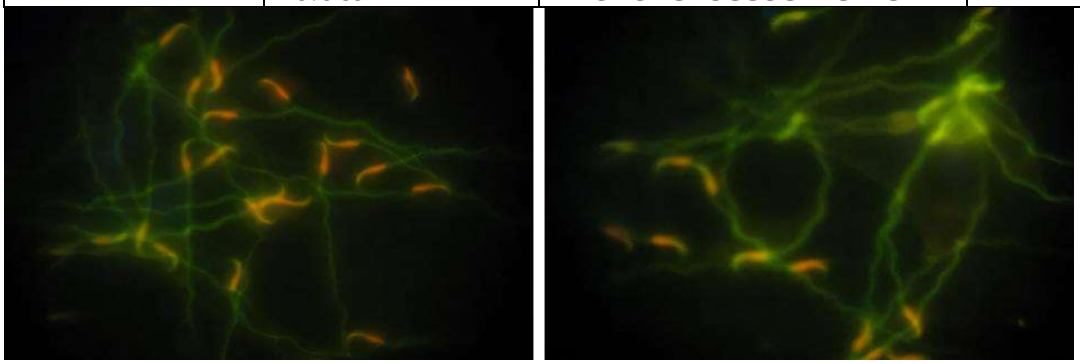

Figure No. 1: Fluorescence micrograph of spermatozoa stained with Acridine Orange showing green fluorescence in sperm with intact double-stranded DNA and orange fluorescence in sperm with fragmented DNA

viability to 84.0%, showing significant improvement compared with BPA alone and no significant difference from the control group (P>0.05).

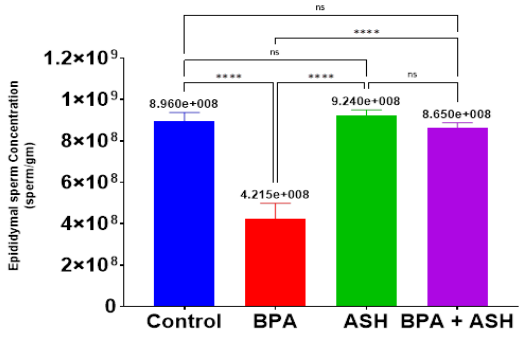

Figure No. 2: Effect of Bisphenol A and Ashwagandha on Epididymal Sperm Concentration (sperm/gm)

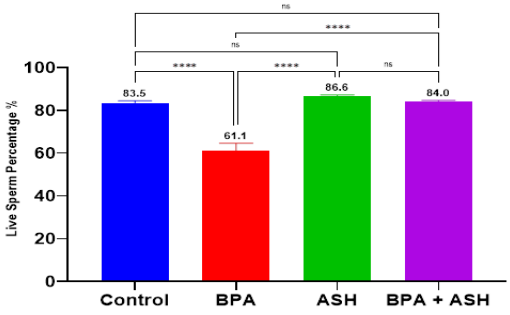

Figure No. 3: Effect of Bisphenol A and Ashwagandha on Sperm Viability (%)

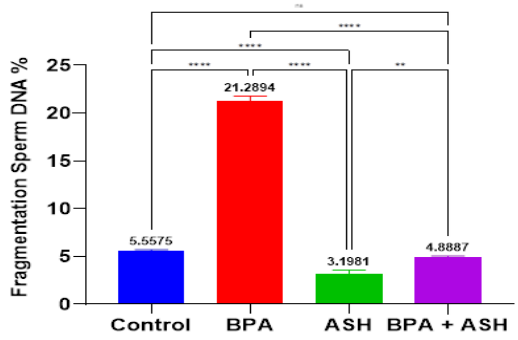

Figure No. 4: Effect of Bisphenol A and Ashwagandha on Sperm DNA Fragmentation (%)

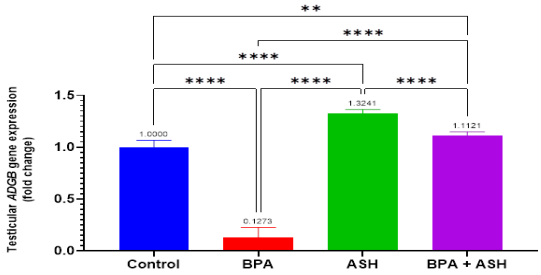

Figure No. 5: Effect of Bisphenol A and Ashwagandha on Testicular ADGB Gene Expression

Figure 4 demonstrated that BPA significantly increased sperm DNA fragmentation (21.29%) compared with the control group (5.56%) (P<0.0001), indicating marked genotoxic stress and compromised sperm chromatin integrity. In contrast, Ashwagandha alone reduced DNA fragmentation to 3.20%, while the BPA+ASH group showed a marked reduction to 4.89%, restoring DNA integrity to levels statistically comparable with the control group (P>0.05).

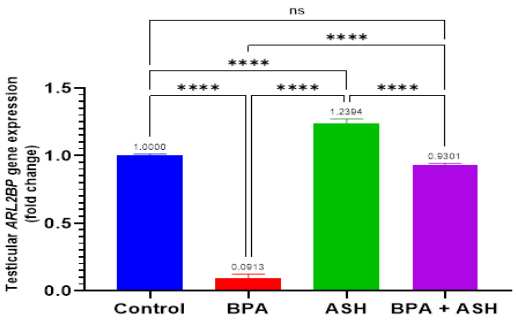

Figure No. 6: Effect of Bisphenol A and Ashwagandha on Testicular ARL2BP Gene Expression

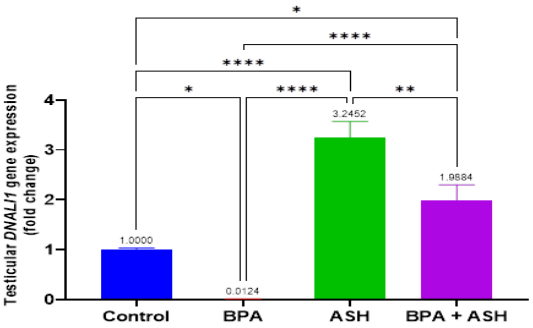

Figure No. 7: Effect of Bisphenol A and Ashwagandha on Testicular DNALI1 Gene Expression

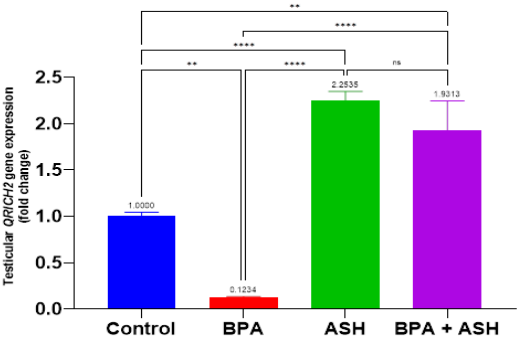

Figure No. 8: Effect of Bisphenol A and Ashwagandha on Testicular QRICH2 Gene Expression

At the molecular level, BPA exposure significantly downregulated genes associated with spermatogenesis, flagellar structure, and sperm motility. ADGB expression was markedly reduced in the BPA group (0.1273-fold) compared with the control group (1.0000-fold) (P<0.0001). Ashwagandha alone significantly upregulated ADGB expression (1.3241-fold), while BPA+ASH restored its expression to 1.1121-fold, with values comparable to the control group (Fig. 5).

Similarly, Figure 6 showed that ARL2BP expression was significantly suppressed in the BPA group (0.0913-fold) compared with the control group (P<0.0001). Ashwagandha alone increased ARL2BP expression to 1.2394-fold, whereas co-treatment with BPA and

Ashwagandha restored its expression to 0.9301-fold, with no significant difference from the control group (P>0.05).

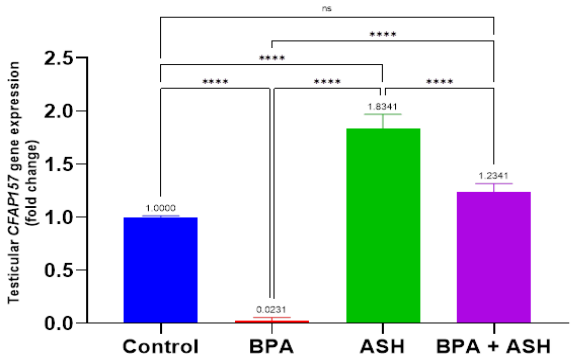

Figure No. 9: Effect of Bisphenol A and Ashwagandha on Testicular CFAP157 Gene Expression

The BPA exposure caused a profound reduction in DNALI1 expression (0.0124-fold) compared with the control group (1.0000-fold) (P<0.0001). Treatment with Ashwagandha alone markedly increased DNALI1 expression (3.2452-fold), while BPA+ASH significantly restored expression to 1.9884-fold compared with BPA alone (P<0.0001), partially exceeding the control level (Fig. 7).The expression of QRICH2 was also significantly affected by BPA exposure. The BPA group showed a marked reduction in QRICH2 expression (0.1234-fold) compared with the control group (1.0000-fold) (P<0.0001). Ashwagandha alone increased QRICH2 expression to 2.2535-fold, while BPA+ASH restored expression to 1.9313-fold, remaining statistically comparable with the control group (P>0.05) [Fig. 8].

Finally, BPA significantly down regulated CFAP157 expression (0.0231-fold) compared with the control group (1.0000-fold) (P<0.0001). Ashwagandha alone significantly increased CFAP157 expression (1.8341-fold), and co-administration of BPA with Ashwagandha restored expression to 1.2341-fold, indicating a protective effect against BPA-induced disruption of genes involved in flagellar assembly and sperm motility (Fig. 9).

DISCUSSION

These alterations indicate that BPA induces both cytotoxic and genotoxic damage to spermatozoa, most likely through oxidative stress, mitochondrial dysfunction, and endocrine disruption. The observed increase in DNA fragmentation suggests impaired sperm chromatin remodeling during spermiogenesis, as BPA has been reported to disturb histone-protamine replacement, increase histone H3 acetylation, and alter DNA methylation patterns, thereby weakening chromatin compaction and increasing susceptibility to oxidative DNA damage.[15] Similar associations between BPA exposure and sperm DNA fragmentation have also been reported in human studies, supporting the genotoxic effect observed in the present rat model.[16]

Ashwagandha supplementation significantly ameliorated BPA-induced reproductive damage by improving sperm motility, morphology, viability, and concentration, while reducing DNA fragmentation. These protective effects may be attributed to the bioactive constituents of Withania somnifera, particularly with anolides and sitoindosides, which possess antioxidant, anti-inflammatory, and mitochondrial-stabilizing properties.[12] By enhancing endogenous antioxidant defenses and preserving sperm membrane and mitochondrial integrity, Ashwagandha may reduce lipid peroxidation and ROS-mediated chromatin damage. The reduction in DNA fragmentation in the BPA+ASH group suggests that Ashwagandha may preserve chromatin condensation and protect sperm DNA from oxidative injury, similar to the protective effects reported for other natural antioxidants against BPA-induced reproductive toxicity.[17]

At the molecular level, BPA exposure caused marked downregulation of genes involved in spermatogenesis, sperm motility, and flagellar structure. BPA-induced suppression of Ahr suggests disruption of aryl hydrocarbon receptor signaling, which plays an important role in xenobiotic metabolism, redox regulation, and testicular homeostasis. BPA may disturb AHR-related pathways and promote oxidative stress through activation of detoxification enzymes such as CYP1A1 and CYP1B1, thereby increasing ROS production within testicular tissue.[1] The restoration of Ahr expression in the BPA+ASH group indicates that Ashwagandha may protect AHR signaling by reducing oxidative and inflammatory stress, possibly through modulation of NF-κB, MAPK, and antioxidant-related pathways.[7]

The down-regulation of ADGB, ARL2BP, DNALI1, QRICH2, and CFAP157 in BPA-treated rats provides molecular evidence for impaired sperm tail formation, axonemal organization, and flagellar motility. ADGB is associated with male fertility, ciliogenesis, and flagellar development, and its suppression may compromise sperm tail formation and motility.[17] Similarly, ARL2BP contributes to microtubule organization and flagellar stability, while DNALI1 encodes a dynein axonemal component essential for flagellar bending and sperm motility.[13] The profound reduction of DNALI1 observed after BPA exposure may therefore explain the marked decline in sperm motility. In contrast, Ashwagandha restored or upregulated these genes, suggesting improved mitochondrial activity, ATP availability, and cytoskeletal organization, which are essential for sperm movement and structural integrity.[17]

CONCLUSION

The extended exposure to bisphenol A induces substantial reproductive harm in male rats. This toxicity is seen by diminished sperm motility, morphology, and viability, and heightened DNA fragmentation inside the reproductive system. The adverse effects are associated with the downregulation of transcription of critical

spermatogenic and structural genes, including Ahr, ADGB, ARL2BP, DNALI1, QRICH2, and CFAP157. These genes together regulate the formation of flagellar structures, the functionality of mitochondria, and the stability of chromatin. The modifications were substantially mitigated by the addition of Ashwagandha. This was achieved by reinstating antioxidant defense, preserving redox homeostasis, and upregulating genes associated with sperm motility and fertility. Ashwagandha has significant protective and restorative effects on testicular function.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Aaya Hamid Al-Hakeem, Hadeel Haider Aldujaili
Drafting or Revising Critically:	Noor Zuhair Bakheet, Aiman Mohammed Baqir Al-Dhalimy
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

Conflict of Interest: The study has no conflict of interest to declare by any author.

Source of Funding: None

Ethical Approval: No. 1007A/JBU/Approval/ JSDJNEHU Dated 25.12.2025

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Original Article

Neurological Complications and Clinical Outcomes of Bacterial Meningitis: A Cross-Sectional Study from Dhi-Qar, Iraq

Hazim Ali Marah

ABSTRACT

Objective: To evaluate the prevalence and the type of neurological complications in patients who had bacterial meningitis.

Study Design: Cross-sectional study

Place and Duration of Study: This study was conducted at the Al-Turky hospital in Dhi-Qar, Iraq from 15th March 2025 31st August 2025.

Methods: Fifty three patients who diagnosed with bacterial meningitis were enrolled. The demographic characteristics, clinical presentation and neurological complications were gathered and analyzed.

Results: The males (54.7%) were more numerous than females (45.3%). The largest age group was 10–20 years (41.5%). Forty-two (79.3%) patients had neurological sequel; while 11 (20.7%) patients were neurologically normal. Seizures, altered mental status, hearing impairment, focal neurological deficits, and cerebrovascular complications were the most common complications observed. The elderly age was the least represented and neurological complications occurred in all age groups.

Conclusion: Neurological complications are very common in patients with bacterial meningitis and play an important role in the poor outcome. Rapid diagnosis and early initiation of antimicrobial treatment and close neurological monitoring is crucial to limit morbidity and optimize prognosis.

Key Words: Bacterial meningitis, Neurological complications, Seizures, Cerebrovascular complications, Hearing loss

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INTRODUCTION

Bacterial meningitis is a potentially severe infection of the central nervous system (CNS) involving the inflammation of the meninges and cerebrospinal fluid (CSF). Despite recent advances in antibiotic therapy, intensive care unit (ICU) management and vaccination programmes, bacterial meningitis continues to be a major cause of morbidity and mortality globally, and a major contributor to long-term neurological disability.[1,2] Poor clinical outcome could also be linked to delayed diagnosis and poor health care in developing countries, adding to the significance of the disease burden.

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Pathogenic microorganisms enter the subarachnoid space by hematogenous dissemination or from contiguous spread from other infectious processes, like sinusitis, otitis media, mastoiditis or head trauma.[4]

In the CSF, bacterial proliferation causes a high inflammatory response that involves infiltration of leukocytes, production of cytokines, disruption of the blood brain barrier, cerebral oedema and changes in cerebral blood flow.[6] These pathological events directly involve in causing neuronal damage and neurological dysfunction.The most common community-acquired bacterial meningitis pathogens are Streptococcus pneumoniae, Neisseria meningitidis, Haemophilus influenzae and Listeria monocytogenes.[1,3] Pneumococcal meningitis is the most likely to cause complications and poor outcomes in adults, because of its inflammatory reaction and ability to cause vascular damage.[8] Neurological involvement can happen in the acute stages of the infection or may be delayed following resolution of clinical illness. Neurological sequelae have been linked to a number of clinical parameters, such as hypoalbuminemia, severe systemic inflammation, seizures, hypotension, advanced age and delayed antibiotic treatment.[5] Ischemic stroke, cerebral infarction, vasculitis, vasospasm, and thrombosis are among the most serious complications, referred to as

cerebrovascular complications.[5,7] In some cases, delayed cerebral thrombosis has also occurred after apparent recovery, and is linked to poor prognosis.[9,10]

Another frequent complication is hearing loss, especially in those who have pneumococcal meningitis. The inflammatory process can extend into the cochlea and vestibulocochlear nerve causing permanent sensorineural hearing loss.[14-17] It has been shown in previous studies that starting adjunctive corticosteroid therapy early (before 12 years of age) will decrease the occurrence of hearing loss and neurological complications.[18]

Other important neurological features include hydrocephalus, seizures, altered mental status, elevated ICP and focal neurological deficits.[19-24] Moreover, survivors can suffer from long-term cognitive dysfunction, memory loss, decreased attention span, and diminished quality of life.[25]

Prompt diagnosis and treatment are still critical to minimizing neurological damage due to bacterial meningitis. Thus, the present study was designed to evaluate the prevalence and spectrum of neurological complications of bacterial meningitis patients admitted to Al-Turky hospital, Dhi-Qar Province, Iraq in addition to determining their clinical effect.

METHODS

This cross-sectional study was conducted in Al-Turky hospital in Dhi-Qar, Iraq from 15th March 2025 31st August 2025 vide letter No.335/QM/Approval/SFHP Dated March 1, 2025. Fifty three patients who diagnosed with bacterial meningitis were enrolled. The patients with bacterial meningitis if they had one or more neurological signs or symptoms (seizures, decreased hearing, mental status changes, visual abnormalities, weakness of the limbs, or psychiatric abnormalities) were included. If the patient was diagnosed with viral meningitis, fungal meningitis, parasitic meningitis or if medical records were incomplete were excluded. The data were collected as age, sex, clinical presentation and neurological sequelae of bacterial meningitis. Neurological complications were diagnosed based on clinical assessment, neurological examination and available radiological and laboratory investigations. The data was entered and analyzed with the SPSS-26.

RESULTS

There were 24 (45.3%) female sand 29 (54.7%) male patients with an absolute predominance of female patients. The maximum number of patients were found to be in the age group of 10-20 years, which made up 22 cases (41.5%). This was followed by the age group 21–30 which had a 10 patients (18.9%) distribution. Eight cases (15.2%) were in the age group 31 to 40 and 51 years and above (Table 1). The least proportion of cases was seen in age group 41-50 years (5 patients, 9.4%).These results show that in the current study population, younger patients were more likely to have bacterial meningitis (Table 1).

Concerning the clinical outcomes, neurological complications were seen in 42 (79.3%) patients of the cases. Alternatively, of those patients who recovered, there were no neurological complications in 11 (20.7%) patients. In comparison, there were slightly more females than males among patients with no neurological complications [6 (11.3%) females vs. 5 (9.4%) males). On the other hand, males had 24 (45.3%) patients of neurological complications, while females had 18 (34%) patients. The neurologic complications were very common in bacterial meningitis and had a higher incidence in male patients than female patients (Table 2).

Table No. 1: Demographic information of the patients (n = 53)

Variable	No.	%
Gender		
Male	29	54.7
Female	24	45.3
Age (Years)		
10–20	22	41.5
21–30	10	18.7
31–40	8	15.2
41–50	5	9.4
≥51	8	15.2

Table No. 2: Gender of the patients with bacterial meningitis distribution of neurological complications (n = 53)

Clinical outcome	Male	Female	Total
Without neurological complications	5 (9.4%)	6 (11.3%)	11 (20.7%)
With neurological complications	24 (45.3%)	18 (34.0%)	42 (79.3%)
Total	29 (54.7%)	24 (45.3%)	53 (100%)

The age distribution of the neurological complications showed that a significant number of patients were aged <15 years. The largest group of 11 patients with no complications had ages between 31 and 40 years, followed by the 10–20-year age group, with 3 patients and 2 patients, respectively, recovering without complications, and only 1 patient aged 41-50 years recovering. No patient in the non-complication group was 51 years or older. Among the 42 patients who experienced neurological complications, the 10–20 year age group had the largest number of patients (n=16), followed by the 21-30 year age group (n=9), 51 years and older age group (n=8), and the 31-40 year age group (n=7). In 41-50-year-old patients, only two cases with neurological complications were found. The present results show that neurological complications

were reported in all age groups, but were most often in younger patients and older people (Table 3).

Further evaluation of the kind of neurological complications showed that seizures were the most common complication, occurring in 19 (45.2%) patients. Seizures were seen more often in patients aged 10-20 years, and most of the seizures were recorded in this group of patients. Altered mental status was the second most frequent complication, with 11 (26.2%) patients experiencing. Five (12.0%) patients experienced cerebrovascular accidents (CVA) with the majority of cases being in patients age 41 years or older.4 (9.5%) patients had unilateral weakness, mostly older patients (51 years and older). Two (4.7%) patients having hearing loss was documented, and hallucinations least common neurological complication with only 1 (2.4%) patient. The incidence of neurological complications was analysed by age and sex group, and males were more likely to have seizures, especially in the younger groups. Altered mental status was seen in males and females and of different age groups. The occurrence of cerebral vascular accidents was mainly seen in the elderly and older female patients, while hearing loss was seen only in younger and middle aged adults. Unilateral weakness was most commonly found in the elderly patients, intimating a possible relationship with cerebrovascular involvement. Hallucinations did not occur in the majority of patients and were only reported in one man aged 31-40 years. In all, seizures and altered mental status were common neurological complications and more than two-third of all the neurological complications were observed in this study, which is why they are very important neurological complications of bacterial meningitis (Table 4).

Table No. 3: The distribution of patients with and without neurological complications by age group and gender (n = 53)

Clinical Outcome	10–20 Years	21–30 Years	31–40 Years	41–50 Years	≥51 Years	Total
Without neurological complications	M=1, F=2	M=1, F=1	M=3, F=2	M=0, F=1	M=0, F=0	11 (20.7%)
With neurological complications	M=9, F=7	M=6, F=3	M=5, F=2	M=0, F=2	M=4, F=4	42 (79.3%)
Total	19	11	12	3	8	53 (100%)

Table No.4: Distribution of neurological complications among patients with bacterial meningitis by age group and gender (n = 42)

Neurological complication	10–20 Years	21–30 Years	31–40 Years	41–50 Years	≥51 Years	Total
Seizures	M = 8	M = 4	M = 1	M = 0	M = 1	19 (45.2%)
	F = 4	F = 1	F = 0	F = 0	F = 0	
Altered mental status	M = 1	M = 1	M = 3	M = 0	M = 0	11 (26.2%)
	F = 2	F = 2	F = 1	F = 0	F = 1	
Cerebrovascular accident	M = 0	M = 0	M = 0	M = 0	M = 1	5 (12.0%)
	F = 0	F = 0	F = 0	F = 2	F = 2	
Hearing loss	M = 0	M = 1	M = 0	M = 0	M = 0	2 (4.7%)
	F = 0	F = 0	F = 1	F = 0	F = 0	
Weakness	M = 0	M = 0	M = 0	M = 0	M = 2	4 (9.5%)
	F = 1	F = 0	F = 0	F = 0	F = 1	
Hallucinations	M = 0	M = 0	M = 1	M = 0	M = 0	1 (2.4%)
	F = 0	F = 0	F = 0	F = 0	F = 0	

DISCUSSION

Although there have been major strides in antimicrobial treatment and supportive care, bacterial meningitis remains a disease of high neurological morbidity. In the current study, neurological complications were found in 79.3% of the patients, which meant that there was a high burden of disease among the patients with neurological complications. This is similar to other studies which have documented high rates of neurologic sequelae after bacterial meningitis.[1,8]

In the present study, male patients were slightly predominant. This has been reported in other epidemiological studies[1,3] which indicate that both biological susceptibility and environmental factors may play a role in the higher rates in males.

Younger age groups had the highest percentage of patients. This finding is in line with previous research showing that adolescents and young adults continue to

be at risk of bacterial meningitis, especially serogroup Neisseria meningitidis and Streptococcus pneumonia.[1,3] Part of this age distribution may be due to regional demographic characteristics.

The high incidence of neurological symptoms reported in this study is typical of bacterial meningitis, which is a very inflammatory condition. Local inflammatory mediators have been shown to play a role in causing cerebral edema, vascular damage, decreased cerebral blood flow and neuronal injury, all of which have been shown to worsen the chances of neurological dysfunction.[4,6]

One of the most severe complications of bacterial meningitis is cerebrovascular. The relationship between cerebral infarction and poor neurological outcomes and a high mortality rate has already been demonstrated in previous studies.[5,7,11] Mechanisms include vasculitis, thrombosis, vasospasm, endothelial damage and disturbances in cerebral autoregulation.[12,13] It is important to maintain neurological monitoring throughout the acute phase of infection and post-clinical recovery, due to these complications.

Hearing loss is also one of the most frequent chronic complications of survival. Inflammatory injury to the cochlea and auditory pathways as such is shown in several studies to cause permanent sensorineural hearing loss.[14-17] This positive impact of adjunctive corticosteroid treatment that has been previously reported further highlights the need for early treatment strategies to limit neurological injury.[18]

Another significant neurological symptom is seizures and these are usually indicative of a more serious disease. They have been linked to higher death rate and worse functional outcomes.[23] Furthermore, those who have seizures in the acute stage may be at higher risk for developing chronic epilepsy after recovery.

Impaired circulation of CSF (secondary to meningeal inflammation) is a known complication of hydrocephalus. Hydrocephalus has been previously reported to be associated with prolonged hospital stays, higher mortality, and poor neurological outcomes, especially in those who undergo neurosurgical treatment.[20-22]

Another important long-term concern among bacterial meningitis survivors is with cognitive impairment. Several studies have reported persistent memory, attention, psychomotor and executive functioning deficits that might impact educational, occupational, and social functioning.[24]

The results of the present study show the persistent burden of bacterial meningitis and its neurological effects in Iraq. Early diagnosis, early initiation of antimicrobial treatment and careful neurological assessment continue to be key to minimising morbidity and patient outcomes. More multicenter studies with larger numbers of patients are suggested to define risk factors and long-term neurological consequences of bacterial meningitis in Iraqi patients.

CONCLUSION

Neurological complications are common and are an important source of morbidity in patients with bacterial meningitis. In this article, around 79.3% of patients suffered from one or more neurologic complications. Patients in the younger age groups were the most numerous, and males were affected slightly more frequently than females. A timely diagnosis, early and timely antimicrobial treatment, and ongoing neurological evaluation are vital in order to prevent complications and optimize patient outcomes.

Author's Contribution:

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Drafting or Revising Critically:	Hazim Ali Marah
Final Approval of version:	The above author
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Original Article

Assessment of Pelvic Floor Muscle Dysfunction and its Association with Quality of Care in Pregnant Women

Pelvic Floor Dysfunction in Pregnant Women

Sadia Yasmin, Madiha Mukhtar and Azeem Kaleem

ABSTRACT

Objective: To evaluate the knowledge about pelvic floor muscle dysfunction, prolapse and incontinence, and the quality of antenatal care among pregnant women.

Study Design: Descriptive correlational study

Place and Duration of Study: This study was conducted at the Rural Health Center Awan Dhaya Wala, Lahore from 15th December 2025 from 30th April 2026.

Methods: Three hundred and forty five pregnant women who accessed antenatal services were recruited by convenience sampling for 5 months following ethical approval. The use of validated and reliable instruments was employed in the collection of data.

Results: 91.0% having moderate pelvic floor muscle dysfunction, 5.8% mild and 3.2% severe distress. The most prominent domain was bladder. Lack of knowledge about prolapse and urinary incontinence was observed in 87.5% of the respondents, while 77.7% indicated poor quality of antenatal care. Pelvic floor muscle dysfunction was significantly related to age, education, occupation, duration of marriage, body mass index, parity, gestational age and mode of previous delivery (all $p<0.05$). There was no significant association found with smoking, episiotomy, family history of pelvic floor dysfunction or previous pelvic floor problems.

Conclusion: Pelvic floor muscle dysfunction is very common during pregnancy, and is associated with moderate distress and marked impact on quality of life for most women. In conclusion, the deficiencies in knowledge and suboptimal care from ante-natal services, point to a high priority need for specific education, better maternal services and early screening to improve maternal outcomes.

Key Words: Pelvic floor muscle dysfunction, Urinary incontinence, Pelvic organ prolapsed, Antenatal care quality

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INTRODUCTION

The pelvic floor is a multi-layered structure of muscles, ligaments and connective tissues that support the pelvic organs and are important for urinary, bowel and sexual function.[1] Pelvic floor disorders (PFDs) are a group of disorders that include urinary incontinence, faecal incontinence, pelvic organ prolapse, pelvic pain and sexual dysfunction. These are prevalent among women and their occurrence rises significantly with age.[2] Epidemiological studies have shown that the prevalence of at least one PFD increases to 47.7% for women older than 80 years compared with 9.7% for those between 20 and 39 years.[3]

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In addition to their physical effects, PFDs can have significant psychological, social and emotional impacts, which in turn can substantially compromise the quality of life and lead to higher health care use and economic cost.[4] The physiological, anatomical, and mechanical alterations during pregnancy and childbirth are known risk factors for the onset of pelvic floor dysfunction.[5]

The physical changes of the growing uterus, raised intra-abdominal pressure, connective tissue remodeling and trauma resulting from vaginal delivery can all negatively affect the function of the pelvic floor's support structures. As a result, PFDs are commonly reported during pregnancy with studies revealing 15.4-24.2% of pregnant women have bothersome LUTS at 36 weeks of gestation and about 10-15% of pregnant women report symptoms 1 year postpartum.[6] These results emphasize the importance of early detection, prevention and treatment for pelvic floor dysfunction during pregnancy.

Despite their high prevalence, awareness and screening for PFDs remain limited among women and healthcare providers.[7] Many affected women do not seek medical attention, resulting in delayed diagnosis and treatment.[8] Pelvic floor muscle dysfunction (PFMD as frontline maternal healthcare providers, nurses are well

positioned to deliver PFMD education and support. Therefore, investigating the effectiveness of nurse-led PFMD is essential for improving maternal health outcomes, preventing pelvic floor dysfunction, and enhancing women's quality of life.[9,10]

METHODS

This descriptive correlational study was conducted at the Rural Health Center, Awan Dhaya Wala, Lahore from 15th December 2025 to 30th April 2026 after obtaining ethical approval from the Institutional Review Board of The University of Lahore vide letter No. UOL/IREB/25/15/04/53 dated 11th December 2025. A total of 345 pregnant women receiving antenatal care at the study setting were recruited through convenience sampling. Pregnant women aged 20-35 years, with a body mass index not exceeding 30 kg/m^2, multigravida with singleton pregnancy and without musculoskeletal deformities or major medical illnesses were included. Women with gestational diabetes, pre-eclampsia, cardiovascular, neurological, neuromuscular, respiratory, or psychological disorders, as well as those with multiple pregnancies, spinal deformities, or pelvic deformities were excluded. The structured demographic questionnaire as well as validated questionnaires to assess PFMD, knowledge about pelvic floor disorders and the quality of antenatal care were used for data collection was used. Pelvic floor dysfunction was assessed using the Pelvic Floor Distress Inventory (PFDI), a 43-item questionnaire that contains 4 domains: urinary distress, pelvic organ prolapse distress, colorectal/anal distress, and sexual dysfunction.[11] To determine the knowledge and awareness of pelvic floor disorders, the Prolapse and Incontinence Knowledge Questionnaire (PIKQ) was used composed of 24 items on various topics related to urinary incontinence and pelvic organ prolapsed.[10] The Quality of Prenatal Care Questionnaire (QPCQ)[12] was used to measure the quality of the antenatal care provided, with this being a 46 item questionnaire, assessing multiple dimensions of antenatal care such as information sharing, anticipatory guidance, sufficient consultation time, approachability, availability, support and respect. After the hospital administration's approval, pregnant women attending the Antenatal Clinic were selected. Participants were self administered with the questionnaires following written informed consent. The data were entered and analyzed through SPSS-25. To test for normality of continuous variables, the Kolmogorov-Smirnov test was used and the data were found to be not normally distributed. Non-parametric tests were used to investigate the association of pelvic floor dysfunction with demographic and obstetric characteristics and Spearman's rank correlation coefficient was also used to determine the relationship of variables. Significant difference was taken as $p \leq 0.05$.

RESULTS

Most participants were between 24-27 years and 28-31 years (36.2%), while only 9.6% were between 32-35 years. Nearly one-third of the participants had secondary level education 30.7%, followed by higher secondary education 22.3%, whereas 13.0% had no formal education. Majority were employed 44.3% while 32.8% housewives and 22.9% self-employed. More than one-third of the participants had been married for 2-5 years (35.4%), followed by 6-10 years (29.6%). Most participants were non-smokers (96.5%). 31.9% were overweight, 25.5% normal weight, 21.7% obese and 20.9% underweight (Table 1).

Most participants had moderate pelvic floor pain (91.0%). Most women had poor knowledge of prolapse and urinary incontinence (87.5%) and the quality of antenatal care provided was mostly poor (77.7%). A very small minority reported that they suffered severe pelvic floor distress (3.2%), had good knowledge (2.3%) or received good antenatal care (4.1%) [Fig. 1].

Table No. 1: Distribution of demographic variables (n=345)

Variable	No.	%
Age (years)		
20-23	62	18.0
24-27	125	36.2
28-31	125	36.2
32-35	33	9.6
Education Level		
No formal Education	45	13.0
Primary Level	71	20.6
Secondary Level	106	30.7
Higher Secondary	77	22.3
Graduate and Above	46	13.3
Occupation		
House wife	113	32.8
Employed	153	44.3
Self Employed	79	22.9
Marital Duration		
<2 Years	72	20.9
2-5 Years	122	35.4
6-10 Years	102	29.6
>10 Years	49	14.2
Smoker		
Yes	12	3.5
No	333	96.5
Body mass index (kg/m^2)		
Underweight	72	20.9
Normal	88	25.5
Overweight	110	31.9
Obese	75	21.7

There were significant associations between PFMD and demographic and obstetric factors. Women aged 24-31 years, higher level of education, women who were

employed or self-employed, women with overweight, parity ≥3, advanced gestational age, longer marital duration, and a history of cesarean section had higher levels of distress. However, smoking status, history of episiotomy, family history of pelvic floor dysfunction and previous pelvic floor problems before pregnancy did not significantly correlate with PFMD (Table 2).

The severity of the symptoms was not associated with the awareness level of the participants. There was a weak positive correlation between pelvic floor muscle dysfunction and quality of antenatal care (r = 0.194), indicating a low level of association between perceived quality of antenatal care and symptom burden. In addition, there was no correlation between knowledge about prolapse and quality of antenatal care (r = −0.019), indicating continued lack of knowledge even when antenatal care is accessed (Table 3).

Table No. 2: Association of demographic and obstetric characteristics with pelvic floor muscle dysfunction

Variable	Mild	Moderate	Severe	p-value
Age (years)				
20–23	8 (40%)	54 (17.2%)	-	0.001
24–27	10 (50%)	109 (34.7%)	6 (54.5%)	
28–31	2 (10%)	118 (37.6%)	5 (45.5%)	
32–35	-	33 (10.5%)	-	
Education Status				
No formal education	5 (25%)	40 (12.7%)	-	0.001
Primary	2 (10%)	69 (22%)	-	
Secondary	7 (35%)	98 (31.2%)	1 (9.1%)	
Higher secondary	6 (30%)	65 (20.7%)	6 (54.5%)	
Graduate or above	-	42 (13.4%)	4 (36.4%)	
Occupation				
Housewife	7 (35%)	106 (33.8%)	-	0.003
Employed	12 (60%)	136 (43.3%)	5 (45.5%)	
Self-employed	1 (5%)	72 (22.9%)	6 (54.5%)	
Body mass index (kg/m^2)				
Underweight	7 (35%)	64 (20.4%)	1 (9.1%)	0.001
Normal	10 (50%)	76 (24.2%)	2 (18.2%)	
Overweight	2 (10%)	100 (31.8%)	8 (72.7%)	
Obese	1 (5%)	74 (23.6%)	-	
Parity				
0	4 (20%)	79 (25.2%)	-	<0.001
1	12 (60%)	89 (28.3%)	3 (27.3%)	
2	4 (20%)	113 (36%)	2 (18.2%)	
≥3	-	33 (10.5%)	6 (54.5%)	
Gestational Age				
1st trimester	13 (65%)	73 (23.2%)	5 (45.5%)	<0.001
2nd trimester	7 (35%)	136 (43.3%)	-	
3rd trimester	-	105 (33.4%)	6 (54.5%)	

Table No. 3: Relationship between pelvic floor muscle dysfunction, knowledge of prolapse/incontinence and quality of antenatal care

Variables	Correlation Coefficient (r)	p-value
Pelvic floor distress vs. prolapse & incontinence knowledge	-0.028	>0.05
Pelvic floor distress vs. quality of antenatal care	0.194	<0.05
Quality of antenatal care vs. prolapse & incontinence knowledge	-0.019	>0.05

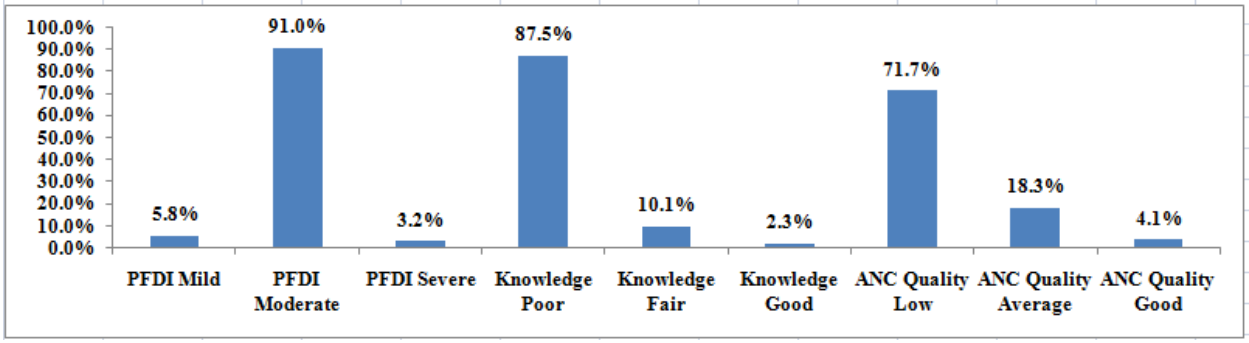

Figure No. 1: Distribution of pelvic floor muscle distress, prolapse and incontinence knowledge, and quality of antenatal care among pregnant women

DISCUSSION

The present study demonstrated a high burden of pelvic floor muscle dysfunction, poor knowledge regarding prolapse and urinary incontinence, and suboptimal antenatal care among pregnant women. The high prevalence of urinary symptoms, including frequency, urgency, nocturia, and stress incontinence, is consistent with previous studies identifying urinary incontinence as the most common manifestation of PFMD during pregnancy[13,14] and aligns with global evidence highlighting bladder symptoms as the leading contributor to pelvic floor distress[5], although variation by gestational age has been reported.[7] Similarly, bowel dysfunction and prolapse-related symptoms observed in this study are supported by literature linking pregnancy-related hormonal and mechanical changes to pelvic floor strain and weakening[15,16], though differences in severity compared to some international studies may reflect population and obstetric variations.[13] The sexual dysfunction results are also consistent with earlier reports that reported a high association between pelvic floor disorders and compromised sexual health and quality of life.[17] An important finding was that there was a very low level of knowledge about pelvic floor disorders, which is in line with other studies from Pakistan[18] and other low and middle income countries which showed low awareness and misconception.[19] The study also found that the quality of the antenatal care provided was generally poor in all domains, especially regarding information sharing, anticipatory guidance, consultation time, availability, and patient support. Restricted communication, counseling and the integration of maternal education in the standard ANC care as reported in the previous study[20] are consistent with the findings from this study. Although provider approachability was relatively better, overall care remained suboptimal, reflecting system-level constraints such as high patient load and limited continuity of care.[21]

Correlation analysis showed no significant relationship between knowledge and pelvic floor muscle distress, suggesting that knowledge alone may not influence symptom severity, which is consistent with studies reporting that low awareness does not necessarily translate into behavioral change in the absence of structured education.[22,23] A weak positive association between antenatal care quality and symptom burden may indicate increased healthcare contact among symptomatic women or insufficient effectiveness of routine antenatal services in preventing PFMD.[18,19,23] Furthermore, the lack of association between antenatal care quality and knowledge highlights persistent gaps in patient education during routine visits, where pelvic floor health is often overlooked in favor of general maternal and fetal care[17], Overall, the findings emphasize the need for structured, patient-centered antenatal education and targeted interventions to improve pelvic floor health awareness and outcomes.

CONCLUSION

Pelvic floor muscle dysfunction was highly prevalent among pregnant women, with most experiencing moderate distress. Bladder symptoms were the most common, followed by sexual dysfunction and prolapse symptoms, significantly affecting quality of life. Several factors such as age, BMI, parity, gestational age, and marital duration were associated with increased severity, while others showed no significant association. Knowledge levels regarding pelvic floor disorders were extremely low, and antenatal care quality was generally poor. No significant relationship was found between knowledge and distress, while only a weak association was observed with antenatal care quality. Overall, the study highlights a high burden of PFMD along with poor awareness and inadequate antenatal care, emphasizing the need for education, improved services, and early screening.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Sadia Yasmin, Madiha Mukhtar
Drafting or Revising Critically:	Sadia Yasmin, Azeem Kaleem
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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Original Article

Comparative Analysis of Radiation Dose Reduction in Radiosurgery Versus Whole Brain Radiotherapy for Intracranial Metastases

Eman Ismail Mohammed and Nashwan K. Abdulkareem

ABSTRACT

Objective: To perform a dosimetric comparison between stereotactic radiosurgery and whole-brain radiation therapy, while evaluating plan quality based on conventional indices and a new efficiency index ($\eta_{50\%}$).

Study Design: Comparative study

Place and Duration of Study: This study was conducted at the Al-Andalus Private Hospital, Iraq from 15th September 2024 to 30th June 2025.

Methods: Whole-brain radiation therapy and stereotactic radiosurgery plans were generated for 17 patients using the Monaco Treatment Planning System. Target volumes and critical structures were contoured on fused computed tomography and gadolinium-enhanced magnetic resonance imaging datasets. Dosimetric evaluation included planned target volume coverage, conformity index, homogeneity index, monitor units, organ-at-risk doses, low-dose brain exposure (V10 and V12), gradient index, and efficiency index ($\eta_{50\%}$).

Results: Dose distribution obtained by stereotactic radiosurgery had higher target coverage (99.40% vs 95.98% for whole-brain radiation therapy. Conformity index was better with stereotactic radiosurgery (0.90 vs 0.87), with improved dose homogeneity (0.103 vs 0.126). Stereotactic radiosurgery resulted in higher monitor units (5505.21 vs 305.60). The stereotactic radiosurgery significantly decreased doses to critical organs at risk ($p<0.001$). Moreover, stereotactic radiosurgery achieved low-dose brain exposure and improved Gradient Index and η_{50}%.

Conclusion: The effectiveness of stereotactic radiosurgery in selected patients, allowing a balance between preservation of normal brain tissue and effective local tumor control. The Efficiency Index (η50%) was found to be a useful metric for evaluating dose utilization alongside conventional indices.

Key Words: Whole brain radiotherapy, Stereotactic radiosurgery, Brain metastases, Radiation dose

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INTRODUCTION

Brain metastases affect approximately twenty to forty percent of patients during their illness.[1] The presence of such tumors leads to a significant medical concern and creates an enormous burden on the healthcare system, given the neurological complications, poor quality of life, and mortality.[2]

In the past, therapeutic choices for these patients were very restricted. Most received primarily supportive treatment, while surgical resection was limited to a carefully selected subset of patients depending upon their health condition, tumor size, and location. Whole-brain radiotherapy (WBRT) became the standard treatment approach for patients with brain metastases.[3]

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Advances in imaging technology have enhanced the early detection and characterization of brain metastases, contributing to a paradigm shift in treatment approaches from WBRT to stereotactic radiosurgery (SRS).[4] Stereotactic radiosurgery is a non-invasive technique that delivers a high radiation dose to tumors in a single fraction, providing effective local tumor control while reducing radiation to critical structures. Thus, SRS decreases the risk of cognitive impairment and other side effects associated with WBRT, leading to improved quality of life for patient.[5] Linear accelerator-based stereotactic has become a widely adopted treatment modality for brain metastases due to its ability to achieve accurate immobilization and

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localization.[6] It is particularly suitable for treating small intracranial lesions. Also, the application of a single-isocenter approach for one or multiple targets enables efficient and precise dose delivery. Among modern techniques, volumetric modulated arc therapy (VMAT) is widely employed in SRS because it provides high conformity and homogeneity with enhanced sparing of organs at risk.[7]

The quality of plans generated using this technique and reported encouraging results.[8,9] However, comprehensive dosimetric comparisons between SRS and WBRT are still limited. To the best of our knowledge, no previous study has evaluated the Efficiency Index (η50%) in LINAC-based VMAT-SRS for brain metastases in comparison with 3DCRT for whole brain radiotherapy. The purpose is to compare SRS and WBRT in terms of dose distribution and to assess how well each approach limits radiation to critical organs and healthy brain tissue while maintaining adequate target coverage, using conventional dosimetric parameters and a new Efficiency Index (η50%).

METHODS

This comparative study was conducted at Al-Andalus Private Hospital, Iraq from 15th September 2024 to 30th June 2025 vide letter No. MTU-0049/Approval/ MTUBa dated September 4, 2024 and 17 patients with brain metastases were enrolled. Computed tomography simulation with 1 mm slice thickness was performed using a thermoplastic mask for immobilization and fused with high-resolution post-contrast T1-weighted MRI images with 1 mm slice thickness. PTV and OARs were delineated by the same radiation oncologist on fused CT/MRI datasets using the Monaco Treatment Planning System. For WBRT, a 5 mm margin was added to the whole-brain CTV to create the PTV, while SRS plans used a 1 mm margin around the GTV. Evaluated OARs included the optic structures, cochleae, eyes, lenses, pituitary gland, brainstem, and normal brain tissue with assessment of V10 and V12.

Two radiotherapy plans were generated for each patient on an Elekta Synergy Agility linear accelerator using 6 MV photon beams. WBRT plans were created with the 3D-CRT technique, delivering 30 Gy in 10 fractions. Dose calculation was performed utilizing the Collapsed Cone algorithm and normalization ensuring ≥95% PTV coverage by 95% of the prescribed dose.[10] SRS plans were created employing single-isocenter VMAT with four to five partial arcs and one full arc (Table 1), prescribing 21 Gy in a single fraction.[11] Monte Carlo algorithm was applied for dose calculation, and optimization ensured ≥99% PTV coverage by at least 95% or more of the prescribed dose.

The planning target volume (PTV) evaluation was performed using dosimetric parameters including Dmax, Dmean, Dmin, and V95%. Organs at risk were assessed based on their respective dose constraints. In addition, healthy brain tissue volumes receiving at least 12 Gy (V12) and 10 Gy (V10) were analyzed because of their clinical importance in predicting radiation-induced necrosis. Plan quality was further quantified using the following indices:

The Paddick conformity index (CI)[12] was computed as

$$CI = \frac{(TV_{PIV})^2}{TV \times V_{RI}} \quad (1)$$

Where TV_{PIV} represents the volume of the target covered by the prescription isodose, TV is the target volume, VRI is the volume encompassed by the prescription isodose. A CI value of 1 indicates ideal conformity.

Homogeneity index (HI)[10] was defined as

$$HI = \frac{D_2 - D_{98}}{D_p} \quad (2)$$

Where D_2 and D_{98} represent the near maximum and near-minimum doses within the PTV, and D_P is the prescription dose.

The efficiency index (η_{50}%) was calculated as described by Dimitriadis and Paddick[13] as

$$\eta_{50\%} = \frac{\text{useful energy}}{\text{Total energy}} = \frac{\text{integral dose}_{TV}}{\text{integral dose}_{PIV50\%}} = \frac{\int_{Dmin}^{Dmax} TV\delta dose}{\int_{PIV50\%}^{Dmax} V\delta dose} \quad (3)$$

Efficiency Index ($\eta_{50\%}$) for a solitary target is calculated using the following equation:

$$\text{Integral Dose}_{TV} = \text{Mean Dose}_{TV} \times \text{Volume}_{TV} \quad (4)$$

Theoretically, this index ranges from zero to 1, where a value of one indicates an ideal value. The gradient index (GI) was defined by Paddick and Lippitz[14] as

$$GI = \frac{V_{50\%}}{V_{100\%}} \quad (5)$$

Where V50% is the volume receiving at least 50% of the prescribed dose, while V100% refers to the volume receiving the total prescribed dose. The ideal GI value should be lower than 3.

Monitor units (MUs) were recorded for each plan as determining the efficiency in delivery and the plan's complexity. Statistical analysis was performed by SPSS-26. The paired samples t-tests were utilized to compare the differences between the two plans and $P<0.05$ was considered as significant.

RESULTS

The majority of cases 58.8% were females while males accounted for 41.2%. Lung cancer was the most common primary tumor site 52.9%, followed by breast cancer 29.4%, while other tumor types accounted for 17.7% of cases. Most patients presented with a single brain metastasis 70.6%, whereas 29.4% had multiple metastases. The mean age of the patients was 63.82±7.91 years (Table 2).

B-PTV coverage and plan quality parameters: SRS demonstrated significantly higher values for all PTV parameters than 3DCRT (Table 3), with Dmax values

of 132.58% versus 104.60%, D mean values of 114.84% versus 96.61%, and minimum dose (94.29%) versus (86.72%) respectively ($p<0.001$). In addition, SRS achieved superior target coverage, as indicated by a higher V95% (99.40% vs. 95.98%, $p<0.001$; Figs. 1-3). SRS demonstrated significantly higher conformity index (0.9086 vs. 0.8724, $p=0.015$) and lower homogeneity index (0.1031 vs. 0.1263, $p=0.023$), indicating improved target conformity and dose uniformity. Moreover, the mean efficiency index (η_{50}%) was 0.7909 and the gradient index (GI) was 2.100, reflecting efficient dose deposition and a steep dose fall-off outside the target. However, SRS required significantly higher monitor units than 3DCRT (5505.21 vs. 305.60, $p<0.001$), indicating greater plan complexity.

C-Normal brain tissue sparing indices: The volume of normal brain receiving at least 12 Gy (V12) was 3.468 cc, while V10 was 5.397 cc, indicating limited exposure of healthy brain tissue (Table 4).

Table No. 1: Characteristic of VMAT arcs in our Stereotactic plans

Field	Arc length (degree)	Couch angles (degree)	Start angle (degree)	Stop angle (degree)	Arc direction
1	360	0	181	179	CW
2	100	340	160	60	CCW
3	100	300	40	140	CW
4	100	90	320	220	CCW
5	100	30	200	300	CW
6	100	60	200	300	CW

CW = Clockwise CCW = Counter clockwise

Table No. 2: Characteristic of patients (n=17)

Characteristic	No.	%
Gender		
Female	10	58.8
Male	7	41.2
Primary site of tumor		
Breast cancer	5	29.4
Lung cancer	9	52.9
Others	3	17.7
Number of brain metastases per patients		
Single	12	70.6
Multiple	5	29.4
Mean age (years)	63.82±7.91	

Table No. 3: Comparison of PTV coverage and plan quality metrics between 3DCRT and SRS plans

PTV parameters	3DCRT (WBRT)	SRS	P value
Dmax (%)	104.60±1.23	132.58±4.25	< 0.001
Dmean (%)	96.61±1.40	114.84±2.37	< 0.001
Dmin (%)	86.72±1.47	94.29±2.65	< 0.001
V95%	95.98±0.26	99.40±0.22	< 0.001
CI	0.8724±0.047	0.9086±0.017	0.015
HI	0.1263±0.021	0.1031±0.015	0.023
Efficiency index ($\eta_{50\%}$)	N/A	0.7909±0.052	---
GI	N/A	2.100±0.624	---
Monitor Units	305.60±42.23	5505.21±1070.15	< 0.001

Table No. 4: Dosimetric indices of normal brain tissue sparing in SRS plans

Parameter	SRS
V12 (cc)	3.468±1.503
V10 (cc)	5.397±1.195

Table No. 5: Dosimetric parameters of OARs for 3DCRT (WBRT) and SRS plans

OARs	Parameters (cGy)	3DCRT (WBRT)	SRS	P-Value
Left lens	Dmax	493.14±85.02	104.50±12.49	< 0.001
Right lens	Dmax	509.92±72.84	115.96±17.25	< 0.001
Left eye	Dmax	1585.83±61.59	148.14±13.12	< 0.001
Right eye	Dmax	1598.45±65.03	153.81±21.43	< 0.001

Left optic nerve	Dmax	3013.10±41.72	319.15±94.13	< 0.001
Right optic nerve	Dmax	3021.58±28.83	357.90±102.74	< 0.001
Optic chiasm	Dmax	3039.92±40.78	563.30±85.23	< 0.001
Pituitary gland	Dmean	2540.93±68.19	306.84±61.99	< 0.001
Brainstem	Dmax	3088.98±72.00	789.92±278.20	< 0.001
Left cochlea	Dmean	2642.57±80.65	272.28±53.74	< 0.001
Right cochlea	Dmean	2648.90±85.47	291.61±55.68	< 0.001

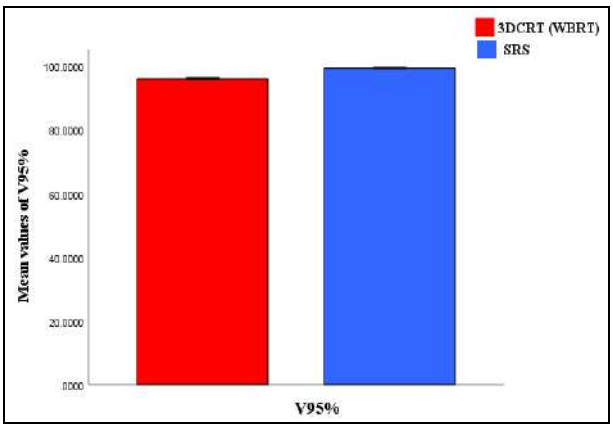

Figure No. 1: Comparison of the PTV coverage between 3DCRT (WBRT) and SRS

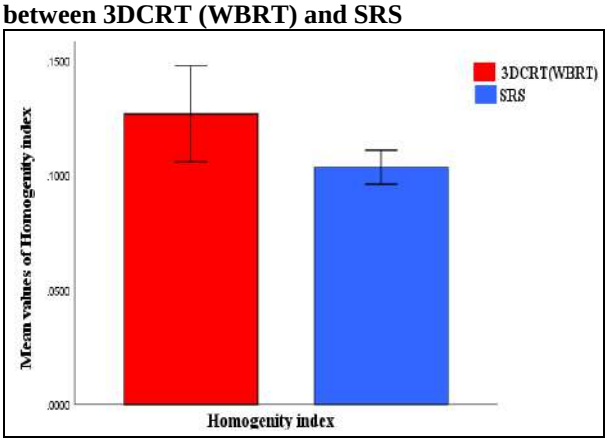

Figure No. 2: Comparison of Homogeneity Index between 3DCRT (WBRT)and SRS

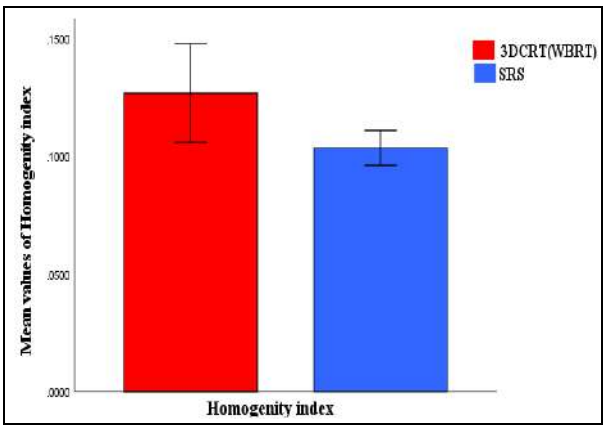

Figure No. 3: Comparison of Homogeneity Index between 3DCRT (WBRT) and SRS

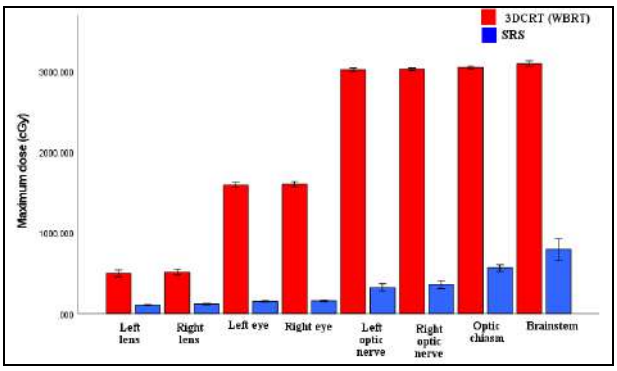

Figure No. 4: Comparison of the maximum dose to OAR between 3DCRT (WBRT) and SRS

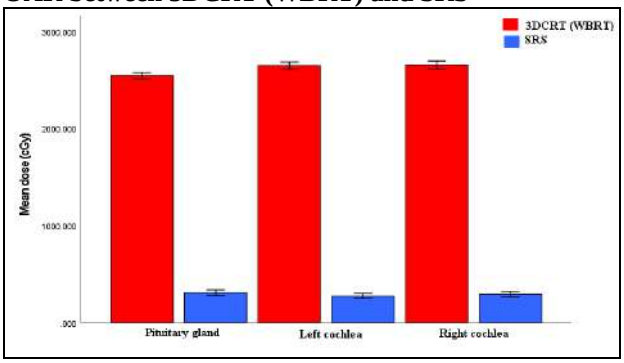

Figure No. 5: Comparison of the mean dose to Pituitary gland and Cochleae between 3DCRT (WBRT) and SRS

D-OAR dosimetry: Statistically significant differences were observed between SRS and 3DCRT (WBRT) in all evaluated OARs (Table 5). For the lenses, SRS reduced Dmax to 104.50 and 115.96 cGy compared with 493.14 and 509.92 cGy in 3DCRT. Similarly, the eyes received markedly lower doses in SRS, with Dmax values of 148.14 and 153.81 cGy versus 1585.83 and 1598.45 cGy in 3DCRT ($p < 0.001$). The optic nerves received markedly reduced doses in SRS, with Dmax values of 319.15 and 357.90 cGy versus 3013.10 and 3021.58 cGy in 3DCRT. Likewise, the optic chiasm dose was reduced from 3039.92 cGy in 3DCRT to 563.30 cGy in SRS. The pituitary gland mean dose was also substantially lower in SRS (306.84 cGy) compared with 3DCRT (2540.93 cGy). In addition, SRS significantly reduced brainstem Dmax to 789.92 cGy versus 3088.98 cGy in 3DCRT. Cochlear doses were likewise minimized, with left and right cochlear doses of 272.28 and 291.61 cGy in SRS compared with

2642.57 and 2648.90 cGy in 3DCRT, respectively ($p<0.001$ for all comparisons) [Figs. 4-5].

DISCUSSION

Stereotactic radiosurgery is considered a suitable option for patients with brain metastases, particularly those with good performance status.[15] Compared with WBRT, SRS has been associated with enhanced local control and reduced risk of neurocognitive decline, which has led to its increasing use in treating brain metastases.[16]

Bodensohn et al[17] and Mizuno et al[18] reported that comprehensive dosimetric comparisons between these treatment modalities remain limited. Therefore, this study was conducted to provide a comprehensive dosimetric analysis and complement existing outcome-based research.

The superiority of SRS plans over 3DCRT plans. This could be because of the exact collimation, and utilization of non-coplanar fields in SRS treatment plans.[19] SRS planning demonstrated significantly higher conformity than 3DCRT, as reflected by the Paddick conformity index (CI). This advantage is mainly attributed to the ability of SRS to generate highly conformal dose distributions through the use of multiple focused beams.[5] Improved CI has important clinical implications in radiotherapy quality, as it reflects adequate target coverage while reducing radiation to the healthy tissues.

Regarding the homogeneity index, SRS demonstrated improved dose uniformity compared with 3DCRT plans. Lower HI values indicate a more homogeneous dose distribution within the target, which may be attributed to the precise dose delivery and advanced beam modulation techniques used in SRS.[20] As far as dosimetric criteria for quality assessment are concerned, such as efficiency index (η50%) indicates how well the dose decreases as the distance from the target increases. The present study contributes by introducing efficiency-based evaluation using η50%, which offers additional insight into dose utilization beyond conventional indices. A lower GI indicates a steeper dose gradient and more rapid dose fall-off outside the target volume, thereby improving normal brain sparing.[21] In addition, some patients may require re-irradiation if there is recurrence in the brain. It is critical to maintain the tolerance of healthy tissues and prevent future toxicity.

Stereotactic radiosurgery plans showed significantly higher monitor units values than 3DCRT. This increase is due to the greater complexity of SRS delivery, which involves multiple beam angles, including coplanar and non-coplanar arcs, to achieve highly conformal dose distributions with sharp dose fall-off.[22]

Reducing radiation dose to healthy brain tissue, particularly low-dose volumes such as V10 and V12, is essential in intracranial radiotherapy. With improved systemic therapies and longer patient survival, preserving normal brain tissue has become increasingly important. Minimizing low-dose exposure helps reduce the risk of late neurotoxicity and cognitive decline, which are key priorities in modern treatment planning.[23] All dosimetric parameters for organs at risk were within acceptable clinical limits for both techniques. However, SRS achieved significantly lower Dmax values to critical structures compared with 3DCRT ($p<0.001$). This improved sparing of healthy tissue is mainly attributed to the high conformity of SRS plans.[24] These observations show that SRS provides better organ sparing than 3DCRT (WBRT) in the treatment of brain metastases.

CONCLUSION

Stereotactic radiosurgery is an effective and precise method for the management of brain metastases compared with whole brain radiotherapy. The dosimetric findings showed that SRS enhances patient outcomes by improving local tumor control and reducing the occurrence of radiation-induced toxicities. Furthermore, the Efficiency Index (η_{50}%) provided additional insight into dose utilization beyond conventional dosimetric parameters. Overall, these results emphasize the clinical value of SRS as a preferred treatment option for selected patients, thus providing safer and more effective treatment for intracranial metastases.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Eman Ismail Mohammed, Nashwan K. Abdulkareem
Drafting or Revising Critically:	Eman Ismail Mohammed, Nashwan K. Abdulkareem
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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Original Article

Crosslinking Strategies for DBM Putty

Ionic versus Covalent Crosslinking of Xenograft Demineralized Bone Matrix Putty: Comparative in Vitro Stability and Osteoblast Compatibility for Spinal Fusion Applications

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ABSTRACT

Objective: To compare an ionic crosslinker, aluminium hydroxide [$Al(OH)_3$] gel, and a covalent crosslinker, paraformaldehyde (PFA), in xenograft DBM putty with respect to in vitro stability and osteoblast compatibility.
Study Design: An in vitro experimental study
Place and Duration of Study: This study was conducted at the Institute of Tropical Disease, Universitas Airlangga, Surabaya, Indonesia, between November 2025 and April 2026.
Methods: An in vitro experimental study was conducted using bovine DBM putty composed of 70% DBM, 25% carboxymethylcellulose, and 5% crosslinker. Specimens were crosslinked with either $Al(OH)_3$ gel or PFA and sterilized by gamma irradiation. Stability was evaluated through swelling ratio, quantitative cohesiveness, and enzymatic degradation testing. Biocompatibility was assessed using 7F2 osteoblast viability and adhesion assays. Twenty-five specimens were analyzed per group.
Results: Swelling ratio was comparable between the $Al(OH)_3$ gel and PFA groups (408.4% vs 444.4%, p = 0.068). PFA demonstrated lower mass loss during cohesiveness testing (26.0% vs 36.3%, p = 0.026) and lower enzymatic degradation (10% vs 25%, p = 0.025). Osteoblast adhesion was higher in the $Al(OH)_3$ gel group than in the PFA group (44.7% vs 38.4%, p = 0.019). Cell viability did not differ significantly between groups (31.7% vs 30.0%, p = 0.210).
Conclusion: PFA was associated with greater cohesiveness and lower enzymatic degradation, whereas $Al(OH)_3$ gel supported greater osteoblast adhesion. Both formulations demonstrated similarly low cell viability, highlighting the need for further formulation optimization.
Key Words: Demineralized Bone Matrix, Spinal Fusion, Bone Transplantation, Biomaterials, Osteoblasts

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INTRODUCTION

Spinal fusion remains a fundamental procedure for the treatment of degenerative, traumatic, and deformity related spinal disorders. Despite advances in surgical techniques and instrumentation, pseudarthrosis continues to represent an important cause of treatment failure and revision surgery. Fusion outcomes depend not only on mechanical stabilization but also on the biological performance of the graft material used to support new bone formation.[1–4]

Autologous bone graft remains the clinical standard because it provides osteoconductive, osteoinductive, and osteogenic properties. However, donor site morbidity, limited graft availability, and additional operative requirements have encouraged the development of alternative bone graft substitutes. Demineralized bone matrix (DBM) has attracted considerable interest because demineralization preserves a collagen rich extracellular matrix and bioactive proteins that contribute to bone regeneration.[5–8]

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Putty form DBM offers practical advantages for spinal fusion, including ease of handling, adaptability to irregular defects, and improved graft containment during implantation. Nevertheless, the collagen-based structure of DBM putty may be associated with excessive swelling, limited cohesiveness, and accelerated degradation under physiological conditions. These limitations may reduce graft retention and shorten the period during which the scaffold can support bone healing.[9,10]

Crosslinking has emerged as a strategy to improve the stability of collagen-based biomaterials by strengthening interactions within the matrix structure. Covalent crosslinking may improve resistance to degradation and material integrity, whereas ionic crosslinking may better preserve cell material interactions.[11–14] However, comparative evidence evaluating ionic and covalent crosslinking approaches in putty form DBM remains limited. This study compared xenograft DBM putty crosslinked with aluminium hydroxide [$Al(OH)_3$] gel as an ionic crosslinker and paraformaldehyde (PFA) as a covalent crosslinker. The formulations were evaluated through in vitro assessments of swelling ratio, cohesiveness, enzymatic degradation, osteoblast viability, and osteoblast adhesion to characterize the balance between material stability and biological compatibility.

METHODS

Study Design: This in vitro experimental study was conducted at the Institute of Tropical Disease, Universitas Airlangga, Surabaya, Indonesia, between November 2025 and April 2026. The study compared xenograft demineralized bone matrix (DBM) putty crosslinked with either aluminium hydroxide [$Al(OH)_3$] gel or paraformaldehyde (PFA). The evaluated outcomes included swelling ratio, quantitative cohesiveness, enzymatic degradation, osteoblast viability, and osteoblast adhesion.

Ethical Approval: The study protocol was approved by the Ethics Committee of the Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia (No. 347/EC/KEPK/FKUA/2025).

Preparation of DBM Putty: All procedures were performed in accordance with ASTM F2212 guidelines for DBM characterization and relevant ISO standards for biological evaluation and sterilization of medical devices. Fresh bovine long bones were cleaned of residual soft tissue and immersed in 70% ethanol for 24 h, followed by 3% hydrogen peroxide for an additional 24 h to remove residual tissue and lipids. The specimens were subsequently demineralized in 0.6 N hydrochloric acid at 4°C for 24–48 h, washed repeatedly with phosphate buffered saline (PBS) until a neutral pH was achieved, and dried at 37–45°C. The resulting DBM was ground and sieved to obtain particles measuring 100–500 μm.

DBM putty was prepared using a formulation adapted from previously reported DBM based composites. The final composition consisted of 70% DBM, 25% carboxymethylcellulose (CMC), and 5% crosslinker. For the ionic crosslinking group, 1% $Al(OH)_3$ gel was incorporated into the DBM CMC mixture and incubated for 1–2 h before PBS washing. For the covalent crosslinking group, 2% PFA was added and incubated for 2 h at 4°C, followed by repeated PBS washing to reduce residual crosslinker. The resulting putty was molded into cylindrical specimens measuring approximately 10 mm in diameter and 5 mm in height. Prior to testing, all specimens were sterilized using 15 kGy gamma irradiation at the Radiation Technology Laboratory, National Research and Innovation Agency, Indonesia.

Stability Assessment: Physical stability was evaluated using swelling ratio, quantitative cohesiveness, and enzymatic degradation assays.

For swelling ratio testing, dried specimens were immersed in PBS (pH 7.4) at 37°C for 24 h. The swelling ratio was calculated from the difference between wet and dry weights and expressed as a percentage of the initial dry weight.

Quantitative cohesiveness was assessed by measuring mass loss after immersion in PBS at 37°C for 2 h. Lower mass loss indicated greater cohesiveness and structural integrity of the putty formulation.

Enzymatic degradation was evaluated by incubating specimens in type II collagenase solution (125 U/mL) at 37°C for 24 h. Following incubation, specimens were washed, dried, and reweighed. Degradation was expressed as the percentage reduction in dry weight relative to baseline.

Biocompatibility Assessment: Biocompatibility was evaluated using 7F2 osteoblast cells in accordance with ISO 10993-5 recommendations. For cell viability testing, material extracts were prepared by incubating 0.2 g of putty in 1 mL of Dulbecco's Modified Eagle Medium (DMEM) for 24 h at 37°C. Extracts were subsequently applied to 7F2 osteoblast cultures seeded at a density of 1×10^4 cells/well. Cell viability was quantified using the MTT assay after 24 h of exposure and expressed relative to untreated controls.

For cell adhesion testing, putty disks measuring approximately 5 mm in diameter and 2 mm in thickness were sterilized by ultraviolet exposure and placed in culture wells containing DMEM supplemented with 10% fetal bovine serum. Osteoblasts were seeded at a density of 1×10^5 cells/well and incubated for 24 h. Nonadherent cells were removed by PBS washing, and adherent cells were quantified using the MTT assay with absorbance measured at 570 nm.

Sample Size and Statistical Analysis: Sample size was estimated using Cohen's d methodology assuming a large effect size (d = 0.8), a significance level of 0.05,

and a statistical power of 80%, resulting in a minimum of 25 specimens per group for each outcome measure.

Data were analyzed using IBM SPSS Statistics version 29. Normality was assessed using the Shapiro–Wilk test and homogeneity of variance using Levene's test. Normally distributed variables were compared using the independent t test, whereas nonnormally distributed variables were analyzed using the Mann–Whitney U test. Statistical significance was defined as $p < 0.05$.

RESULTS

A total of 25 specimens were evaluated in each group for all outcome measures (Total sample size = 250). Enzymatic degradation data were not normally distributed and were analyzed using nonparametric methods, whereas all other variables met assumptions for parametric analysis.

The mean swelling ratio across all specimens was 426.4%. The $Al(OH)_3$ gel group demonstrated a lower swelling ratio than the PFA group (408.4 ± 62.8% vs 444.4 ± 73.3%), although the difference was not statistically significant ($p = 0.068$).

Quantitative cohesiveness differed significantly between groups. The $Al(OH)_3$ gel group exhibited greater mass loss than the PFA group (36.3 ± 15.8% vs 26.0 ± 15.9%; $p = 0.026$), indicating lower cohesiveness and reduced structural integrity following PBS immersion.

Similarly, enzymatic degradation was significantly greater in the $Al(OH)_3$ gel group than in the PFA group, with median degradation rates of 25% (range, 0–48%) and 10% (range, 0–40%), respectively ($p = 0.025$). These findings indicate greater resistance to collagenase mediated degradation in the PFA crosslinked formulation.

Table No.1: Stability and biocompatibility outcomes of xenograft DBM putty crosslinked with aluminium hydroxide gel and paraformaldehyde

Outcome	$Al(OH)_3$ gel (n = 25)	PFA (n = 25)	p value
Swelling ratio (%)	408.4 ± 62.8	444.4 ± 73.3	0.068
Mass loss (%)	36.3 ± 15.8	26.0 ± 15.9	0.026
Enzymatic degradation (%)†	25 (0–48)	10 (0–40)	0.025
Cell viability (%)	31.7 ± 5.7	30.0 ± 4.0	0.210
Cell adhesion (%)	44.7 ± 8.8	38.4 ± 9.6	0.019

Data are presented as mean ± standard deviation unless otherwise indicated.

† Data are presented as median (range).

The mean cell viability across all specimens was 30.8%. No significant difference was observed between the $Al(OH)_3$ gel and PFA groups (31.7 ± 5.7% vs 30.0 ± 4.0%; $p = 0.210$). Notably, cell viability remained below the ISO 10993-5 threshold for noncytotoxic materials in both formulations.

In contrast, osteoblast adhesion differed significantly between groups. The $Al(OH)_3$ gel group demonstrated greater cell adhesion than the PFA group (44.7 ± 8.8% vs 38.4 ± 9.6%; $p = 0.019$), suggesting a more favorable surface environment for early osteoblast attachment.

A summary of all stability and biocompatibility outcomes is presented in Table 1.

DISCUSSION

This study compared ionic and covalent crosslinking strategies in xenograft demineralized bone matrix (DBM) putty for spinal fusion applications. The principal finding was a tradeoff between structural stability and cellular response. PFA crosslinking improved cohesiveness and resistance to enzymatic degradation, whereas $Al(OH)_3$ gel supported greater osteoblast adhesion. Swelling behavior and cell viability were comparable between formulations. These findings highlight the challenge of balancing scaffold persistence and biological performance during the development of DBM based graft substitutes.[15,16]

Although swelling ratio did not differ significantly between groups, marked differences were observed in cohesiveness and enzymatic degradation. The lower mass loss and reduced collagenase mediated degradation observed in the PFA group indicate that covalent crosslinking generated a more stable matrix structure. This observation is consistent with previous studies demonstrating that crosslinking strengthens intermolecular interactions within collagen-based biomaterials and improves resistance to degradation.[17,18] In the context of spinal fusion, preservation of scaffold integrity may be advantageous because premature graft degradation could reduce osteoconductive support before sufficient new bone formation occurs.

The biological findings warrant careful consideration. Despite demonstrating superior stability, PFA did not support greater osteoblast adhesion. Instead, adhesion was significantly higher in the $Al(OH)_3$ gel group, suggesting that ionic crosslinking may better preserve surface characteristics that facilitate early cell attachment. Surface chemistry plays a critical role in regulating cell material interactions, and modifications that improve scaffold stability may simultaneously alter cellular attachment behavior.[19] Because osteoblast attachment precedes proliferation, differentiation, and matrix deposition, this finding may have important implications for the biological performance of DBM based graft substitutes.

No significant difference in cell viability was observed between groups. However, both formulations demonstrated viability values below the ISO 10993-5 threshold for noncytotoxic materials. This represents the most important limitation identified in the present study. The finding suggests that neither formulation achieved satisfactory cytocompatibility under the tested conditions. Previous studies have reported that aluminium containing biomaterials and aldehyde based crosslinkers may influence osteoblast function in a concentration dependent manner.[20,21]

The present findings emphasize that improvements in physical stability alone are insufficient for the development of clinically useful bone graft substitutes. An ideal scaffold for spinal fusion should maintain structural integrity while simultaneously supporting favorable cellular responses. While covalent crosslinking enhanced cohesiveness and degradation resistance, ionic crosslinking favored osteoblast attachment. Neither formulation achieved an optimal balance between these characteristics, indicating that further refinement of formulation composition and crosslinker concentration is required.

Several limitations should be acknowledged. The absence of an uncrosslinked DBM control group limits assessment of the absolute contribution of crosslinking. In addition, only in vitro outcomes were evaluated, and osteogenic differentiation, mineralization, mechanical properties, and in vivo fusion performance were not assessed. Future studies should investigate optimized formulations and validate these findings in preclinical spinal fusion models.

Overall, PFA crosslinking improved cohesiveness and resistance to enzymatic degradation, whereas $Al(OH)_3$ gel supported greater osteoblast adhesion. However, neither formulation achieved satisfactory cytocompatibility. Further optimization is required before either approach can be considered for in vivo evaluation.

CONCLUSION

PFA crosslinking improved cohesiveness and resistance to enzymatic degradation, whereas $Al(OH)_3$ gel promoted greater osteoblast adhesion. However, neither formulation achieved satisfactory cytocompatibility. Further optimization is required to improve the balance between scaffold stability and biological performance before in vivo evaluation for spinal fusion applications.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Andi Bahauddin Fahmi, Lukas Widhiyanto, Dwikora Novemberi Utomo
Drafting or Revising Critically:	Heri Suroto, Romaniyanto, Atika
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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Original Article

Assessment of Women's Knowledge about Breast Self-Examination at Al-Yarmouk Teaching Hospital

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ABSTRACT

Objective: To assess women's information and knowledge about breast self-examination and identify the relationship between social and demographical characteristics (age, level of education and marital status) with breast self-examination knowledge.

Study Design: Descriptive study

Place and Duration of Study: This study was conducted at the Al-Yarmouk Teaching Hospital in Baghdad from 27th June 2022 to 22nd May 2023.

Methods: This descriptive study was conducted at Al-Yarmouk Teaching Hospital in Baghdad including 100 women.

Results: Majority of participants were aged 20–29 years (33%), had completed high school (42%), and were married (84%). Overall, participants demonstrated adequate knowledge of breast self-examination, although gaps were identified in specific items 3, 7, and 14. No significant association was found between age and overall knowledge, except for awareness of breast self-examination importance ($P \leq 0.05$). Educational level showed a significant relationship with most knowledge items, while items 10, 12, and 13 were not significant. Marital status was significantly associated with knowledge of breast self-examination timing, technique, steps, and perceived importance, while other items were not significant ($P \leq 0.05$).

Conclusion: Differences were observed in women's knowledge of breast self-examination, with noticeable improvement after participants benefited from motivation related to the examination.

Key Words: Assessment, Women's, Knowledge, Breast self-examination

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INTRODUCTION

Cancer is a major contributor to the global disease burden, with newly diagnosed cases increasing from about 10.2 million in 2002 to nearly 15 million annually. Approximately 60% of cases occur in developing countries, reflecting a rising burden in low- and middle-income regions.[1] Breast cancer is one of the most common cancers in women worldwide and a major cause of cancer-related morbidity and mortality.

It is a heterogeneous disease characterized by uncontrolled malignant cell growth in the breast, most commonly originating in the ducts or lobules, with the ability to invade surrounding tissues and metastasize to distant organs.[2] Cancer incidence varies geographically, with lower age-standardized rates in developing countries compared to industrialized nations. In the Eastern Mediterranean region, non-communicable diseases have increased due to demographic shifts, urbanization, and lifestyle changes. In Iraq, breast cancer is a major public health concern, significantly contributing to cancer incidence among women.[3] It has been showed that a significant proportion of breast tumors about 70% are initially detected by women themselves by noticing abnormal tenderness or lumps. Hence, learning regular breast self-examination (BSE) is essential for early breast abnormalities detection. This would significantly enhance the likelihood of successful treatment, increases the availability of treatment options and significantly improves the chances of recovery.[1,2] One of the main benefits of regular breast examination is to allow females to be familiar and aware about the normal feel and look of their breasts helping in identify any changes early. Slight asymmetry between the right and left breasts is common, however any changes beyond should be referred to specialist's consultant. Although most breast

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changes are not cancerous, only a professional evaluation can confirm this.[4]

Women who are liable to be affected by breast cancer are especially encouraged to be aware about an early detection importance through the routine of BSE.[5] Through practicing BSE, breast cancer physical signs and symptoms for example; lumps, swelling, distortion, dimpling of the skin, nipple pain, scaliness, or nipple retraction can be detected.[6] To increase knowledge about BSE and encourage breast cancer early detection, health education interventions are essential. These include educational programs and training that explain techniques, benefits, and practice of BSE, helping women to understand the correct examination performance and recognize any potential abnormalities. Such training has been shown to significantly improve women's awareness, beliefs, and frequency of BSE practice, by this means supporting earlier presentation to healthcare providers when changes are detected. In Iraq, factors such as war, environmental pollution, and lifestyle transition have a main contribution to a significant increase in cancer incidence. Despite of the available medical interventions, the lack of effective cancer prevention strategies has led to many cases being diagnosed at advanced stages which reduces the chances of successful treatment.[7,8]

METHODS

This descriptive study was conducted at Al-Yarmouk Teaching Hospital in Baghdad from 27th June 2022 to 22nd May 2023 letter No. 91 date 5th May 2022 and included 100 women aged 20 years and above. The study consisted of two parts: demographic data age, educational level, and marital status and a structured questionnaire of 14 items assessing women's knowledge about breast self-examination, with responses classified as "I know" (3), "I'm not sure" (2), and "I don't know" (1). Content validity of the instrument was established by a panel of 10 experts from relevant specialties. Data were analyzed using SPSS version 25, and the Chi-square test was applied.

RESULTS

Majority were between 20-29 years old (33%), high school 42%, married 84% [Table 1]. Most of women answered (I know) BSE except items 3, 7 and 14 who answered (I don't know) [Table 2]. No significant relationship between women's age and their knowledge about BSE except item 4 where they realized the importance of BSE at P≤0.05. It showed that most items recorded a high significant related to women's level of education and their knowledge about BSE while items 10, 12, 13 were non-significant at P≤0.05 (Tables 3-4). Items (the best time to do BSE is the first week after the menstrual cycle ended, I know how to examine my breast (steps I have to follow during examination), evaluate other advices about importance of BSE have significant, while the rest items have no significant at P≤0.05 (Table 5).

Table No. 1: Demographic characteristics of women (n=100)

Variable	No.	%
Age (years)		
20-29	33	33.0
30-39	26	26.0
4049	20	20.0
50-59	16	16.0
≥60	5	5.0
Level of Education		
Neither read nor write	9	9.0
Read and write	5	5.0
Primary school	20	20.0
High school	42	42.0
Intermediate or Graduate	19	19.0
Postgraduate	5	5.0
Marital status		
Single	10	10.0
Married	84	84.0
Divorce	3	3.0
Widow	3	3.0

Table No. 2: Distribution of the women's knowledge about breast self-examination

Women's Knowledge	I Know		I'm Not Sure		I Don't Know	
	No.	%	No.	%	No.	%
Each woman has to do BSE	56	56.0	7	7.0	37	37.0
Breast self- examination is considered as the easiest way of early detection of breast cancer	52	52.0	22	22.0	26	26.0
The best time to do BSE is the first week after the menstrual cycle ended	46	46.0	4	4.0	50	50.0
Realize the importance of the BSE	72	72.0	8	8.0	20	20.0
I know how to examine my breast. (Steps I have to follow during examination	51	51.0	8	8.0	41	41.0
It is better to examine your breast in bathroom in front of a mirror	44	44.0	15	15.0	41	41.0
It is better to use water and soap or powder when start doing breast self-examination	29	29.0	17	17.0	45	45.0
Realize the natural physiological breast changes	52	52.0	19	19.0	29	29.0
Check out all reports and medical advices about breast self –examination	46	46.0	14	14.0	40	40.0
I know the risk of taking hormonal therapy without consulting my doctor	49	49.0	18	18.0	33	33.0
I abide the necessary examination for early detection of breast diseases and	62	62.0	15	15.0	23	23.0

cancer						
I realize the pathological changes that happened; breast size, bedsore & abdominal secretion	71	71.0	13	13.0	16	16.0
Evaluate others advices about importance of breast self –examination	81	81.0	13	13.0	6	6.0
Keep on my fitness by exercising	27	27.0	17	17.0	55	55.0

Table No. 3: Relationship between women's knowledge and age groups

Items	20-29			30-39			40-49			50-59			60 and above			P value
	I know	Not sure	Don't know	I know	Not sure	Don't know	I know	Not sure	Don't know	I know	Not sure	Don't know	I know	Not sure	Don't know	
Each woman has to do BSE	21	1	11	12	3	11	12	2	6	9	1	6	2	-	3	0.809
	33%			26%			20%			16%			5%			
BSE helps early detection of breast cancer	17	10	6	14	4	8	10	4	6	9	4	3	2	-	3	0.574
	33%			26%			20%			16%			5%			
Best time: first week after menstruation	18	1	14	13	1	12	5	1	14	9	1	6	1	-	4	0.472
	33%			26%			20%			16%			5%			
Aware the importance of the BSE	25	-	8	17	3	6	17	-	3	11	4	1	2	1	2	0.043*
	33%			26%			20%			16%			6%			
Know steps of BSE	25	-	8	17	3	6	17	-	3	11	4	1	2	1	2	0. 274
	33%			26%			20%			16%			6%			
BSE done in front of mirror/ bathroom	17	6	10	12	3	11	5	5	10	9	1	6	1	-	4	0.276
	33%			26%			20%			16%			6%			
Soap/water may be used in BSE	11	7	15	7	4	15	3	3	14	7	2	7	1	1	3	0.714
	33%			26%			20%			16%			6%			
Recognize normal breast changes	19	5	9	12	6	8	9	4	7	9	4	3	3	1	1	0.989
	33%			26%			20%			16%			6%			
Check out all reports and medical advices about BSE	15	4	14	12	3	11	8	6	6	9	-	7	2	1	2	0.492
	33%			26%			20%			16%			6%			
Know risks of hormones without doctor	11	4	18	14	6	6	14	3	3	9	3	4	1	2	2	0.063
	33%			26%			20%			16%			6%			
Do screening for early detection	22	5	6	15	6	5	13	1	6	11	1	4	1	2	1	0.368
	33%			26%			20%			16%			6%			
Recognize abnormal breast changes.	25	5	3	17	5	4	14	-	6	11	2	3	4	1	-	0.405
	33%			26%			20%			16%			6%			
Evaluate others' advice about BSE	30	3	-	23	1	2	15	3	2	10	4	2	3	2	-	0.135
	33%			26%			20%			16%			6%			
Maintain physical fitness through regular exercise	11	6	16	7	4	15	7	2	11	3	5	8	-	-	5	0.415
	33%			26%			20%			16%			6%			

*P=Significant (≤0.05)

Table No. 4: Relationship between women's knowledge and Level of Education

Item	No read & write			Read & write			Primary school			High school			Intermediate / Graduate			Postgraduate			P value
	I know	Not sure	Don't know	I know	Not sure	Don't know	I know	Not sure	Don't know	I know	Not sure	Don't know	I know	Not sure	Don't know	I know	Not sure	Don't know	
Each woman has to do BSE	2	-	7	1	1	3	6	1	13	25	4	13	17	1	1	5	-	-	0.001*
	9%			5%			20%			42%			19%			6%			
BSE helps early detection of breast cancer	2	4	3	2	-	3	5	5	10	23	9	10	16	3	-	4	1	-	0.004*
	9%			5%			20%			42%			19%			6%			
Best time: first week after menstruation	3	-	6	1	-	4	4	2	14	21	2	19	12	-	7	5	-	-	0.051*
	9%			5%			20%			42%			19%			6%			
Aware the importance of the BSE	2	2	5	1	1	3	12	2	6	34	2	6	18	1	-	5	-	-	0.002*
	9%			5%			20%			42%			19%			6%			
Know steps of BSE	4	-	5	3	-	2	3	3	14	21	47	17	15	1	3	5	-	-	0.010*
	9%			5%			20%			42%			19%			6%			
BSE done in front of mirror/ bathroom	1	1	7	1	1	3	3	-	17	20	10	2	14	3	25	-	-		0.000*
	9%			5%			20%			42%			19%			6%			
Soap/ water may be used in BSE	1	1	7	-	-	5	3	2	15	16	5	21	4	6	9	5	-	-	0.000*
	9%			5%			20%			42%			19%			6%			
Recognize normal breast changes	1	5	3	-	1	4	9	3	8	26	3	13	12	6	1	4	1	-	0.001*
	9%			5%			20%			42%			19%			6%			
Check out all reports and medical advices about BSE	-	2	7	1	-	4	6	1	13	25	6	11	12	3	4	2	2	1	0.003*
	9%			5%			20%			42%			19%			6%			
Know risks of hormones without doctor	3	2	4	4	-	1	8	2	10	19	10	13	12	2	5	3	2	-	0.318
	9%			5%			20%			42%			19%			6%			
Do screening for early detection	1	2	6	3	-	2	10	4	6	30	5	7	14	3	2	4	1	-	0.041*
	9%			5%			20%			42%			19%			6%			
Recognize abnormal breast changes.	5	2	2	3	-	2	13	3	4	34	4	4	12	3	4	4	1	-	0.657
	9%			5%			20%			42%			19%			6%			
Evaluate others' advice about BSE	6	1	2	4	1	-	14	4	2	39	3	-	14	3	2	4	1	-	0.248
	9%			5%			20%			42%			19%			6%			
Maintain physical fitness through regular exercise	-	2	7	-	1	4	2	3	15	8	9	25	13	2	4	5	-	-	0.000*
	9%			5%			20%			42%			19%			6%			

*P=Significant (≤0.05)

Table No. 5: Relationship between women's knowledge and marital status

Item	Single			Married			Divorce			Widow			P value
	I know	Not sure	Don't know	Know	Not sure	Don't know	I know	Not sure	Don't know	I know	Not sure	Don't know	
Each woman has to do BSE	4	1	5	51	5	28	1	-	2	-	1	2	0.212
	10%			84%			3%			3%			
BSE helps early detection of breast cancer	3	1	6	21	19	44	-	1	2	2	1	-	0.468
	3%			3%			84%			10%			
Best time: first week after menstruation	2	-	1	-	2	1	42	2	40	6	-	4	0.000*
	3%			3%			84%			10%			
Aware the importance of the BSE	-	0	3	-	0	3	16	8	60	4	-	6	0.467
	3%			3%			84%			10%			
Know steps of BSE	2	1	-	1	2	-	34	5	45	4	-	6	0.002*
	3%			3%			84%			10%			
BSE done in front of mirror/ bathroom	3	-	-	1	1	1	34	13	37	3	1	6	0.404
	10%			84%			3%			3%			
Soap/water may be used in BSE	2	-	1	2	0	1	45	15	24	5	2	3	0.968
	3%			3%			84%			10%			
Recognize normal breast changes	2	-	1	-	2	1	25	17	42	2	-	8	0.097
	3%			3%			84%			10%			
Check out all reports and medical advices about BSE	1	-	2	1	1	1	35	12	37	3	1	6	0.858
	3%			3%			84%			10%			
Know risks of hormones without doctor	1	1	1	-	-	3	27	17	40	5	-	5	0.357
	3%			3%			84%			10%			
Do screening for early detection	1	-	2	2	-	1	19	14	51	1	1	8	0.476
	3%			3%			84%			10%			
Recognize abnormal breast changes.	2	1	-	-	1	2	14	10	60	-	1	9	0.071
	3%			3 %			84%			10%			
Evaluate others' advice about BSE	-	-	3	1	2	-	5	10	69	-	1	9	0.026*
	3%			3%			84%			10%			
Maintain physical fitness through regular exercise	1	1	1	1	1	1	47	14	23	6	1	3	0.929
	3%			3%			84%			10%			

*P=Significant (≤0.05)

DISCUSSION

Most participants were aged 20–29 years (33%), had a high education level (42%), and were married (84%) [Table 1]. Lack of knowledge negatively affects screening practices and attitudes toward early detection. Education, marital status, age, and exposure to information are key predictors of breast cancer knowledge and BSE practice.[9,10] Higher knowledge is associated with increased likelihood of performing BSE, especially among educated women and those receiving training. Younger age and educational interventions are linked to higher BSE frequency.[11]

Most women reported "I know" BSE, except items 3, 7, and 14 with "I don't know" responses (50%, 45%, 55%) [Table 2]. Jahan et al[12] showed 76% had good knowledge of risk factors, 26% were unaware of symptoms, and 69.7% had never heard of BSE. Despite positive attitudes, 74% lacked access to information. Self-instruction programs significantly improved BSE skills ($t=4.23$, $p<0.0001$) and increased knowledge from pre- to post-test.

Dagne et al[13] showed that although awareness of breast cancer risk factors, symptoms, and BSE was high, actual practice was low, indicating a gap between knowledge and preventive behavior due to moderate knowledge levels. Another cross-sectional survey of 200 school teachers in Lagos, Nigeria achieved a response rate of 94%.[14] Several studies[15,16] have reported that awareness of women about BSE is generally high, only few of them actually perform it. In Nigeria, a study found that most adolescent girls were aware of BSE, but few practiced it[17], highlighting the need for interventions to improve practice and early detection. Table 3 showed that only "realize the importance of BSE" was significant, while other items were not significant regarding age group and BSE knowledge ($P<0.05$). Table 4 indicated that most items were significantly associated with education level, except items 10, 12, and 13 ($P<0.05$). Table 5 showed significant results for items related to timing of BSE,

examination steps, and valuing others' advice, while other items were not significant (P<0.05). Awogbayila et al[18] reported among market women in Owo, Nigeria found low knowledge of breast cancer risk and BSE, especially among younger and less educated women, with common misconceptions and poor screening awareness. The study recommended targeted educational interventions to improve BSE awareness and early detection in high-risk groups. Similarly, Oladimeji et al[19] reported low knowledge of the correct timing and methods of breast self-examination among Nigerian market women, especially among younger, married, and less educated participants, and recommended targeted educational interventions to improve screening practices.

CONCLUSION

Most women were aged 20–29 years (33%), high school education 42% and married 84%. Differences were observed in women's knowledge of BSE and participants' knowledge improved with motivation related to BSE.

Author's Contribution:

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Final Approval of version:	All the above authors
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Original Article

Nurses Knowledge Towards Infection Control Measures in Burn Unit

Fatima Jaber Shinjar, Abbas Abdulhasan Qasim and Mohannd Abd alkareem Khafel

ABSTRACT

Objective: To assess knowledge the nurses concerning measures of infection control among in burn units at al-Nasiriya city.

Study Design: Descriptive study

Place and Duration of Study: This study was conducted at the Al-Hussein Teaching Hospital in Al-Nasiriyah City, Iraq from 15th March 2024 to 2nd April 2025.

Methods: Seventy-two nurses selected purposively from the burn unit. Qualified nurses who were working in the hospital's burn unit, a nurse who was directly involved in the care of burn patients while working on locum bases for more than six months were included. Nurse who refused to participate in study, nurses were not involved directly in patients care e.g. nurse managers and nurses were excluded.

Results: The highest percentage of nurses working the burn unit were 56.2% with age 21-30 years and majority of them female nurses were with nursing diplomas. Most of the participants had a fair level of knowledge regarding infection control measures in burn unit. There is statistically significant relationship between nurses' knowledge and their age, training program and the Protocol availability about infection control, whereas non-significant association with the other variables.

Conclusion: Nurses in burns specialty wards must be proficient in aseptic technique practices since they play a critical role in preventing sepsis during burn patient care. Nurses who work in the hospital's burn units in Al-Nasiriya City are have fair level of on how to prevent infections in burn patients.

Key Words: Nurses knowledge, Infection control, Burn unit

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INTRODUCTION

About 180,000 individuals die from burn injuries annually, making burn injuries a serious public health concern globally. In low and middle-income countries, the number of burn-related deaths is seven times higher than in a high-income nation.[1] A burn episode in low- and middle-income nations occurs every 15 seconds which consider one of the primary causes of disability-adjusted life years lost is.[2]

Varity of infections have been frequently reported among patients with burn. Throughout the past ten years, the most frequent clinical consequences among patients admitted to a burn center were pneumonia, cellulitis, and urinary tract infections.[3] Up to 2.2% of hospitalizations for burn patients resulting from pneumonia complications, which consider the most common systemic infection in those patients.

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After a burn injury, invasive infection considered the primary cause of morbidity as well as mortality, with percent 51% of fatalities.[4] Moreover, the main causes of increased infection rates in burn wounds are low socioeconomic status, a lack of funds, a lack of prophylactic measures, a shortage of skilled health-care providers, beside to limited access to the primary healthcare facilities.[5,6]

Total body surface area (TBSA) of burn patient is often larger; increases the risk of infection since the skin's protective layer is lost; as well as 75% of all mortality in burns patients with more than 40% TBSA are as a result of burn site infection.[7] Within two weeks of admission, sepsis and the related invasive infection were the leading reasons of death after the first twenty-four hrs following a burn injury.[8]

Burn wound infections are dangerous and occasionally fatal conditions that can develop after an injury, with major consequences for burn individuals.[2,9] Thus, it was crucial that health-care providers who treat burn patients have knowledge beside abilities needed to ensure that standard care given to the patients and thereby avoid infection.[8] Since infection is a constant concern in hospital settings, the facility needs to develop a thorough plan to treat infection cases. This protocol should include infection surveillance, health education for medical staff, as well as isolation measures.[10,11] For infection prevention and control to be

implemented successfully, nurses' participation is essential.[12]

Because they work in an environment that encourages infections, nurses have a great responsibility to protect themselves, their families, as well as their patients. In their clinical work, nursing staff members are regularly exposed to a range of pathogens.[13]

In order to prevent as well as control infections, nurses are crucial. In order to lower the risk of infections as well as its complications, care for burn patients must be provided by knowledgeable as well as competent nurses who adhere to certain guidelines or protocols.[14]

The rate of hospital-acquired infections can increase due to lack of knowledge among nurse regarding infection control measures.[15]

METHODS

This descriptive study was conducted at Al-Hussein Teaching Hospital in Al-Nasiriyah City, Iraq from 15th March 2024 to 2nd April 2025 vide letter No. 5 dated 4-3-2024. Seventy-two nurses selected purposively from the burn unit. Qualified nurses who were working in the hospital's burn unit, a nurse who was directly involved in the care of burn patients while working on locum bases for more than six months were included. Nurse who refused to participate in study, nurses were not involved directly in patients care e.g. nurse managers and nurses were excluded.

Sociodemographic data has six items. It focuses on gathering basic sociodemographic information from research participants, such as age, sex, nursing qualification, years of experience in burn unit, participation in training program and protocol availability about infection control. Nurse's knowledge concerning measures of infection control in burn unit was involved 20 multiple-choice questions. For the right response, these are evaluated at (2), and for the incorrect response, at (1). Aggregate knowledge scores range from 0–20

The validity of the Instrument and the Instructional program had been accomplished by 20 experts from various scientific branches having at least 10 years of expert. Reliability was established by using test–retest reliability coefficient (r = 0.83). Data analysis and handling through IBM 25 SPSS software. Inferential statistical techniques, such as Chi-square.

RESULTS

The majority of the subjects were female (75%). According to age the results showed that most of the subjects were aged 21-30 years with percent (56.2%), and Diploma level of education with percent (69.4%). Regarding period of experience in a burn unit the results presented that most participants 37.5% have 1-2 years and 35.4% less than 1 year respectively. Only 9 of the nurses have training program about infection control guidelines and 77.1% of nurses in burn unit stated that there is no protocol available concerning infection control (Table 1).

Table No. 1: Sociodemographic characteristics of the nurses (N=72)

Category	No.	%
Gender		
Female	54	75.0
Male	18	25.0
Age (years)		
21-30	41	56.2
31-40	28	39.6
41 or above	3	4.2
Qualification		
Secondary	7	9.7
Diploma	50	69.4
Bachelors	15	20.8
Experience in the burn unit (years)		
< 1	25	35.4
1-2	27	37.5
3-5	18	25.0
> 5	2	2.1
Training about aseptic technique		
Yes	9	11.9
No	63	88.1
Availability of protocol about infection control		
Yes	16	22.9
No	56	77.1

Table No. 2: Nurses' total knowledge about infection control

Overall Items	Assess.	Freq.	%	Mean of score	Assess.
Knowledge about infection control measures	Poor	1	1.38	1.45	Fair
	Fair	47	65.27		
	Good	24	33.33		

Table No. 3: The Correlation between sociodemographic variables with nurses' knowledge related infection control measures at burn unit (n=72)

Sociodemographic variables	Chi	D.F.	P value	Significant
Age	13.375	2	0.010	S
Nursing qualification	13.644	2	0.762	NS
Experience	8.71	3	0.586	NS
Training about aseptic technique	1.443	1	0.02	S
Protocol availability regarding infection control	8.140	1	0.01	S

Nurses' knowledge concerning infection control is fair was 65.27% (Table 2).

Table 3 demonstrates that knowledge of burn nurses about infection control was statistically significantly correlated with their age (P=0.009), training program (P=0.02), also protocol availability (P=0.01), but not with the other variables.

DISCUSSION

The findings of the present study revealed most of subjects are female, this result congruent with a study conducted by Bandojoat[16], who found that 74 are female. This is not surprising because that nursing is viewed as a historically female profession and that women predominate in nursing schools.

More than half of studied subjects were within age group 21-30 yrs. These finding in agreed with study by Kadhim & Hamza[17] presented that 75% of the nurses were with age group 21-30 years. Sixty- nine of them had earned a diploma in general nursing. According to another study, 85.3% of the sample has a nursing diploma.[18]

The years of experience in the current study range from one to two years (37.5%). According to the study, 45% of the study sample had one year or less of experience.[13] The present study findings showed that only 11.9% of the burn nurses attended sessions for prevention of infection, on the other hand, 88.1% of them not attending these sessions. A study conducting in the Middle Euphrates teaching hospitals at burns units to determine nurses' knowledge about nosocomial infection conclude that more than half of burn nurses not attending training sessions concerning nosocomial infection at burns units.[19]

Many of nurses (77.1%) stated that there is no available protocol about infection management. In contrast, 90% of the nurses in the study stated that there is a strategy available for infection management.[13]

Nurses in the current research had a fair level of knowledge regarding infection management in burn patients, according to the statistics. In order to equip nurses for infection prevention, in-service education programs must be developed, even though they learned this information through practice.

The prevention of hospital-acquired infections in burn patients is largely dependent on nurses' understanding of infection management. The finding showed that fair level of knowledge about infection control in burn patients. These findings are comparable to AL-Salih et al[19] that reported that most of the nurses at burn unit were passed knowledge concerning nosocomial infections with 69.8%.

The results of the current investigation showed a statistically significant link correlation between age, training program as well as the protocol availability about infection control and knowledge the studied nurses. On the other hand, indicated there was no significant association between sex, levels of education as well as experience of burn nurses and their knowledge. This result proved by Kadhim[14] findings. The researchers believe that availability of the required equipment as well as training regarding infection control for burn patients making the nurses aware of how to utilize the equipment properly, they have learned how to control the infection. But AL-Salih et al[19] found no correlation between the demographic characteristics of the nurses and their level of knowledge in the burn units.

CONCLUSION

Nurses in burns specialty wards must be proficient in aseptic technique practices since they play a critical role in preventing sepsis during burn patient care. As stated by the study's findings, nurses who work in the hospital's burn units in Al-Nasiriya City are have fair level of on how to prevent infections in burn patients.

The highest proportion of the burn nurses were (21-25) years old, female, With experience is 1-2 year, Diploma, and the majority of them did not participating in training program

There is significant correlation between age, training program as well as the Protocol availability about infection control and knowledge the studied nurses. Whereas sex, levels of education, nurse's experience did not statistically significant correlate with nurses' knowledge related to measures of infection control in burn unit. However, there was no statistically significant relationship between nurses' experience, education, sex, and their knowledge of infection control measures in burn units.

Recommendations

- To improve adherence to aseptic technique among nurses in burn wards, there should be a continuous medical education program and reference policy materials available.
- A sufficient quantity of tools and supplies, such as colour coded bins, to help nurses in the burn units separate waste efficiently.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Fatima Jaber Shinjar, Abbas Abdulhasan Qasim
Drafting or Revising Critically:	Fatima Jaber Shinjar, Mohannd Abd alkareem Khafel
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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Narrative Review

Predicting Clinical Deterioration Using Sequential Laboratory Trends with Machine Learning Techniques

Clinical Deterioration Using Sequential Laboratory Trends

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ABSTRACT

Objective: To summarize the role of sequential laboratory trends and machine learning techniques in predicting clinical deterioration among hospitalized patients.

Place and Duration of Study: This study was conducted as a narrative review article from June 2024 to April 2025.

Methods: Relevant literature was searched through PubMed, Google Scholar, Scopus, Web of Science, and IEEE Xplore which was published till April 2025. Evidence regarding the predictive value of serial laboratory measurements and the performance of various machine learning algorithms was synthesized.

Results: Sequential changes in laboratory parameters, including serum creatinine, lactate, white blood cell count, platelet count, electrolytes, inflammatory markers, and arterial blood gases, were identified as important early indicators of worsening organ dysfunction and impending clinical deterioration. Machine learning approaches, such as logistic regression, random forest, gradient boosting, support vector machines, artificial neural networks, and recurrent neural networks, demonstrated the ability to identify complex temporal patterns and improve prediction accuracy compared with conventional risk assessment methods.

Conclusion: Predictive modelling based on sequential laboratory trends and machine learning techniques represents a promising strategy for the early detection of clinical deterioration in hospitalized patients. Further research focusing on robust validation, interpretability, and seamless clinical integration is required to optimize patient outcomes and enhance healthcare safety.

Key Words: Clinical deterioration; Machine learning; Sequential laboratory trends; Electronic health records; Early warning systems; Risk stratification.

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INTRODUCTION

Clinical deterioration in hospitalized patients remains a major challenge in modern healthcare, often leading to increased morbidity, prolonged hospital stays, and higher mortality rates. Early identification of patients at risk of deterioration is critical for timely intervention and improved clinical outcomes[1].

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Traditional methods of monitoring, including periodic vital sign assessments and clinician judgment, are often limited by subjectivity and may fail to detect subtle physiological changes that precede acute events. As a result, there is growing interest in leveraging data-driven approaches to enhance early detection and risk stratification in clinical settings[2]. Laboratory investigations are routinely performed in hospitalized patients and provide objective, quantifiable insights into physiological and biochemical status. Importantly, changes in laboratory parameters over time rather than isolated values may better reflect evolving pathophysiological processes[3]. Sequential laboratory trends, such as rising inflammatory markers, worsening renal function, electrolyte imbalances, or declining hematological indices, can serve as early indicators of clinical deterioration. However, the complexity and volume of such longitudinal data make it difficult for clinicians to interpret patterns accurately in real time, particularly in high-acuity environments. Recent advances in machine learning have opened new avenues for analyzing large and complex healthcare datasets[4]. Machine learning algorithms can identify nonlinear relationships, temporal patterns, and

interactions among multiple variables that may not be apparent through conventional statistical methods. By integrating sequential laboratory data into predictive models, these techniques can generate dynamic risk scores and provide early warnings for clinical deterioration[5]. Models such as random forests, gradient boosting machines, support vector machines, and deep learning architectures including recurrent neural networks and long short-term memory networks have shown considerable promise in capturing temporal dependencies and improving predictive accuracy in various clinical contexts[6]. The application of machine learning in predictive modelling has demonstrated encouraging results in areas such as sepsis detection, intensive care monitoring, and hospital readmission prediction[7-9]. However, many existing models rely heavily on vital signs or static baseline variables, with relatively limited focus on the prognostic value of sequential laboratory trends[10]. Furthermore, there is a need for models that are not only accurate but also interpretable and clinically actionable. Black-box models, although powerful, may face resistance in clinical adoption due to lack of transparency, highlighting the importance of explainable artificial intelligence in healthcare[11-13].

METHODS

Traditional methods of monitoring, including periodic vital sign assessments and clinician judgment, are often limited by subjectivity and may fail to detect subtle physiological changes that precede acute events. As a result, there is growing interest in leveraging data-driven approaches to enhance early detection and risk stratification in clinical settings[2]. Laboratory investigations are routinely performed in hospitalized patients and provide objective, quantifiable insights into physiological and biochemical status. Importantly, changes in laboratory parameters over time rather than isolated values may better reflect evolving pathophysiological processes[3]. Sequential laboratory trends, such as rising inflammatory markers, worsening renal function, electrolyte imbalances, or declining hematological indices, can serve as early indicators of clinical deterioration. However, the complexity and volume of such longitudinal data make it difficult for clinicians to interpret patterns accurately in real time, particularly in high-acuity environments. Recent advances in machine learning have opened new avenues for analyzing large and complex healthcare datasets[4]. Machine learning algorithms can identify nonlinear relationships, temporal patterns, and interactions among multiple variables that may not be apparent through conventional statistical methods. By integrating sequential laboratory data into predictive models, these techniques can generate dynamic risk scores and provide early warnings for clinical deterioration[5]. Models such as random forests, gradient boosting machines, support vector machines, and deep learning architectures including recurrent neural networks and long short-term memory networks have shown considerable promise in capturing temporal dependencies and improving predictive accuracy in various clinical contexts[6]. The application of machine learning in predictive modelling has demonstrated encouraging results in areas such as sepsis detection, intensive care monitoring, and hospital readmission prediction[7-9]. However, many existing models rely heavily on vital signs or static baseline variables, with relatively limited focus on the prognostic value of sequential laboratory trends[10]. Furthermore, there is a need for models that are not only accurate but also interpretable and clinically actionable. Black-box models, although powerful, may face resistance in clinical adoption due to lack of transparency, highlighting the importance of explainable artificial intelligence in healthcare[11-13].

Selection of Articles: Articles were selected if they discussed machine learning or artificial intelligence methods for predicting clinical deterioration in hospitalized patients. Studies using laboratory parameters, time-series clinical data, electronic health records, or sequential patient monitoring data were included. Preference was given to recent original articles, review articles, and clinically relevant prediction model studies. Case reports, editorials, letters to the editor, opinion-based articles, non-English articles, and studies not related to clinical deterioration or machine learning were excluded.

Data Extraction: Information was extracted regarding author, year of publication, study population, laboratory variables, machine learning algorithms, predicted clinical outcomes, model performance, and major findings. Attention was given to studies using sequential laboratory trends rather than single-point laboratory values. The extracted information was reviewed and summarized narratively. The findings were organized according to the role of laboratory trends, commonly used machine learning techniques, predicted outcomes, clinical usefulness, limitations, and future directions.

Clinical deterioration in hospitalized patients remains one of the most significant contributors to preventable morbidity and mortality in modern healthcare systems. It refers to a progressive decline in a patient's physiological condition that may ultimately result in severe complications such as organ dysfunction, unplanned intensive care unit (ICU) admission, cardiac arrest, prolonged hospitalization, or death if not recognized and managed promptly[1]. Deterioration may occur suddenly or evolve gradually over hours to days, often preceded by subtle physiological, biochemical, or clinical warning signs that may be overlooked in busy clinical environments[14]. Hospitalized patients, particularly those admitted to medical wards,

emergency units, and postoperative recovery settings, remain vulnerable to clinical decline due to underlying disease progression, infection, treatment-related complications, metabolic disturbances, or acute organ dysfunction[15]. Common causes include sepsis, respiratory failure, acute kidney injury, electrolyte imbalance, myocardial ischemia, hemorrhage, and neurological deterioration[4]. Timely identification of these changes is critical because delayed intervention significantly worsens outcomes and increases mortality risk. Despite this, failure-to-rescue remains a persistent problem due to delayed recognition, inadequate monitoring, fragmented communication, and variability in clinician response[16]. Traditional monitoring systems primarily depend on bedside clinical assessment and early warning scores such as the Modified Early Warning Score (MEWS), National Early Warning Score (NEWS), and Sequential Organ Failure Assessment (SOFA). These scoring tools are widely used to identify deteriorating patients by integrating vital signs such as respiratory rate, heart rate, blood pressure, oxygen saturation, and temperature[7].

Role of Sequential Laboratory Trends

Sequential laboratory trends play a critical role in the early identification of clinical deterioration among hospitalized patients. Unlike isolated laboratory measurements taken at a single time point, sequential laboratory monitoring provides dynamic information regarding the progression or improvement of a patient's physiological status over time[17]. Clinical deterioration is often not an abrupt event but rather a gradual biological process characterized by evolving biochemical abnormalities before overt symptoms become clinically apparent. Therefore, temporal laboratory changes may serve as early indicators of impending deterioration, allowing timely intervention and improved patient outcomes. Routine laboratory investigations are integral to inpatient care and provide objective insights into organ function, inflammatory status, metabolic balance, and systemic physiological stress. Commonly monitored parameters include complete blood count, serum electrolytes, renal function tests, liver enzymes, inflammatory markers, coagulation profiles, lactate, arterial blood gases, and cardiac biomarkers[18].

For example, a progressive rise in serum creatinine over successive measurements may suggest worsening renal function before overt acute kidney injury becomes clinically obvious[19]. Similarly, increasing serum lactate may reflect deteriorating tissue perfusion, occult shock, or developing sepsis even when vital signs remain temporarily stable[20]. Progressive leukocytosis or neutrophilia may signal worsening infection, while falling hemoglobin may suggest occult bleeding or marrow suppression. Temporal trends are particularly important because clinical physiology is dynamic rather than static. A laboratory value that remains within the conventional "normal" range may still be clinically concerning if it shows rapid deterioration relative to the patient's baseline[3]. For instance, creatinine rising from 0.7 to 1.2 mg/dL may remain technically within acceptable limits but could represent substantial renal decline. Static threshold-based systems may fail to detect such early warning patterns, whereas sequential analysis captures evolving trajectories. Laboratory trends are also less vulnerable to observer bias compared with subjective clinical assessments. Vital signs may be inaccurately recorded due to human error, inconsistent technique, or workload limitations, whereas laboratory results are generated using standardized analytical methods[4].

Machine Learning Techniques in Prediction Models

Machine learning (ML) has emerged as a transformative analytical approach in modern healthcare, particularly in predictive modelling for early detection of clinical deterioration. Unlike traditional statistical models that rely on predefined assumptions and linear relationships, machine learning algorithms can process large multidimensional datasets, recognize hidden patterns, model nonlinear interactions, and continuously improve predictive performance through iterative learning. These characteristics make machine learning especially valuable in hospital settings, where patient deterioration is influenced by complex interactions among physiological, biochemical, demographic, and treatment-related variables. Traditional clinical prediction systems such as MEWS, NEWS, and SOFA are useful bedside tools but remain limited by their dependence on manually selected variables, threshold-based scoring, and static interpretation[11].

Several machine learning techniques have been applied in healthcare deterioration prediction. Logistic regression, although traditionally considered a statistical method, remains one of the most commonly used baseline machine learning classifiers due to its simplicity, interpretability, and robust performance in binary outcome prediction[13]. In clinical deterioration modelling, logistic regression has been used to predict ICU transfer, mortality, and sepsis using combinations of laboratory values, demographics, and clinical observations. Decision trees are another commonly used machine learning approach. These models classify patients through hierarchical branching decisions based on predictor thresholds[14].

DISCUSSION

Predictive modelling of clinical deterioration has emerged as an increasingly important area in modern healthcare due to the growing need for early recognition of patient instability and prevention of adverse outcomes. Hospitalized patients frequently demonstrate physiological and biochemical warning signs before overt clinical collapse; however, conventional

monitoring approaches often fail to recognize these subtle dynamic changes in time. This review highlights the evolving role of sequential laboratory trends combined with machine learning techniques in improving prediction of clinical deterioration, offering a more data-driven and proactive approach to inpatient care[21]. One of the major findings from the reviewed literature is that clinical deterioration is rarely a sudden isolated event but rather a progressive process characterized by evolving physiological and biochemical abnormalities. Traditional early warning systems such as NEWS, MEWS, and SOFA remain clinically useful, but their dependence on threshold-based scoring and intermittent bedside observations limits predictive sensitivity, especially in patients whose deterioration follows non-linear or atypical patterns[22]. Previous studies have shown that static scoring systems may miss early deterioration signals that are detectable through temporal data analysis. This limitation has created a need for more adaptive predictive strategies capable of recognizing hidden clinical trajectories[22-25].

Sequential laboratory trends represent an important advancement in this regard. Unlike isolated laboratory values, serial biochemical measurements provide dynamic insight into organ function, inflammatory progression, metabolic instability, and evolving systemic stress. Progressive changes in creatinine, lactate, platelet count, leukocyte count, electrolytes, arterial blood gases, and inflammatory biomarkers often precede overt clinical decline[26]. The reviewed literature consistently suggests that temporal laboratory monitoring offers superior predictive information compared with single-point measurements, particularly for identifying sepsis, acute kidney injury, respiratory failure, and impending ICU transfer. Another important observation from this review is the increasing effectiveness of machine learning in predictive healthcare applications[27]. Conventional statistical models often struggle to handle high-dimensional datasets, temporal dependencies, and nonlinear predictor interactions. Machine learning algorithms such as logistic regression, decision trees, random forests, gradient boosting, support vector machines, artificial neural networks, and recurrent neural networks demonstrate significant advantages in this context. These techniques can process large clinical datasets, detect complex hidden relationships, and continuously improve predictive performance[28].

CONCLUSION

Predictive modelling of clinical deterioration using sequential laboratory trends and machine learning techniques represents a promising advancement in modern healthcare. Unlike conventional monitoring systems that rely primarily on static observations and threshold-based scoring, these approaches enable dynamic assessment of patient risk by capturing evolving biochemical and physiological changes over time. Sequential laboratory trends provide valuable early indicators of organ dysfunction and systemic deterioration, while machine learning algorithms offer the capability to analyze complex multidimensional clinical data with greater accuracy and adaptability.

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Case Report

Depression During Prolonged Diagnostic Uncertainty in Non-Tuberculous Mycobacterial Infection

Yustika Izziyatu Anindita[1,2], Azimatul Karimah[1,2], Ariani Permatasari[3,4] and Linda Astari[5,6]

ABSTRACT

Non tuberculous mycobacterial infection may resemble pulmonary tuberculosis, particularly in tuberculosis endemic settings, and confirmation often requires repeated microbiological evaluation before the causative organism is identified. During this period patients may experience persistent symptoms, treatment interruptions, and considerable uncertainty regarding the course of illness. A 38-year-old woman underwent a complex four-year diagnostic course before infection with Mycobacterium other than tuberculosis was confirmed. She was initially treated for pulmonary tuberculosis but developed drug reactions and repeatedly inconclusive microbiological results. As investigations continued without diagnostic clarity she developed emotional exhaustion, sleep disturbance, functional decline, and persistent low mood. Psychiatric evaluation revealed a Patient Health Questionnaire 9/17 and a Generalized Anxiety Disorder 7/7, consistent with severe major depressive disorder. Management included supportive psychotherapy, family psychoeducation, and initiation of sertraline alongside ongoing multidisciplinary care involving psychiatry, pulmonology, and dermatology. After psychiatric involvement the patient reported better understanding of the diagnostic process and remained engaged with treatment while further microbiological identification was pursued. The clinical course reflects the psychological strain that prolonged diagnostic uncertainty may impose during the evaluation of chronic infectious disease.

Key Words: mycobacterium infections, nontuberculous, depressive disorder, consultation liaison psychiatry, diagnostic errors, patient compliance

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INTRODUCTION

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Non-tuberculous mycobacterial infections are increasingly recognized causes of chronic pulmonary and extrapulmonary disease. In tuberculosis endemic regions these infections often resemble pulmonary tuberculosis clinically and radiologically, which can lead to misdiagnosis and repeated treatment changes before the correct diagnosis is established.[1,2] Confirmation frequently requires integration of clinical findings with repeated microbiological testing, making the diagnostic process lengthy and uncertain.[2,3] When illness trajectories extend over months or years, repeated investigations and changing treatment explanations can become a significant psychological burden. Persistent symptoms and uncertainty regarding the course of disease may generate frustration, fatigue, and loss of control, which over time can contribute to depressive symptoms and reduced engagement with care.[4-6]

CASE REPORT

(clinical summary, pathological findings, management and outcome)

A 38-year-old woman was referred to the psychiatry service at the TB DOTS clinic for psychological evaluation after a prolonged illness course marked by repeated diagnostic changes. The major clinical events

during this diagnostic course are summarized in Table 1. Her symptoms began in 2021 with chronic cough lasting more than three months. In 2022 she was diagnosed with pulmonary tuberculosis at a primary healthcare center and started on first line anti tuberculosis therapy. Two weeks after treatment initiation she developed generalized urticaria followed by drug induced hepatitis, requiring discontinuation of treatment for approximately nine months. After hepatic recovery anti tuberculosis therapy was restarted, but she developed recurrent pruritus and progressive cutaneous nodules. In early 2023 further evaluation at a referral hospital showed negative sputum and radiological findings for tuberculosis, and she was treated as a non-tuberculosis case with surgical management of cutaneous abscesses, although her symptoms persisted.

Figure No. 1: Multiple nodular and crusted cutaneous lesions caused by non-tuberculous mycobacterial infection.

Table No. 1. Chronological timeline of the patient's illness showing major clinical events, diagnostic evaluations, treatment interruptions, and the onset of depressive symptoms

Year	Clinical event
2021	Chronic cough begins
2022	Diagnosis of pulmonary tuberculosis, anti-tuberculosis therapy started
2022	Drug induced hepatitis, treatment discontinued
2023	Progressive cutaneous nodules, negative sputum evaluation
2025	Referral to tertiary hospital, biopsy performed
2025	Non tuberculous mycobacteria confirmed
2025	Depressive symptoms identified, psychiatric treatment initiated

In April 2025 she was referred to Dr Soetomo General Academic Hospital for further evaluation. Repeated sputum examinations remained negative, but chest computed tomography suggested active pulmonary infection and anti-tuberculosis therapy was restarted. Worsening cutaneous lesions prompted additional evaluation, including investigation for autoimmune disease. Subsequent biopsy and microbiological examination of skin tissue identified non tuberculous mycobacteria, confirming Mycobacterium other than tuberculosis and leading to modification of antimicrobial therapy.

During this prolonged diagnostic course, the patient reported increasing emotional distress with persistent sadness, fatigue, sleep disturbance, and hopelessness that had been present for approximately one year prior to psychiatric referral. Psychiatric assessment demonstrated a Patient Health Questionnaire nine score of seventeen and a Generalized Anxiety Disorder seven score of seven, consistent with severe major depressive disorder. She had marked fatigue, reduced appetite with six kilograms of weight loss, and difficulty walking due to painful nodular lesions on the soles of her feet. Multiple nodular and partially crusted skin lesions were observed on the face, scalp, hands, and soles of the feet (Figure 1). Social withdrawal and dependence on family members for daily care gradually increased.

Management involved supportive psychotherapy focused on coping with illness related uncertainty, family psychoeducation, and initiation of sertraline. Multidisciplinary communication between psychiatry, pulmonology, dermatology, and community health services was strengthened to support adherence and provide consistent explanations regarding the diagnostic process. With psychiatric support the patient

reported better understanding of her condition and remained engaged with ongoing treatment and

DISCUSSION

Non tuberculous mycobacterial infection often takes time to diagnose, especially in settings where tuberculosis is common and is usually treated first.[2,3] In this patient, the problem was not only the delay itself, but the repeated shifts in explanation and treatment. Each change seemed to reset expectations without leading to clear improvement. Over time, this made the illness feel unpredictable and difficult to make sense of. The depressive symptoms did not appear suddenly but seemed to build up alongside this process. The patient described increasing fatigue, frustration, and eventually a sense that there was no clear endpoint to her condition. In that context, the low mood and loss of motivation felt closely tied to the ongoing uncertainty rather than being a separate problem. This pattern is often seen in patients who go through long and unclear medical courses, where the issue is not only the illness itself but the lack of a stable understanding of what is happening.

From a practical point of view, these changes matter because they affect how patients stay engaged with treatment. When the course feels unclear or repeatedly changing, it becomes harder to maintain motivation.[2,3] In this case, involving psychiatry helped create space to address those concerns directly. Supportive therapy, family involvement, and more consistent explanations from the treating teams seemed to help the patient stay engaged while the medical workup continued.

TAKE HOME MESSAGE

Prolonged diagnostic uncertainty in chronic infectious disease can impose a significant psychological burden and may contribute to depressive symptoms that affect treatment engagement. Early recognition of emotional distress and collaboration between medical and psychiatric teams can help patients remain engaged in care during complex diagnostic and treatment pathways.

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