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Aerobic Bacteriological Profile among the Burn Cases and their Antimicrobial Susceptibility Pattern in Tertiary care Hospital in South-East Rajasthan.

Krishan Bihari Badaulia[1*], G.Soni[2] , Suchitra Morya[3]
1. Dept. of Microbiology, Govt. Medical College Kota.

ABSTRACT

A burn is a wound in which there is coagulative necrosis of the tissue, majority of which are caused by heat. Burn injury is a major public health problem in many areas of the world. Infection in burn wounds is the second most common cause of mortality in burn cases after pneumonia. Burns predispose to infection by damaging the protective barrier function of the skin, thus facilitating the entry of pathogenic microorganisms. Burn itself is an immunocompromised condition. The present study was therefore undertaken to isolate and identify the aerobic bacterial flora in burn patients and its antibiotic susceptibility pattern. A total of 100 patients admitted with different degree of burns were studied. Wound swabs were taken with aseptic precautions by dry sterile cotton swab sticks. These swabs were transported to the microbiology laboratory and isolates were identified by standard microbiological methods. Antibiotic susceptibility was done by Kirby Bauer's Disk Diffusion method as per CLSI (Clinical and Laboratory Standards Institute) guidelines. A total of 120 bacterial pathogens were isolates from 100 patients. Out of them 70 are monomicrobial in and 20 are polymicrobial in nature. The most frequent cause of infection was found to be *Staphylococcus aureus* (33.33%), followed by *Pseudomonas aeruginosa* (29.67%), *Klebsiella pneumoniae* (17.5%), *E.coli* (13.33%) *Citrobacter spp* (4.1%) and *Proteus spp.* (2.94%). Out of the total *Staphylococcus aureus* isolates, 55% were Methicillin sensitive and 45% were Methicillin resistant (MRSA). All the MRSA strains were 100% sensitive to Vancomycin and Linezolid. The *Pseudomonas aeruginosa* isolates were most sensitive to Imipenem (97%), Amikacin (57%), Pipercillin (57%) , Ciprofloxacin (54%) and Ceftazidime (34%) *Staphylococcus aureus* and *Pseudomonas aeruginosa* were major causes of infection in burn wounds. Therefore it is necessary to implement urgent measures for restriction of nosocomial infections, sensible limitation on the use of antimicrobial agents, strict disinfection and hygiene.

Keywords: Burn wound infection, Antibiotic susceptibility testing, MRSA

*Corresponding Author Email: dr.badaulia@gmail.com
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INTRODUCTION

Burns provide a suitable site for bacterial multiplication and are more persistent richer sources of infection than surgical wounds, mainly because of loss of skin barrier and immune compromised status of patients with prolong duration of stay in the hospital[1]. Infection is a major cause of morbidity and mortality in hospitalized burn patients[2] It has been estimated that about 75% of the mortality associated with burn injuries is related to sepsis especially in developing countries[3]. In addition, overcrowding in Burns Units is an important cause of cross infection which necessitates a regular monitoring of bacterial species and their antibiotic susceptibilities because significant shifts in these data may be correlated with changes in clinical management with respect to drug choice for therapy[4]. Infection causes 50% to 60% of deaths in burn patients in spite of intensive therapy with antibiotics both topically as well as intravenous[5]. The pattern of infection differs from hospital to hospital; the varied bacterial flora of infected wound may change considerably during the healing period[6].

Although the advances in patient care and the use of a large number of antimicrobial agents, infections which complicate the clinical course of patients who had sustained severe thermal injures continue to be a major unsolved problems. Organisms associated with infection in burn patients include Gram-positive, Gram-negative. The distribution of organisms changes over time in the individual patient and such changes can be ameliorated with appropriate management of the burn wound and patient. The typical burn wound is initially colonized predominantly with Gram- positive organisms, which are quickly replaced by antibiotic- susceptible Gram-negative organisms within a week of the burn injury. Microorganisms routinely isolated from burn wounds include aerobic organisms such as *Staphylococrus aureus, Pseudomonas aeruginosa, Escherichia coli, Klebsiella spp., Proteus spp. Citrobacter spp.* Etc[7]. The present study is undertaken to study the micro flora in burn wounds of the burn patients from a tertiary care medical hospital. This study will help to assess the burden of infections at the centre and antimicrobial susceptibility testing will help to formulate antibiotic policy for better management of these patients. The present study is undertaken with the following aims and objectives:

1. To find out the bacterial profile for post burn infection in wound.
2. To evaluate the antibiotic sensitivity of organisms cultured and isolated.

MATERIALS AND METHOD

The present study was carried out in the Department of Microbiology, Govt. Medical College,

Kota Rajasthan from July 2015 to July 2016. The wound swabs were collected from 100 adult patients having total body surface area (TBSA) of burn in between 20% and 40% (according to rule of nine) on the 3rd and 7th day of admission in burn ward of MBS Hospital , Medical College, Kota Rajasthan.

A total of 100 wound swabs were collected and processed without delay in the following manner.

A. Gram staining for microscopy.
B. Inoculation on culture media (Blood agar, Macconkey agar).
C. preliminary identification of the growth (Gram stain, catalase test oxidase test, motility, etc.).
D. Routine biochemical tests.
E. Antimicrobial susceptibility testing [8]

RESULTS AND DISCUSSION

Total 100 swabs were taken from 100 patients admitted in the burn unit in our hospital over a period of 12 months. They were studied to identify the aerobic bacteriological profile of burn wound infections. The most common age group involved was between 21 and 50 years. Male 52% preponderance was seen over females (48%). The burning agent was predominantly flames (61%) followed by scalding (24%) and electric (15%).

Out of 100 swabs, 90 swabs revealed growth while 10 swabs showed no growth. The overall isolation rate was 90% (90 / 100). 20 patients were expired after giving the seconds sample. A total of 120 organisms were isolated from 90 swabs. It was observed that single isolates (70 swabs) were seen more commonly than multiple isolates (20 swabs) Overall, Gram-negative bacteria 80 (66.66%) were more common than Gram-positive bacteria 40 (33.33%). *Staphylococcus aureus* (33.33%) was the most common isolate followed by *Pseudomonas aeruginosa* 35 (29.67%), *Klebsiell pnemoniae* (17.5 %), *E. coli* 16 (13.33%), *Citrobacter spp.* 05 (14.16 %) and Proteus spp.03 (2.5 %). On the 3rd day of burn *Staph. aureus* 25 (62.5%) was the most predominant whereas on the 7th day of burn *Pseudomonas aeruginosa* 24 (34.28%) was most common isolate.

Table 1: Bacteriological profile of burn isolates.

Organism	3rd Day (First Weak)	7th Day (Second Weak)	Total
Pseud. aeruginosa	11 (30.55%)	24 (34.28%)	35 (29.67%)
Staph. aureus	25 (62.5%)	15 (21.43%)	40 (33.33%)
Kleb. pneumoniae	08 (34.78%)	13 (18.57%)	21 (17.5%)
E.coli	04 (25%)	12 (17.14%)	16 (13.33%)
Proteus spp.	01 (33.33%)	02 (66.66%)	03 (2.5%)
Cirobacter spp.	01 (20%)	04 (80%)	05 (4.16%)

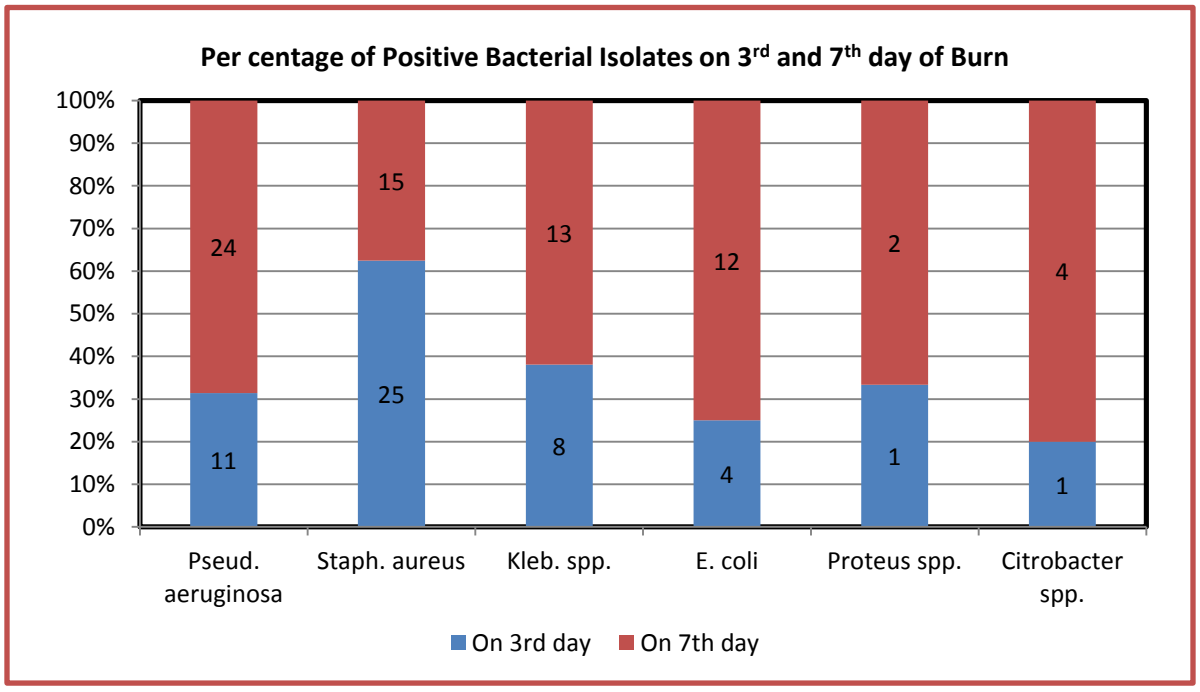

Table 2: Antibiotic sensitivity pattern of bacterial isolates from burn wounds.

Organism	CIP	AK	CTX	GEN	CEPH	CD	CX	IMP	CAZ	PIP	VA	LZ
Pseudo. aeruginosa (35)	19 (54%)	15 (43%)	02 (6%)	03 (9%)	NT	NT	NT	34 (97%)	12 (34%)	20 (57%)	NT	NT
Staph. aureus (40)	16 (40%)	18 (45%)	NT	10 (25%)	0 (0 %)	35 (87.5%)	22 (55%)	NT	NT	NT	40 (100%)	40 (100%)
Kleb. pneumoniae (21)	16 (76%)	09 (43%)	02 (10%)	03 (38%)	NT	NT	NT	20 (95%)	10 (47.6%)	18 (86%)	NT (48%)	NT
E. coli (16)	10 (63%)	08 (50%)	06 (38%)	09 (56%)	NT	NT	NT	15 (94%)	12 (75%)	12 (75%)	NT	NT
Proteus spp.(03)	02 (67%)	02 (67%)	01 (33%)	02 (67%)	NT	NT	NT	03 (100%)	01 (33%)	03 (100%)	NT	NT
Citrobacter spp.(05)	03 (60%)	03 (60%)	01 (20%)	05 (100%)	NT	NT	NT	05 (100%)	04 (80%)	04 (80%)	NT	NT

CIP- Ciprofloxacin , AK- Amikacin, GEN- Gentamicin, CAZ- Ceftazidime, , CX-Cefoxitin, IMP-Imipenem, PIP-Pippercillin ,VA-Vancomycin, LZ-Linezolid, CEPH-Cephalaxin, NT- Not tested

The antimicrobial sensitivity pattern of the organisms to different antimicrobial agents varied depending on the isolate as shown in Table 2. Overall gram negative organisms are maximum sensitive to Imipenem, Pippercillin and Amikacin and least sensitive to Gentamicin, Ciprofloxacin, Cefotaxime and Ceftazidime as depicted in table 2.

Among the isolated Staph. aureus all of them are sensitive to Vancomycin (100%) and Linozolid (100%) and Clindamycin (87.5%). All the Staph. aureus are resistance to Cephalaxin (100%) and Gentamicin (75%). 45% Staph. aureus show resistance to cefoxitin and they are considered as MRSA (Methicilin resistance Staphylococcus aureus). All the MRSA are sensitive to Vancomycin and Linezolid.

DISCUSSION

Burn patient are at high risk of infection as a result of nature of burn injury itself, the immunocompromized effect of burn, prolong hospital stay and intensive diagnostic and therapeutic procedures. In the present study 70% of the patients are in 20 to 30 years of age group. Males (52%) are the most commonly affected as compared to females (48%). This due to occupational hazards. Burn due to flame (61%) was the predominant cause of accidents among the patients in our study. Similar results were obtained in the study by Shazad et al [7] and Demacedo and Santos [8] In this study mortality rate is very low (20 %) which is comparable to the study by Lari et al. (19.6%).[9] This can be because of the fact that we dealing with the patients having the TBSA of burn between 20% to 30%. In the present study, the overall isolation rate is 90% which is comparable to the finding of Shriniwasan et al [10] and Sapna G. Muganda et al [11.] It is also seen in our study that single isolated are more common (80%) that multiple isolates (20%). This is in agreement with the other report.[1] According to Pruitt et al [12] there are time related changes in the predominant flora of burn wounds. Initially, predominant Gram positive flora in 1st weak is replaced by predominantly Gram-negative flora in the 2nd weak. In the present study similar time related changes are noted, *Staph. aureus* is the most common isolated from the wound swab taken on the 3th day, while *Pseudomonas aeruginosa* is recorded more common when swabs were taken on 7th day after the burn. In the present study, we find that most common isolated were *Staph. aureus* (33.33%) followed by *P. aeuginosa* (29.67%), *K.pneumoniae* (17.5%) , *E.coli* (13.33%) , *Citrobacter spp.* (4.16%) and *Proteus spp* (2.5%) . In our study the main culprit is *Staphylococcus aureus*. It is similar to the studies by Bhat et al.[17] Who recorded that *Staphlococcus aureus* was the most common isolate but it is not agreed to the studies done by Kaur et al [13] and Rajput et al [14] that find the *Pseudomonas aeruginosa* as a most common isolate. In contrast other

studies by Shriniwasan et al [10] , Kehinde et al[15] and Mohammed et al[16] noted that *Klebsiella pneumoniae* was the common isolate. In the present study isolation rate for *E.coli* is very low (9.3%) which is comparable to the study by Bhat et al. (7.34%). [(17)] The isolation rate for *proteus spp.* in our study is 6.2% while it is 2.75% in study conducted by Mehta et al.[18]

On antibiotic susceptibility testing of Gram negative bacteria, they were found the most susceptible to imipenem, Piprecillin and Amikacin. While the susceptibility for, Gentamacin, Ceftazidime , Cefotaxime and Ciprofloxacin were reduced as depicted in table 2 . This finding is similar to study done by Saxena et al[19] in which high level of drug resistance was observed for Cefotaxime, Ceftazidime and Gentamycin among Gram- negative pathogens. It may be due to frequent use of combination of 3rd generation Cephalosporins and Gentamycin. The isolate of *staph . aureus* are sensitive to Linezolid (100%) , Vancomycin (100%) and Clindamycin (87.55). Similar finding were recorded by Mehta et al [(18)] and Saxena et al. [19] In our study only 55% *Staph. aureus* were sensitive to Cefoxitin and 45% of total isolated *Staph. aureus* are diagnosed as MRSA. Rate of isolation of MRSA is comparable to a study by Mago et al [20] and Rajput et al.[14] In India the isolation rate of MRSA among the burn wounds is 70% and this varies according to the socioeconomical profile of society and hospitals. Increasing incidences of MRSA isolation in Burn units in developing countries is a serious problem because they have limited spectrum of drugs and caused the cost of treatment.[21]

CONCLUSION

Staphylococcus aureus is the main culprit in burn wound infections. *Pseudomonas aeruginosa* was the second commonest cause of infection in burn patients. These suggest that burn patients overcrowding and hygiene problem are main causes of these infections. *Pseudomonas aeruginosa* is resistance to most of the commonly used antibiotics like Ciprofloxacin, Ceftazidime and Amikacin. This situation warrants the implementation of an efficient infection control program and regular surveillance of antimicrobial resistance in *Staphylococcus aureus* and *Pseudomonas aeruginosa* isolates in order to established a rational antibiotic policy for the better management of such infections.

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