Bacteriological profile and antimicrobial sensitivity pattern in burn wound infection.

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***Abstract*—: Burns are a major public health concern; it is noted that 73% of all death in burn patients is within first 5 days due to sepsis. The patients are predisposed to infections as a result of disruption in skin's mechanical integrity. The infections are mostly due to multidrug resistant (MDR) organisms present in the hospital which further limits therapeutic options, resulting in high antibiotic cost and prolonged hospital stay. Therefore, the study was conducted to study the bacteriological profile and antimicrobial sensitivity pattern in burn wound infection in tertiary care hospital.**

***Index Terms*—Burn wound infection, *Pseudomonas aeruginosa, Acinetobacter spp,* Multidrug resistant.**

I. INTRODUCTION

Burn wound infections are a major public health concern. Burn injury disrupts the normal skin barrier which leads to disruption of both local and systemic immune responses. [1] Thus, burn wound is an ideal microenvironment for the growth of pathogens. [2] Once established these infections are a major cause of morbidity and mortality. [3] Risk factors that contribute to microbial infections at the burn wound site includes the extent and area of the burn, the patient's age, immune function, the severity of the burn, and any preexisting comorbidities. [4]

Prevalent pathogenic bacteria isolated from infected burn wound include *Pseudomonas aeruginosa, Acinetobacter baumannii, Staphylococcus aureus, Klebsiella pneumoniae* etc. [5] The challenges in treating burn wound infection arise due to microbial infections, especially those caused by multidrug-resistant (MDR)-bacteria leading to treatment failure. [6] These MDR pathogens in the burn unit are a major concern.

Therefore, the study was conducted to study the bacteriological profile and antimicrobial sensitivity pattern in burn wound infection in tertiary care hospital.

II. OBJECTIVE

To study the bacteriological profile and antimicrobial sensitivity pattern in burn wound infection in tertiary care hospital.

III. MATERIAL AND METHODS

Study setting: A prospective study was conducted in the Microbiology department of Government Medical College, Nagpur over a period of 6 months. Ethical approval was obtained from the college's ethics committee.

Wound swab samples from burn patients were studied after following inclusion and exclusion criteria. Patients with flame burns, electric contact and flash burns, chemical burns and hot water/ liquid scald burns were included in the study. Patients not willing for participation in the study were excluded from the study.

Sample collection: Wound Swab - Swabs were taken from burn wound at admission. Later swabbing was performed twice per week in the morning, while dressing burn wounds. Wound samples were collected for culture after several clinical assessments from the leading edge of wound sites showing signs of infection, such as discoloration, bad odour and rapid separation of the eschar or the presence of pus. A sterile cotton swab moistened with sterile normal saline was rubbed onto the burn wound surface. Swabs were taken preferably away from urogenital region and other potentially contaminated sites. The swabs were then sent for culture.

Sample processing: Upon arrival at the laboratory, the wound swab samples were immediately cultured on nutrient agar, MacConkey agar and blood agar, and then incubated at 37°C for 18 to 72 hours. After incubation, colony morphology, including colour, shape and general appearance of the individual colonies on each of the plates, was examined. For identification gram staining and biochemical tests were performed. The antibiotic sensitivity testing was performed by Kirby Bauer's disk diffusion test on Mueller-Hinton agar as per Clinical and Laboratory Standards Institute guidelines 2024. [7]

IV. RESULT

Over the period of 6 months a total of 75 patients were admitted in the burn ward. Out of which 39 (52.0%) were male and 36 (48.0%) were female patients. The mean ± SD age was 22.94 ± 19.21 years.

A total of 128 wound swabs were collected from the 75 patients. 13 samples showed no growth, 96 samples had monomicrobial and 19 samples had polymicrobial growth. 7 different bacterial species were identified with the predominant bacterial isolate being *Pseudomonas aeruginosa.* (Table1)

Table 1: Bacterial isolates from burn wound infections

Organism	Number of isolates (%)
Pseudomonas aeruginosa	57 (42.5%)
Escherichia coli	25 (18.6%)
Acinetobacter spp	19 (14.2%)
Klebsiella pneumoniae	15 (11.2%)
Proteus spp	9 (6.7%)
Staphylococcus aureus	7 (5.2%)
Citrobacter spp	2 (1.6%)

Table 2: Resistance pattern in Gram Positive Cocci isolates

Antimicrobials	*Staphylococcus aureus* n= 7
Penicillin	7 (100%)
Cefoxitin	3 (42.8%)
Erythromycin	6 (85.7%)
Clindamycin	5 (71.4%)
Sulfamethoxazole/ trimethoprim	2 (28.5%)
Doxycycline	2 (28.5%)
Linezolid	0
Vancomycin	-
Gentamycin	3 (42.8%)

Table 3: Antimicrobial resistance pattern of Enterobacterales isolates

Antimicrobials	*E coli* (n=25)	*K pneumoniae* (n=15)	Others (n= 11)
Ampicillin	21 (84%)	15 (100%)	11 (100%)
Amoxicillin/ clavulanic acid	19 (76%)	12 (80%)	8 (72.7%)
Gentamycin	14 (56%)	10 (66.6%)	5 (45.4%)
Cefazolin	20 (80%)	12 (80%)	9 (81.8%)
Cefoxitin	17 (68%)	11 (73.3%)	6 (54.5%)
Ceftriaxone	19 (76%)	10 (66.6%)	8 (72.7%)
Cefepime	16 (64%)	11 (73.3%)	6 (54.5%)
Piperacillin/ tazobactam	15 (60%)	11 (73.3%)	6 (54.5%)
Ertapenem	13 (52%)	9 (60%)	4 (36.3%)
Amikacin	12 (48%)	8 (53.3%)	7 (63.6%)
Ciprofloxacin	20 (80%)	12 (80%)	10 (90.9%)

Table 4: Antimicrobial resistance pattern of Non fermenter isolates

Antimicrobials	*P aeruginosa* (n=57)	*Acinetobacter spp* (n=19)
Piperacillin/ tazobactam	32 (56.1%)	12 (63.1%)
Ceftazidime	40 (71.2%)	15 (78.9%)
Cefepime	37 (64.9%)	15 (78.9%)
Aztreonam	40 (70.1%)	-
Meropenem	29 (50.8%)	10 (52.6%)
Gentamycin	31 (54.3%)	11 (57.8%)
Amikacin	25 (43.8%)	10 (52.6%)
Netilmicin	39 (68.4%)	-
Levofloxacin	46 (80.7%)	16 (84.2%)
Minocycline	-	11 (57.8%)

V. Discussion

The present study aimed to describe the bacteriological profile and antimicrobial sensitivity pattern of isolates from burn wound infection in order to improve our therapeutic approach and to prevent burn wound infections at our center.

In the present study, the rate of burn injuries was almost equal in female and male subjects (48% vs. 52%). This is in contradiction to a study conducted in 2014 in Morocco by Essayagh et al.8 which reported a higher incidence of burn injuries in male (64%) than in female (36%) subjects.

In our study the most common organism isolated is *Pseudomonas aeruginosa* (42.5%) followed by *E coli* (18.6%). Similar observations were made by Agnihotri et al in where *Pseudomonas aeruginosa* was found to be the most common isolate in wound cultures followed by *Staphylococcus aureus* and *Acinetobacter spp*. 9

Burn wards are known to harbor MDR bacterial isolates, which colonize burn patients and may establish infection. 5 In our study the bacterial strains isolated were resistant to most of the commonly used antibiotics. Enterobacterales (*E coli, Klebsiella spp, Proteus spp, Citrobacter spp*) were resistant to common antibiotics like ampicillin, ciprofloxacin, Amoxicillin/ clavulanic acid, Cefazolin, Cefoxitin, Ceftriaxone, Cefepime Piperacillin/ tazobactam in majority of the cases. Non-Fermenting Gram Negative bacilli (*Pseudomonas aeruginosa, Acinetobacter spp*) were resistant to ceftazidime, cefepime, aztreonam and levofloxacin. The organisms were mostly sensitive to Amikacin, gentamycin and piperacillin tazobactam. In a study conducted by Agnihotri et al similar results were seen, where amikacin was found to be the most effective antibiotic against Gram Negative Bacteria. 9 In our study, linezolid was the most effective antibiotic against *S. aureus* which is concordance with the findings of Garg I et al. 10

Our study showed a high prevalence of MDR bacterial infections among burn patients comparable to studies conducted in other countries such as Iran [11] and Tunisia [12]. This is attributed to antibiotic misuse, different hospital strategies for the management of infections, hygiene protocols and geographic climate variation [11,12]. To manage and prevent the spread of MDR isolates in burn units, careful and regular microbiological surveillance, pre-treatment antibiotic sensitivity testing, and strict antibiotic stewardship are pivotal. These measures can help reduce infection-related morbidity and mortality in burn patients. Overcrowding in burn wards also contributes significantly to cross-infection and must be avoided to control infections.

VI. Conclusion

Burn wound infections are a major public health concern. *Pseudomonas aeruginosa* is the main culprit followed by *E. coli*. High prevalence of MDR bacterial infections is also an area of concern. Thus, early and prompt diagnosis of microorganisms causing burn wound infections by wound swab cultures/tissue cultures and administering antibiotics according to their antibiotic sensitivity patterns is of foremost importance in the management of these infections. Along with this strict infection control practices and antibiotic stewardship are vital to reduce morbidity and mortality in burn wound patients.

VII. References

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