Original Article

Bucket Handle Tear Reduction and Repair by a Locally Customized Outside-in Technique; A Simple, Cost-Effective Approach

Javed Iqbal, Shams U Rehman and Naeem Ullah

ABSTRACT

Objective: Financial restraints are one of the factors that affect repair of the bucket handle tear, as this surgery needs more costly implants and so repair is impractical in limited resources parts of the globe. Therefor the default treatment of bucket handle tear is meniscectomy. A simple, cost effective and reproducible technique has been develop in such scenario. We sought to evaluate the effectives of this technique for bucket handle tear

Study Design: A Prospective study.

Place and Duration of Study: This study was conducted at the Department of Orthopaedic, Traumatology and Sports medicine, MTI, LRH from January 2023 to January 2024.

Methods: A total of 26 patients included in this study & followed for 12 months Bucket handle tear was first reduced and then stabilized by outside in technique, and then the posterior horn was repaired by all-inside meniscus repair device. stability was assessed per operatively by probing the repaired part and success was assessed by patients' symptoms, Barrett et al criteria and return to their routine activities and sports.Pre surgery, post-surgery and final follow up PROMS were recorded using IKDC & Tegner Lysholum scores.

Results: A total of 26 patients of both genders with mean age of 32.3±5.30 years were included in this study. 24(92%) patients were male and 2 (8%) patients were female. Associated ACL injury was in 3 cases (7%), Road traffic accident was the most common cause. During surgery, successful reduction and repair was achieved in 25 patients (96%), while reduction failed in one case (3%)Using Barrett et al criteria, healing was achieved in 24patients (96%), while 1 (4%) patient had recurrence of tear. Repair was planned but that patient lost for further treatment. Our treatment modality was much cheaper that commercially available treatment; average cost of this Outside -in implants was RS 600 to RS 1500, and the average cost of commercially available implant was Rs 18000 to Rs. 25000.IKDC, Tegner Lysholum scores showed a statistically significant improvement at each follow up in all patients

Conclusion: This study concluded that this customized Outside-In technique is simple, reproducible, cost effective, technique leading to satisfactory healing rate and excellent functional outcomes.

Key Words: Bucket handle tear, meniscus tear, meniscus repair, Outside-In meniscus, meniscectomy

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INTRODUCTION

Meniscus tear is the most common injury of the knee joint, that happens during trauma to the knee during sports like football, cricket, badminton, Kabaddi and other vigorous and pivoting sports1. Road traffic accident, Fall from height, landing on foot in awkward positions are the other main causes of meniscus tear.[1,2]

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Meniscus tear is of various types that include longitudinal tear, horizontal tear, radial tear, bucket handle tear, root tear, degenerative tear and complex tear,[3] If left as such, meniscus tear causes symptoms like pain, swelling, popping, catching, locking, inability to perform activities of daily living, return to sports, and finally early onset osteoarthritis Treatment for meniscus tear is either meniscectomy, or repair. This has shown by many studies that meniscus repair is superior over meniscectomy.[4-6] There are various types of implants available for meniscus repair which include All-Inside repair devices, Inside-Out repair devices, Outside-In repair devices. [7]Bucket handle tear comprises up to 10 % of meniscus tears; Meniscectomy for such tears removes large portion of meniscus with resultant increased risk of osteoarthritis knee joint.[3,8]On the other hand, Repair for bucket handle tear has many challenges including cost of implants, technical expertise and post operative rehabilitation protocol and care. [7,8] In developed countries of the globe where cost

is not an issue for medical care, the modern repair implants and gadgets has facilitated the repair where repair for the bucket handle tear is common practice. But in limited resources settings where cost is a restraint to medical care, all modern gadgetries can't be utilized for meniscus repair and so the default treatment is still meniscectomy, with resultant suboptimal outcomes compared to repair.[8,9] One way to repair bucket handle tear is to first reduce the displaced meniscus, then stabilization is achieved by Inside -Out Implant; that is sharp shooter needles. Then posterior horn is stitched and stabilized by All Inside meniscus repair device.[10,11,12.] The above mentioned Inside-Out Meniscus repair device/Sharp shooter, is expensive, and thus adding to the high cost of the procedure. In this study, we have utilized a cost effective, simple, and reliable Outside-In technique for the reduction and repair of the bucket handle tear; this of course is a step-in paradigm shift from meniscectomy to meniscus repair in poorer and limited resources settings, as this approach decrease cost of procedure.

METHODS

This prospective descriptive case series was conducted in the Department of Orthopedics, Traumatology, and Sports Medicine, MTI-LRH, from jan 2023 to jan 2024, with ethical approval and informed consent obtained. Patients aged 15–45 years with bucket-handle tears of the medial meniscus, including those with anterior cruciate ligament injuries, were included. Exclusions were multi-ligament injuries, cartilage lesions, non-repairable degenerative meniscus tears, and revision surgeries. All patients were admitted via purposive sampling, with detailed history, clinical examination, MRI, and preoperative knee scores recorded. Surgical planning included identifying features like the double PCL sign on some MRIs. Procedures were performed by a single surgeon using standardized techniques and materials, including a meniscus repair device.

involved recording patient demographics, detailed clinical history, and specialized knee examination findings. MRI findings, including any double PCL sign, were documented. Preoperative knee scores were noted, and surgical details, including the type of meniscus repair device used, were recorded. Postoperative follow-ups assessed functional outcomes and complications systematically.

Statistical Analysis: SPSS version 22 was used for statistical analysis of the variables categorical variables were expressed in frequency & percentages, while scale variables were expressed in form of mean & standard deviation. Inferences for categorical variables were calculated using chi square test.Scale variables inferences were calculated using paired t test.Sub group analysis used for confounding effect adjustment and to know the effect among different variables P value of less than 0.05 was kept significant

RESULTS

A total of 26 patients of both genders were included in this study . Age range was from 18 years to 45 years with mean age of 32.3±5.30 years .24(92 %) patients were male and 2 (8%) patients were female. Right knee was involved in 18 cases (70%) and left in 8 cases (30%). Associated ACL injury was in 3 cases (7%), Road traffic accident was the most common mechanism, 14 patients, (53.84%).Sports injuries including cricket and football injury was in 8 patients (30.76%), and fall was the cause in 4 patients (15.38%) Time since injury to surgery was from 6 months to 24 months (13.38±4)Tear that was extending up to anterior horn and that was stabilized by one stitch was 23, (95.83%).

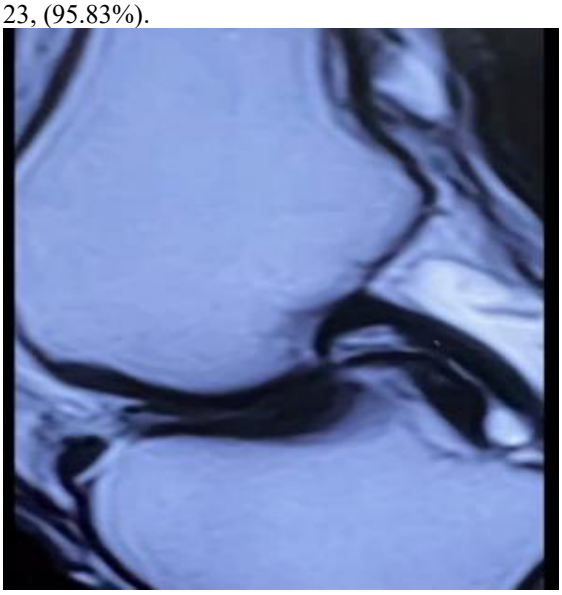

Figure No. 1: Double PCL sign.

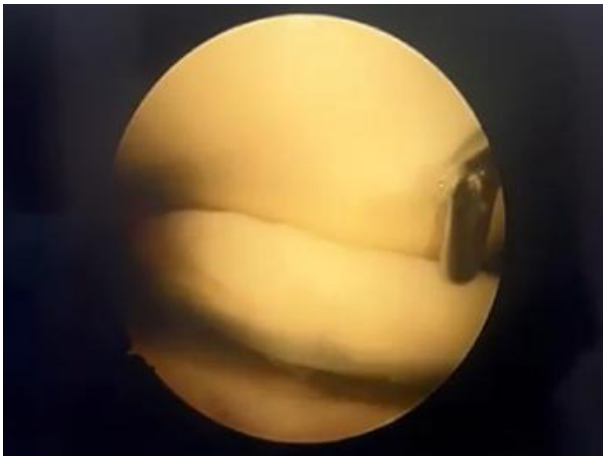

Figure No. 2: Bucket Handle tear displaced in intercondylar notch

While tear that involved anterior horn and that was stabilized by 2 stitches (4.16%) was in one meniscusIn 3 patients (11.53) Vicryl 2/0 suture was used for repair, & in all 3 patients' successful reduction and then

healing achieved (100%)While in remaining all 23 patients (88.46%), PDS 2/0 suture was used for reduction and repair and it was successful in all (100%)

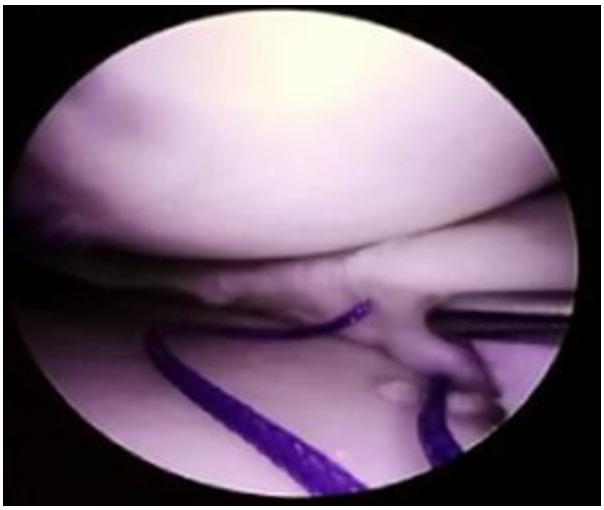

Figure No. 3: Locally customized technique Stitch looping through the meniscus body

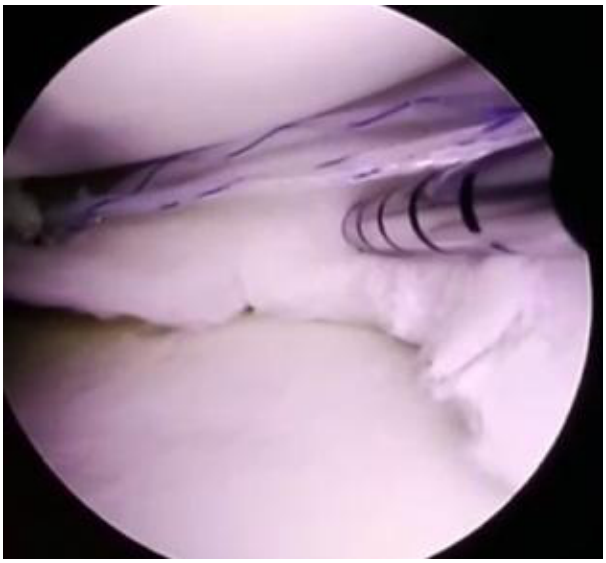

Figure No. 4: All -Inside Stitch in posterior Horn

Table No. 1: Patients Demographics Details

Parameters		Total number of cases n =26	
		Number	Percentage and mean
1	Age	18 years to 45 years	32.3±5.30 years
2	Gender	Male 24 Female 2	92% male 8% female
3	Side	Right knee 18 Left knee 8	69.23% right knee 30.76% left knee
4	Time since injury	6 months to 24 months	13.38 ±4
5	Associated ACL tear	2 patients	7 %
6	No of stabilizing stitches	One stitch ……23 Two stitches …….1	95.83 % 4.16%
7	Mechanism	RTA 14 Sports Injuries 8 History of Fall 4	53.84% 30.76% 15.38%

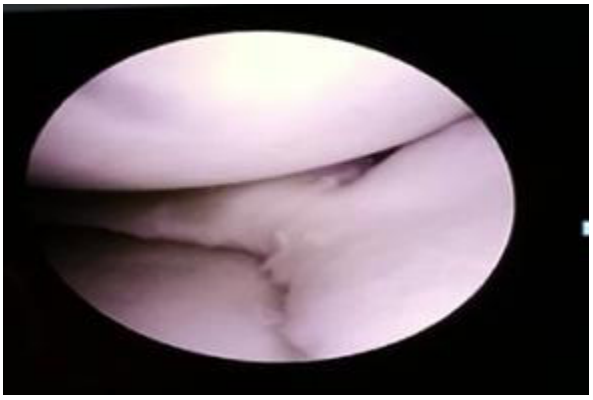

Figure No. 5: Reduced & Stabilized meniscus

Table No. 2: Per Operative outcome of customized outside-in repair technique.

Variable	Total number	Percentage
Reduction and Repair successful	25 Menisci	96.15%
Reduction and Repair Failed	1 meniscus	3.84%

Table No. 3: Post Operative Outcome of meniscus repair and healing. Clinical Criteria of Barrett et al.)

Variables	Total numbers	Percentage
Meniscus healed	24	96%
Meniscus Failed to heal	1	4%

Table No. 4: Comparison of Pre-Operative and Post Operative PROM values.

Scoring tool	Mean				P Value
	PRE-OP	POST OP 3MONTHS	POST OP 6MONTHS	POST OP 12 MONTHS	
IKDC	37.05±5.35	50.13±7.89	65.81±7.04	88.73±11.02	P<0.001
Tegner Lysholum score	40±11.5	58±8.05	87±10.02	96±8.31	P<0.001

Table No. 5: Comparison of Implants charges used in Meniscus repair surgery

Implant	Per patient charges in
Sharp shooter needles	Rs 18000-25000/patient= 74USD
Customized Canula and Suture for outside in technique	Rs 600 -1500 /patient ,=3.7USD

DISCUSSION

Our study was aimed to sought out the effectiveness of this cost-effective Customized Inside Out reduction and stabilization stitch & All Inside Meniscus Repair Device stitch for bucket handle tear medial meniscus. A successful reduction & repair was achieved, and there was marked improvement in all PROMs. Most patients were able to return to the same preinjury level of activity. We got successful reduction & repair in 25 patients (96.18%). In one patient, reduction was failed to achieve as the nature of tear was much complex, and tissue quality was not good, and meniscectomy was performed in that case. Like in our case, successful repair was achieved in 89.5% of patients in a study by Allicia Ostoposides Imada1 et al, they had failure in two (5.3%) patients.[2] In our study, we used Barret criteria for assessment of healing. we had healed meniscus in 25 patients (96%), and in one case, healing was not achieved, (4%). In literature, various rates of success have been mentioned from 66.1% to 100%[13] but few reports have evaluated BHMT. Success rates of 83-89.6% have been reported after repair of BHMT,[14] higher rate of success in our study may be due to tear location in red zone, good quality, concomitant ACL reconstruction. Researcher reported high healing success of white-white zone BHMT repair& reported 5 failed in 43 repaired patients with BHMT[15-16]. As far as the location of tear is concerned, posterior horn is notorious for slow healing. We used combined repair of Inside Out Technique for the reduction and then stabilization of the body, and then posterior horn was stabilized and fixed with all inside repair device, and this protocol has been followed in majority of the cases[17-20]. The success and failure of this customized Inside Out Device showed comparable results with commercially available Inside Out Implants, like sharp shooter meniscus repair needles.[21] One factor is injury surgery interval, and that was 6 moths to 24 months in our study. According to another study that the time between injury and repair was the most important factor influencing healing. On other hand, in a recent published study revealed high success rate (83%) in repair of chronic BHMT according to Barrett's criteria at a mean follow-up of 48 months[18,20] We used a variety of suture material, including Proline, PDS, fiber wire, and the results were comparable in short outcome.[13] The cost of a single meniscal Inside Out Sharp Shooter Needles is 74USD (16000-25000 PKR)[14] On the other hand, all gadgets of the customized Inside Out Protocol, including canula, strong sutures like Fiber Wire suture, PDS, Prolene, on average, was 3.7USD (600-1500 PKR). All PROMS improved significantly from pre surgery level and then at each follow up; IKDC score improved from 37.05±5.35 to 88.73±11.02, and Tegner activity score also improved from 40±11.5 to 96±8.31.Previous studies have demonstrated higher PROM scores in patients undergoing meniscal repair compared to those who underwent a meniscectomy.[22-23]

Limitations: There were some limitations like small number of patients and lack of control group. A 2nd look arthroscopy is gold standard to evaluate the healing status of meniscus. MRI can also be used postoperatively to assess the meniscus status. We used the Barret criteria which indirectly determines the healing status. So, we recommend multicenter, double blinded COHORT study to overcome these limitations and to generate strong evidences

CONCLUSION

This study showed that this locally customized OUTSIDE-IN TECHNIQUE is cost effective, reproducible, promising results-oriented approach for the reduction and stabilization of body of bucket handle tear medial meniscus along with ALL-INSIDE meniscus repair device for posterior horn repair

Future Findings: This gives direction regarding matters that would require more study; this approach ought to be researched with bigger groups of patients followed up for a longer period in larger and double blinded randomized control trial. Moreover, expanding the understanding of how personalized and individualized approach, indicating certain anatomical characteristics, therapy plans would have a beneficial effect on patients' outcomes as well.

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Author's Contribution:

Concept & Design or acquisition of analysis or	Javed Iqbal, Shams U Rehman

interpretation of data:	
Drafting or Revising Critically:	Shams U Rehman, Naeem Ullah
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.

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