

Antibiotic Resistant *Pseudomonas Aeruginosa* Causing Nosocomial Infection in Burn Patients of Quetta, Pakistan

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ABSTRACT

Objective: This study was planned to estimate the possible risk factor of burn wound infection, frequency and antibiotic resistant to *Pseudomonas aeruginosa* in burn patients.

Study Design: Descriptive study.

Place and Duration of Study: This study was conducted at the Department of Microbiology Bolan Medical Complex Hospital Quetta from November 2018 to November 2019.

Materials and Methods: A total of 270 Swab samples were collected from 137 burn wound infected patients from BMC Hospital Quetta. Samples were then subjected to culture on different microbiological media along with Gram staining different biochemical tests and antimicrobial sensitivity was done with disc diffusion procedure.

Results: Revealed 220 out of 270 (81.48%) sample were contaminated with in different microorganism. Out of these positive culture n=125 (57%) strains of *Pseudomonas aeruginosa* were isolated. The most common cause was flame burns n=57(41.59 %), followed by scalds burns 38 (27.72 %), electric burns 23 (16.77 %) and chemical burns 19 (13.87 %), respectively. A total 125 isolates of *Pseudomonas aeruginosa* were recovered from burn patients and the most resistance 100% antibiotic was ampicillin and doxycillin. And least resistant of drugs are azithromycin and imipenem.

Conclusion: Increased trend of antimicrobial resistance is an alarming in infections in the area. Moreover, majority of burn patients were male aging above 20 years with flame burn the main cause of accident and incident.

Key Words: Antimicrobial resistance, Burn, *Pseudomonas aeruginosa*, Nosocomial infection.

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INTRODUCTION

Burn patients have a higher threat of nosocomial infection for numerous of reasons, Immuno-compromised impacts of burn, prolonged hospitalization, delayed of diagnosis and treatment method of burns patient¹. Burns infections are serious common public health problem worldwide. The Burn injuries vary among different age groups, gender and geographical region of the country². About half of the total global burn cases occur in South Asian region alone. Public health is a global disquiet due to injuries and demises, with an expected 265,000 deaths yearly according to the World Health Organization.

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Most are found in low- and middle-income nations, and practically half happen in the South-East Asia Region³. Burn injury is a significant yet under-investigated zone in Pakistan. According to Global Burden of Disease in 2010 investigation appraises that the age-standardized death rate for injury brought about by fire, heat, and hot substances is 5.8per 100,000 populace in Pakistan⁴. Over 0.3 Million deaths are reported from Burns and fires each year throughout the world. Although this rate have been declined in recent years due to strict vigilance and establishment of state of the art modern burn centers⁵. The presence of dead and denatured burn scar, the suppression of the cellular immune and antibody mediated immune system reduce chemical mediator and exposed skin surface may favor microbial growth⁶.

Generally, deaths in burn patients attributed to complication of the infection with multiple organisms and also the involvement of maximum body surface area⁵. Although Gram-negative organisms are the most common to cause serious infection in burn patients. However, in most of the cases *Staphylococcus aureus* has also notable figure in burn wounds. In extensive burn cases, when the organisms proliferate in the scar and the number of organisms reaches in millions per

gram of tissue, it leads to systemic infection and lethal bacteremia⁷.

The most common isolated microorganisms from the burn skin surface are *Staph aureus* and *Pseudomonas aeruginosa*. Others may include, *Klebsiella* spp, coagulase negative *Staphylococcus*, *Escherichia coli*, *Enterobacter* spp and *Candida* spp etc⁸. However, *P. aeruginosa* is opportunistic human pathogen causing around 9-10% of hospital acquired nosocomial infections. The organism has great potential of developing resistance to commonly used antibiotics. This resistance is due to many factors such as, efflux pump, ability and production of antibiotic deactivating enzymes etc⁹. Resistance to Penicillin and Cephalosporin may be due to enzymes Cephalosporinases with its hyper production or suppression. Similarly, Porins protein channels also allow the uptake of nutrients and other constituents such as antimicrobial substances into cell¹⁰.

MATERIALS AND METHODS

The Descriptive study was conducted at the Department of Microbiology Bolan Medical Complex Hospital Quetta from November 2018 to November 2019. Multiple samples were collected from different site of burnt patients n= 137 (Male n= 80: Female n=57) with sterile swabs and were immediately transported to the Microbiology laboratory of BMC Hospital. Patients with burn cases from outpatient department and indoor patients both were recruited with no age restriction. All the samples were inoculated on different microbiological media and were then incubated at 37 °C for 24 hours in aerobic condition. The organisms were gram stained and various biochemical tests (oxidase, catalase, citrate, indole and carbohydrate utilization test) were performed. Isolates of *Pseudomonas aeruginosa* were identified on the basis of colony characters and growth pattern on Cetrimide agar and various biochemical tests. While antimicrobial susceptibility screening was done on Mueller-Hinton agar by agar disc diffusion method. Data collected were entered in SPSS. Version.18.0 and demographic data were analyzed using standard protocol.

RESULTS

A total of 137 patients admitted in different ward (Burn ICU 48 and Burn ward 89) in BMC Hospital, Quetta were consented for samples and 270 samples were collected from these patients.

Those samples collected from patients were culture onto different media and 220 (81%) out of 270 samples were positive for bacterial culture growth, while 125/220 (56.81%) growth were positive for *Pseudomonas aeruginosa*.

In this study 80 (58.39%) and 57 (41.60%) patients were male and female, respectively as shown in figure 1.

Percent of gender wise distribution

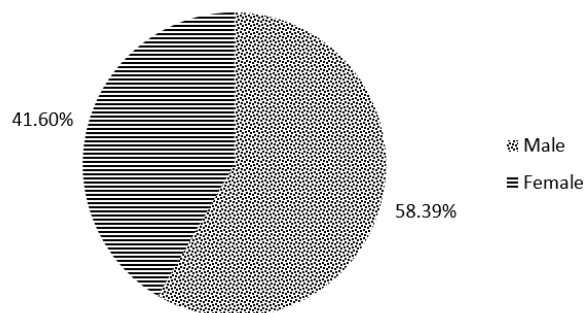


Figure No. 1: Gender wise distribution of burn wound infected patients

Result showed on age basis 59/137 (43%) patients were from 21-40 years with 36/137 (26%) were from 01-20 years and 42/137 (31%) patients from 41-60 years and above as shown in Table No.1.

Table No.1: Demographic characteristics of burn patients

Age (Years)	Male	Female	Total
01- 20	19	17	36
21 – 40	37	22	59
41 -60	24	18	42
Total	80 (58.39)	57(41.60)	137

The most common cause recorded were flame burn 57/137 (42%), followed by 38/137 (27%) by scalds as shown in Fig.2

Frequency of different factor for burn both age group

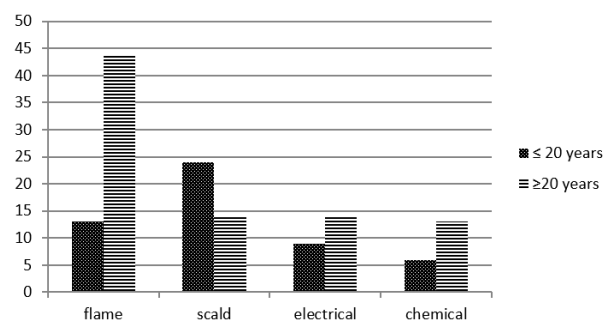


Figure No.2: Frequency of different factors for burn in both age groups

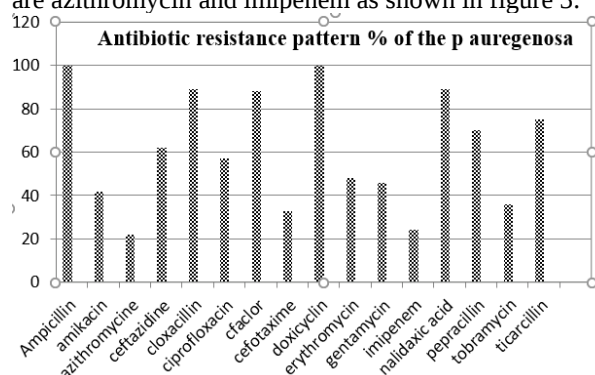
Risk factor related to burn wound infection: The degree of burn with 3rd and 4th degree burn was more common in female than male patients, 31 (22.62%), 65 (47.44%) and 41 (30.00%) patients were with 1st degree, 2nd degree and 3rd, 4th degree respectively. Total body surface area (TBSA) were also evaluated and 78/137 (56.93%) 39/137 (28.46%) and 20/137 (14.59%) patients were with 20%, 40% and 60 % respectively of TBSA as shown in Table.2 Stay at hospital were recorded and 90 (65.69%) and 39 (28.46%) patients were with 2 week and 2-4 weeks stay in hospital for treatment as shown in table.2.

Table No. 2: Risk factor related to burn wound infection

Degrees	Male	Female	Total (%)
1st degree	19	12	31 (22.62%)
2nd degree	45	20	65 (47.44%)
3rd and 4th degree	16	25	41(30.00%)
Total	80	57	137 (100%)
Total Body Surface Area (TBSA)	Number of patients (%)		
1 to 20 %	78 (56.93%)		
21 to 40 %	39 (28.46%)		
41 to 60 %	20 (14.59%)		
Total	137 (100%)		
Hospital stay (days)	Number of patients (%)		
3 to 14 days	90 (65.69%)		
15 to 30 days	39 (28.46%)		
> 30 days	8 (5.83%)		
Total	137 (100%)		

Antimicrobial resistance pattern

The result of antimicrobial resistance to *P. aeruginosa* isolated from wound swab culture of burn infected patients against 16 antimicrobial agents is presented (Fig.2). The most resistance 100% antibiotic was ampicillin and doxycycline. And least resistant of drugs are azithromycin and imipenem as shown in figure 3.

**Fig No. 3: Antibiotic sensitivity pattern (%) of the wound isolates****DISCUSSION**

Thermal injuries are considered as a major health problem especially in low income countries. It generally occurs due to fire, chemicals, exposure to hot liquid and contact surface. Naked necrotic tissues can be commonly seen in burnt patient and are considered major site of microbial contamination. Malfunctioning of neutrophils, cellular and humoral immune response leads to immuno-suppression leading to enhanced chance of wound colonization by microorganisms.

The overall, environment of burn unit is prone to be easily contaminated by organisms which have the ability to transfer from one patient to other.

Pseudomonas aeruginosa is well-known opportunistic organism. It colonizes burn wounds and gains access to burnt patients through cross contamination. Due to emergence of resistance the mortality rate due to *pseudomonas* is rising.

In the present study, male patients were more than female in burn centers. This might be due to the fact that males in Pakistan are more concerned than females and responsible for the majority of duties outside home that may increase risks of burn accidents. This finding is in line with similar studies in Palestine.¹¹

In this study, more patients were from fire burn followed by scalds and were supported by previous studies (Fig.2). These findings corroborate with study from Karachi, Pakistan, in which scald and fire were reported the leading causes of burn¹². Similarly, flame burn was the most common cause of burns followed by scalding, in a study from Iran¹³. Similarly, 30-50 years were the most common age of the patients. Our this findings corroborate with findings from Karachi, Pakistan.^{13, 14}

In this study, body surface area burnt varied from 6 - 60 %. In n=78 (56.93% patients, it ranged from 1-20 %, TBSA. 21-40 % category included the percentage of patients n=39 (28.46%) and 41%-60 % burns category showed the lower percentage of patients n= 20 (14.59%). Our results were in conflict with a study in which 11 -30 % body surfaces of 35 patients and 31 % - 60 % of 46 patients had burns while 19 patients had 61 - 92 % burns¹⁵.

Pseudomonas aeruginosa were isolated 125 strains from 220 positive culture samples (56.81 %) from burn patients in this study. This finding was in consistent to other studies.^{5,16} Some other previous studies have reported higher occurrence of *P. aeruginosa* along in patients with 59 %¹⁷ 57 %¹⁸ 54.4 %¹⁵ and in Quetta 37%.¹⁹

Antimicrobial resistance pattern of different antibiotics was checked against *P. aeruginosa*. Our results revealed high level resistance against cloxacillin, Piperacillin, Ceftazidime and low-level resistance against Imipenem (Fig-3). Nikokar et al., (2013)²⁰, studied antibiotic sensitivity and resistivity pattern of *P. aeruginosa* isolates and reported similar results as of our findings.

Pseudomonas aeruginosa remains an opportunistic culprit that causes most of the hospital acquired infections and has developed resistance to various common antimicrobial drugs. Similarly, Ali et al., (2015)²¹ also reported the resistance of different isolates of *P. aeruginosa* to commonly used drugs such as, Ofloxacin, Ciprofloxacin, Gentamycin and Imipenem etc. It exploits great potential of organism to develop MDR.

In this study, we found that during prolong hospitalization (2-4 weeks) of the patient, *P. aeruginosa* more common in such cases. It is obvious that satisfactory and better attention of the burned patient is

necessary to shorten the patient stay in hospital. The early detection of isolates and its antibiotic sensitivity is recommended for quick and early recovery of patient.

CONCLUSION

Burn injuries are traumatic with adverse effects long lasting effects on patient life. Male patients were more prone to burn wounds predominantly caused thermal flame with 31-50 years most common age. Patients with 21- 40 % TBSA and long hospital stay were mostly infected with *P. aeruginosa*. The most common susceptible antibiotics were Imipenem, Cefotaxime, Tobramycin and Amikacin. Rational use of antibiotics may be discouraged and proper in vitro screening of complicated cases against commonly used antibiotics will surely help in the better management of multi-drug resistant in burn patients.

Author's Contribution:

Concept & Design of Study: Ashiq Hussain
 Drafting: Bezan Baloch, Masroor Ahmad Shafee
 Data Analysis: Muhammad Khosa, Muhammed Tahir, Nazeer Ahmed Sasoli
 Revisiting Critically: Ashiq Hussain, Bezan Baloch
 Final Approval of version: Ashiq Hussain

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

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