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Original Research Article

Bacterial and Mycological Study in Burn Patients Admitted in Gauhati Medical College and Hospital

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Abstract:

Background: Burn wound infection is a major public health problem and globally the most devastating form of trauma. It delays healing, causes scarring and may result in bacteraemia, sepsis or multiple-organ dysfunction syndrome leading to increased morbidity and mortality.

Materials and Methods: The present study was a hospital based prospective observational study on 120 burn patients admitted to the Burn ICU. The wound swabs collected from the included patients were Gram stained & bacterial and fungal culture and sensitivity was done.

Results: Out of the total 120 patients, highest 41(34.16%) belonged to the 21-30 years age bracket. Preponderance of males 62(51.66%) was more than females 58(48.33%). Flame burn was found to be the commonest form of burn injury (66.7%). Bacterial culture was positive in 104 (87%) of cases, while in 12(10%) cases fungus was isolated. 154 bacterial isolates were isolated, 131 (85%) were Gram negative while rest 23(15%) were Gram positive. Pseudomonas aeruginosa was the most common bacteria isolated from 60 (39%) samples followed by Klebsiella species 28(18%) samples. Pseudomonas aeruginosa (n=60) was mostly susceptible to Imipenem (75%) followed by Gentamicin and Tigecycline with 70% and 50% respectively. Gram positive bacterial isolates (n=23) were found to be most susceptible to Vancomycin 23(100%) and Linezolid 18(100%).

Conclusion: The findings of the present study revealed that Gram negative bacilli are still predominant pathogens infecting the burn wounds in this region. Effective strict isolation techniques and infection control are thus needed to decrease the occurrence of burn wound infection.

Keywords: Burn infection, MRSA, Pseudomonas aeruginosa, Culture, Flame burn.

Introduction

Burn wound infection is a major public health problem and globally the most devastating form of trauma. It delays healing, causes scarring and may result in bacteraemia, sepsis or multiple-organ dysfunction syndrome leading to increased morbidity and mortality. [1]

Bacteria and fungi are the most common pathogens of burn wounds, as these microbes form multi-species biofilms on burn wounds within 48 – 72 hours of injury. Gram-positive bacteria are some of the first to colonize burns, followed quickly by gram-negative within a week of the burn injury. [2]

Pseudomonas aeruginosa and Staphylococcus aureus are the most frequent colonizing agents. These organisms originate from the patient's own skin, gut and respiratory flora, as well as exogenous organisms from the hospital environment, which are generally more resistant to antimicrobial agents than endogenous organisms. [3] Burn injuries are a major problem in the low-income and middle-income countries. [4]In India, over 70,000 burn patients are admitted to hospitals each year. Infection is the major cause of morbidity and mortality among burn patients, relating to 75% burns. [5]

Aims and objectives

1. To determine the prevalence of bacterial infections with their antibiotic susceptibility pattern among the patients in Burn ICU.
2. To determine the prevalence of fungal infections in burn wound patients in Burn I.C.U.

Materials and Methods

The present study was a hospital based prospective observational study, carried out in the department of Microbiology and d Plastic Surgery, Gauhati Medical College and Hospital, Guwahati, Assam for a period of 1 year from August, 2016 to July, 2017. A total of120 burn patients admitted to the Burn ICU were recruited for the study.

Ethical clearance certificate was obtained prior to the study, from the Institutional Ethics Committee.

Data collection: Patient consent was taken in pre-designed proforma and clinical details recorded. In case of unconscious patients and children consent was obtained from their attendants.

Sample collection& processing: The wound swabs were collected from those included patients. The wounds were inspected during change of dressing and 2 swabs were collected after scraping away the remnants of topical antibiotics, if any. The samples were transported in Amie's transport media. [6] Each kit consisted of a sterile cotton swab stick and a polystyrene tube containing pre-sterilized Amie's medium. The collected wound swabs were processed in the Microbiology department. First microscopic examination was done with Gram's stain and KOH mount. Bacterial culture was done in Blood and Mac Conkey agar, while fungal culture was done in Sabouraud's dextrose agar (SDA).The isolates were confirmed by the tests for the identification of bacteria according to the standard methods. [6]

Antibiotic sensitivity of isolates was tested using the Kirby Bauer disc diffusion method as per the CLSI recommendations. The source for media and antibiotic discs was Hi-Media Ltd. Mumbai, India.

Standard strains of Escherichia coli ATCC 25922, Staphylococcus aureus ATCC 25923 and Pseudomonas aeruginosa ATCC 27853 were used as controls.

Data analysis: Data analysis was done in Microsoft excel 2010 version.

Results

Patient Characteristics: Out of the total 120 patients, 41(34.16%) belonged to the 21-30 years age bracket, followed by 35(29.16%) in the 0-10 years of age.

Table 1: Shows the age wise distribution of 120 patients in the burn ICU

Age Distribution	Number	Percentage
0-10 years	35	29.16
11-20 years	16	13.33
21-30 years	41	34.16
31-40years	22	18.33
41-50years	4	3.33
51-60years	2	1.6

Out of 120 patients, preponderance of males 62(51.66%) was more than females 58(48.33%), with ratio equal to 1.06:1.

Table 2: Shows the sex wise distribution of the total burn cases

Sex	Number	Percentage
Male	62	51.66
Female	58	48.33

Flame burn was found to be the commonest form of burn injury, 80(66.66%) among the cases followed by electrical burn at 28(23.33%).

Table 3: Shows distribution of patients according to type of Burn Injury

Type of burn injury	Number	Percentage
Flame	80	66.66
Scald	18	15
Electrical	28	23.33
Chemical	4	3.33

Mortality rate in burn patients: 20 (16.7%) patients out of 120 expired, with 15 (70%) of the death occurring in patients with 30 % above % TBSA burns. Maximum mortality was seen among adult which was 15(75%) while among the pediatric age group which was 5(10%).

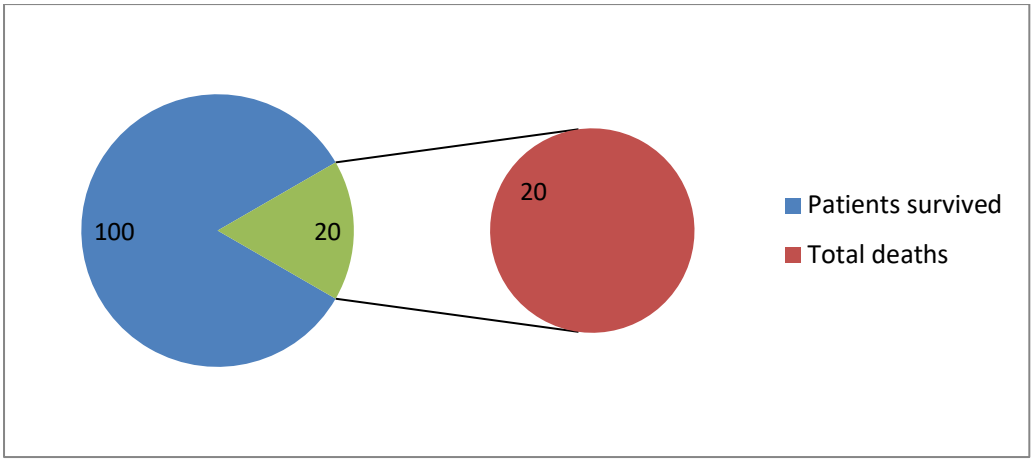

Figure 1: Showing mortality rate among the burn patients

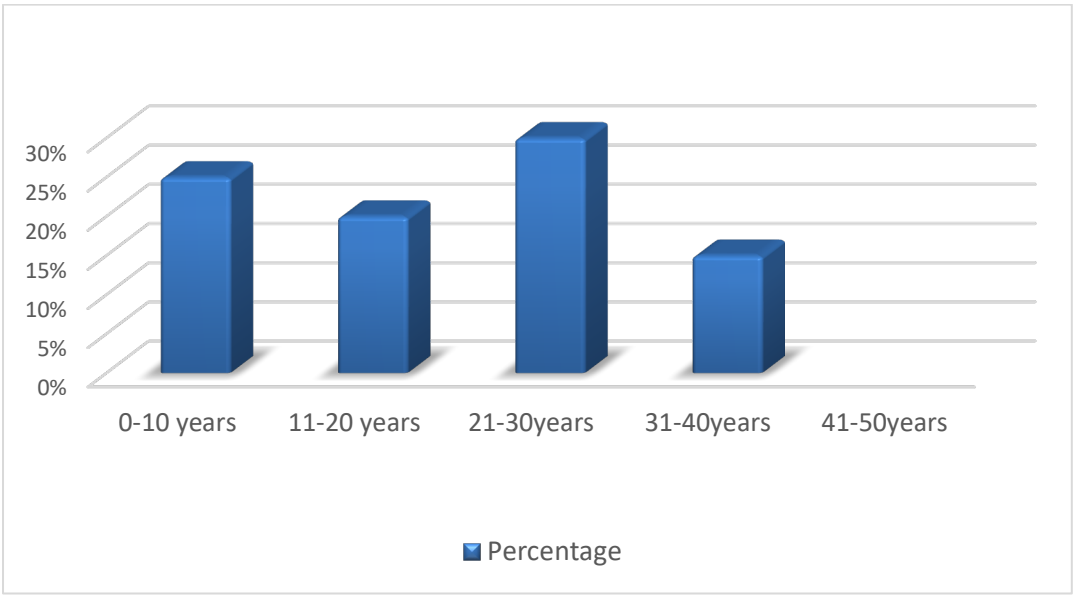

Figure 2: Showing Mortality according to age group

Out of 120 patient's samples received, bacterial culture was positive in 104 (87%) of cases, while in 12(10%) cases fungus was isolated.

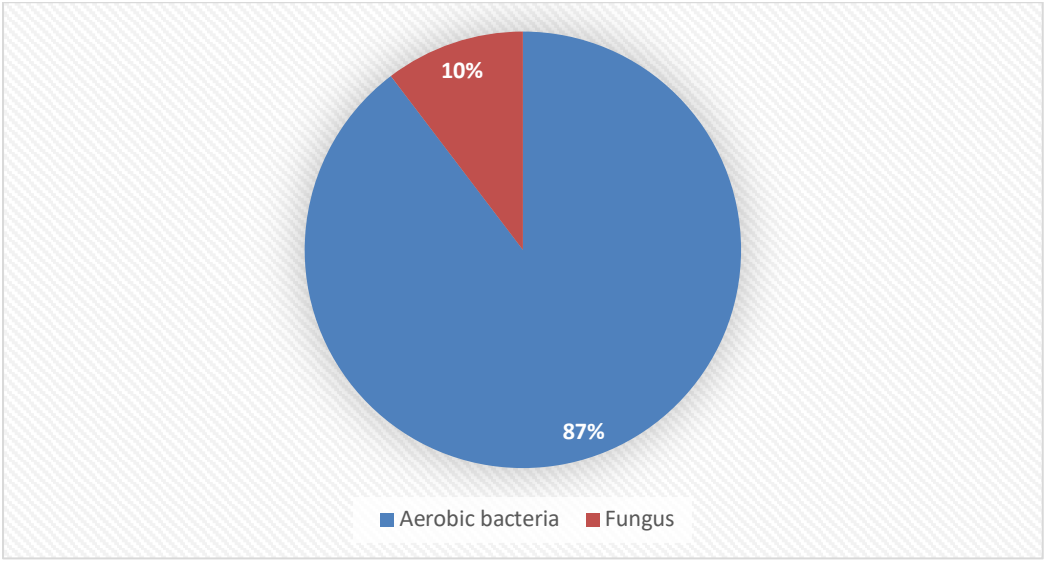

Figure 3: Showing pattern of the isolates among the samples (n=120)

Among the total of 104 culture positive, 154 bacterial isolates were isolated, with 124(81%) were found to be polymicrobial and 30(19%) monomicrobial. Among the 154 bacterial isolates, 131 (85%) were Gram negative while rest 23(15%) were Gram positive. Pseudomonas aeruginosa was the most common bacteria isolated from 60 (39%) samples followed by Klebsiella species in 28(18%) samples.

Table 4: Pattern of bacterial isolates from the burn wounds

Bacteria	Number	Percentage (%)
Pseudomonas aeruginosa	60	39
Klebsiella species	28	18
Coagulase negative Staphylococcus	16	10.38
Citrobacter freudii	12	7.79
Proteus mirabilis	10	6.49
Escherichia coli	9	5.84
Staphylococcus aereus	7	4.54
Acinetobacter baumannii	6	3.89
Proteus vulgaris	4	2.59
Citrobacter koseri	2	1.29

Fungus was isolated in 12(10%) of the 120 samples collected.

Table 5: Pattern of fungal isolate among the samples

Fungal isolate	Number	Percentage (%)
Candida albicans	2	16.66%
Non- albicans Candida species	2	16.66%
Aspergillus niger	2	16.66%
Aspergillus fumigatus	1	8.33%
Penicillium spp.	1	8.33%
Fusarium oxysporium	3	25%
Fusarium solani	1	8.33%

Table 6: Organisms isolated with duration of admission.

Organisms isolated	1st week (n=120)	2nd week (n=91)	3rd week (n=63)	Total organisms isolated
Pseudomonas aeruginosa	60	30	20	110
Klebsiella species	28	19	7	54
Coagulase negative Staphylococcus	16	12	1	29
Proteus mirabilis	12	6	4	22
Citrobacter freundii	10	9	3	22
Escherichia coli	9	4	2	15
Staphylococcus aureus	7	3	2	12
Acinetobacter baumanii	6	2	1	9
Proteus vulgaris	4	2	1	7
Citrobacter koseri	2	1	1	2
Fusarium oxysporium	0	0	3	3
Candida albicans	0	0	2	2
Non-Candida albicans	0	0	2	2
Aspergillus niger	0	0	2	2
Aspergillus fumigatus	0	0	1	1
Penicillium spp.	0	0	1	1
Fusarium solani	0	0	1	1

Antimicrobial susceptibility of organisms isolated: Among the Gram-negative bacteria (n=131), Pseudomonas aeruginosa (n=60) was mostly susceptible to Imipenem (75%) followed by Gentamicin and Tigecycline with 70% and 50% respectively. Klebsiella species (n=28), were most susceptible to Imipenem with 78.57% followed by Gentamicin at 50%.

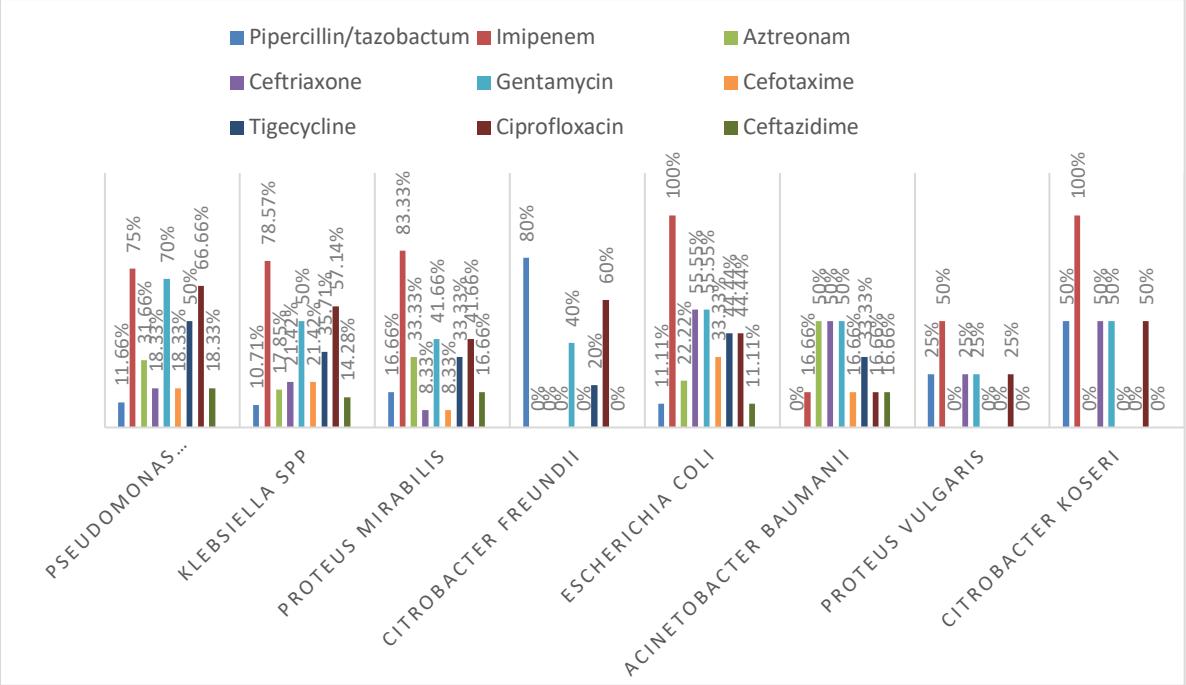

Figure 4: Showing antimicrobial susceptibility pattern of Gram-negative organisms

Gram-positive bacterial isolates (n=23) were found to be most susceptible to Vancomycin 23(100%) and Linezolid 18(100%) followed by Doxycycline 16(69.56%). All Staphylococcus aureus (n=7) isolates were found to be MRSA strains.

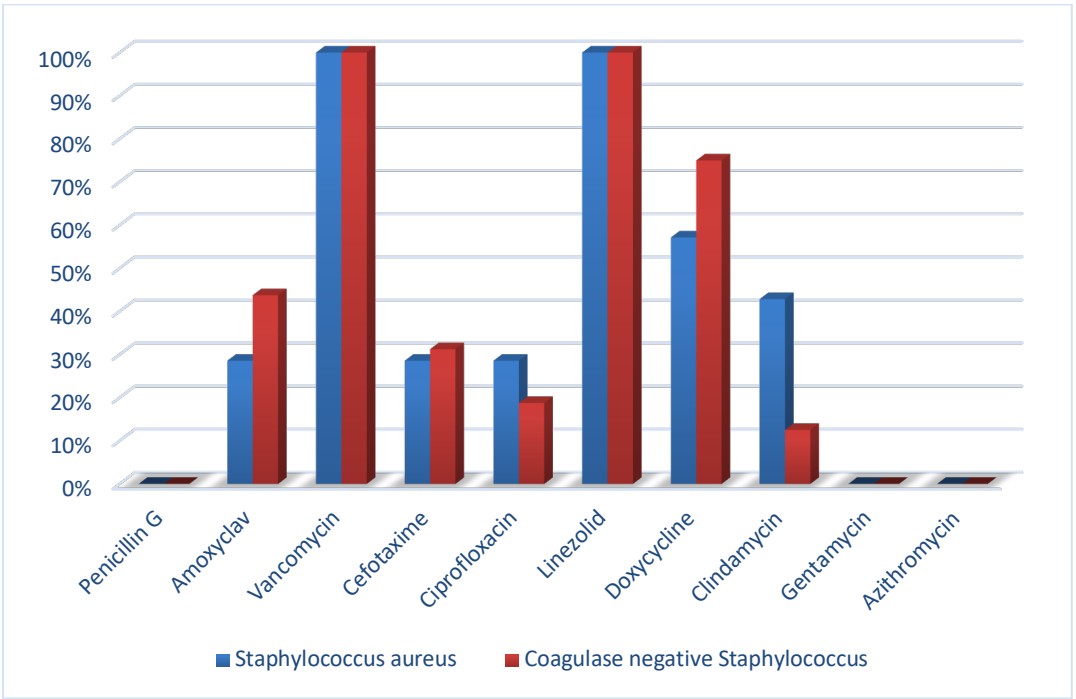

Figure 5: Showing susceptibility pattern of Gram-positive organisms isolated

Discussion

In the present study, about 31.14% of the patients were in the 20-30 years age group which was similar to one another Indian study. [7]Male preponderance 62(51.66%) was found to be slightly more than females 58(48.33%), with ratio equal to 1.06:1.This is in contrast to most of the Indian study where females are more affected than males, due to occupational hazards of working in the kitchen.[8]

Burn due to flame 80 (66.66%) was the predominant cause among patients in our study,

similar results were recorded in other studies.[2] [9]In this study, mortality rate was low (16.6%), which is comparable to studies in Tehran and India, which was found it to be 18% and 19.6% respectively.[4][10] The isolation rate of Gram negative bacteria was higher as compared to the Gram positive and is in accordance with study done earlier.[11] This is in contrast to other studies where the isolation rate of Gram positive bacteria was much higher [12,13]. Time-related changes are seen in the predominant flora of the burn wound. Initially, sparse Gram-positive flora establishes, which gets replaced by predominantly dense Gram-negative flora that in turn may be followed by nonbacterial flora.[14]In the present study also, similar time related changes were noted, Gram-positive cocci were the most common isolate from wound swab taken on the 1st week, while Gram-negative bacilli in the 2nd week. Whereas, fungal isolates were isolated from swabs collected on the 3rd week after burn, which was similar to result found by one earlier study. [9]

In the present study, the most commonly isolated organisms from burn patients in the burn ICU were Pseudomonas aeruginosa followed by Klebsiella spp. and Coagulase negative Staphylococcus. These results are in accordance with other studies. [12,15]The most frequent microbial isolate in our patients being Pseudomonas aeruginosa also conforms to many published studies. [17,18]In striking contrast to our finding, some published studies have reported Staphylococcus aureus as their predominant microbe of bacterial burn wound infections. [19,20]

Another important fact, which was noted in the present study, was equal rate of infection caused by Candida albicans (16.16%) and non- albicans Candida species (16.16%). This signifies that there is a shift of fungal burn wound infection from common organism like Candida albicans to newly arising non- Candida albicans species. This is comparable with one earlier Indian study. [16]Candida colonization of burn wounds is more common than invasive disease and may arise from an endogenous or exogenous source. Wound colonization by fungi usually occurs later on .[21,22]

On antibiotic susceptibility testing of Gram-negative bacteria, they were most susceptible to Imipenem which is in accordance to one study done.[23]. High level of drug resistance was observed for cefotaxime, ceftazidime, and ceftriaxone among Gram negative bacteria in one of the study done in India, which is similar to our findings.[24]The isolates of Staphylococcus aureus and Coagulase negative Staphylococcus were 100% sensitive to linezolid and vancomycin which was almost in accordance in other study. [25] All Staphylococcus aureus isolates were found to be MRSA strains.

Conclusion

The findings of the present study revealed that Gram negative bacilli are still predominant pathogens infecting the burn wounds in this region. Pseudomonas aeruginosa is the predominant etiological agent causing infections in burns. It has been concluded that wound infections in this were mostly polymicrobial in nature. Results also displayed that there is a high rate of antibiotic resistance in all pathogens isolated. Effective strict isolation techniques and infection control are thus needed to decrease the occurrence of burn wound infection. Also, the high prevalence of antibiotic resistance in burn infection necessitates the judicial use of antibiotics, thus improving the overall infection related morbidity and mortality.

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