ORIGINAL ARTICLE

Study of Organisms Causing Septicemia among Burns Patients in a Tertiary Hospital, Tumkur

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Abstract:

Background: Burns occur in daily day to day activities, while cooking, fire accidents, road traffic incidents, explosions. In India burns are second leading cause of mortality, first being road traffic accidents. Due to large area involved, longer hospital staying, burns are site of bacterial growth and are much more affected than surgical wounds. *Aim and Objectives:* The aim of the study was to determine microbial profile of burn victims admitted in Shridevi institute of Medical sciences and Research Hospital, Tumkur. *Material and Methods:* The study included110 consecutive patients, admitted to burns ward during the study period of March to December 2016.Wound swab cultures were assessed on day four of the admission for bacterial growth. *Results:* Bacterial infection reached maximum by fourth week of infection. *Staphylococcus aureus*, coagulase negative *Staphylococci* and *Klebsiella pneumonia* were the most frequently isolated organisms. *Conclusion:* These results would enable early treatment of imminent septic episodes with proper empirical antibiotics thereby preventing mortality among burns patients.

Keywords: Burns, Infection, Microbial Profile, Nosocomial Infection

Introduction:

Burn is defined as an injury caused by application of heat/chemicals to external or internal surface of body which cause destruction of tissues [1]. In India, burns are second leading cause of mortality, first being road traffic accidents. Annually 1-1.5 lacks suffers burns and require hospitalization [2]. Due to large area involved, longer hospital staying, burns are site of bacterial growth and are much more affected than surgical wounds [3]. In developing countries, sepsis amounts for 75% mortality among burn victims [4]. In addition to above overcrowding of burns cases is a contributing cause for spread of infection locally and a source of cross infection [5]. Despite use of intravenous as well as topical antibiotics, sepsis causes 50-60% of deaths in burns patients [6]. The pattern of infection varies from hospital to hospital and place to place. Historically *Staphylococci* and beta hemolytic S*treptococci* were commonest organisms responsible for sepsis in burns patients in earlier days, now a variety profile of organisms causing sepsis can be noted [7]. Data from National Center for Injury Prevention and control shows 2 million fire accidents annually, out of which 1,00,000 people are admitted and 5,000 people die as a result of burn related complications [8-11]. In patients with deep burns over more than 40% of the Total Body Surface Area approximately 75% of all deaths were related to sepsis or infection related complications [12]. Immediately following burns, gram positive organisms colonize the wound [13], following which gram negative organisms colonize in first few days after infliction of injuries [14]. Wound

colonization by yeast and fungi occurs in later stages due to use of broad spectrum antibiotics [15].

Micro-organisms routinely isolated from burn wounds include aerobic organism like *Staphylococcus aureus, Streptococcus pyogenes, E. coli, Klebsiella, Pseudomonas,* anaerobic organisms like *Bacteroids fragilis, Pepto-streptococcus*, fungi like *Aspergillus niger*, *Candida* and *Zygomycetes*. These species have been routinely isolated by many researchers from burn surfaces and blood specimens [16]. The aim of present study was therefore to study the microbial profile and evaluate their sensitivity to routinely used antibiotics.

Material and Methods:

The study included 110 patients of both sexes admitted to burns ward in SIMS RH, Tumkur during ten months study period from March to December 2016. Study group consisted of patients with all degree of burns. Patients with co-morbid illnesses, pregnant women, newborns and people on immune suppressive drugs were excluded from the study. All available data including patient's personal details were recorded.

1. **Sample collection:**
   Surface swabs were taken from all patients included in the study on the day of admission. During collection the swab was rolled on its side for one full rotation over an area of 5 Sq Cm of the wound. The swabs were immediately transferred to Microbiology Research wing. Swabs for anaerobic culture were transported in thiolglycate broth in well sealed bottles. Afterwards samples were placed on culture media as early as possible according to Steer *et al*. [17].
2. On suspicion of septicemia or fungaemia, two blood samples were collected under complete aseptic conditions.
3. **Sample processing:**

A. Direct Examination:
Two swabs were taken from wounds. One examined by adding 10% KOH solution for fungal identification. Second was stained by Gram stain for bacterial examination.

B. Culture:
Swabs were inoculated onto MacConkey agar, Blood agar and Sabouraud Dextrose agar. While other swab in thioglycolate was incubated for 24 hrs, then inoculated on to blood and MacConkey agar and incubated anaerobically for 2-4 days. Suspected blood samples were inoculated separately for aerobic and anaerobic organisms. Bacterial growth and fungal yields were identified according to standard conventional procedures. Species identification was done based on series of test results. Identified isolates were stored on nutrient agar slant. Results obtained were entered in standard formats and analyzed using suitable statistical methods.

C. Blood Culture:
Blood culture was done by using Brain Heart Infusion (BHI) broth for Aerobes and for anaerobes Robertson Cooked Meat media and pre-reduced medias were used.

Results:

The study included 110 patients, of which 76 were males (69.1%) and 34 were females (30.90%), their ages ranged from 5 years to 69 years. Total Body Surface Area was a mean of 25%.

Table 1: Socio-demographic Characteristics (Age in Years) of Burns Patients

Age (Years)	Number	Percent
Till 15	12	10.90
16-30	56	50.90
31-45	22	20.00
46-60	18	16.37
>60	02	01.82
Total	110	100

In the present study, majority of victims were of the age group 16-30 year (50.90%), followed by 31-45 age group (20%). While the remaining were in 46-60 age groups (16.37%), 12 cases were below 15 years (10.90%).

Table 2: Socio-demographic Characteristics (Sex) of Burn Patients

Sex	Number	Percent
Male	76	69.10
Female	34	30.90
Total	110	100

In the present study majority of patients were males 76 (69.10%), female patients were 34 (30.90%). Male: female ration is 2.23:1.

Table 3: Causes of Burns and Percentage

Cause	Number	Percent
Accidental	75	68.18
Hot water	20	18.18
Steam	05	04.55
Hot food	10	09.10
Total	110	100

Predominant causes of burn infection in the study were accidental burns 75(68.18%), followed by infliction of burns by hot water 20(18.18%), steam 05 (4.55%) and hot food related incidents 10 (9.10%).

Table 4: Distribution of Degree of Burn Wounds

Degree of Burn	Number	Percent
First	25	22.73
Second	80	72.72
Third	03	02.72
Fourth	02	01.81
Total	110	100

Main group of burns was second degree 80 (72.72%), while first degree followed at a rate of 25 (22.73%). In comparison third and fourth degree burns were 3 (2.72%) and 2 (1.81%) respectively.

Table 5: Types of Strains Isolated from Blood culture of Burns Patients

Isolates of Species	Number	Percent
Staphylococcal Species	27	45
Enterococci	08	13
P. aeruginosa	12	20
E.coli	6	10
Klebsiella pneumoniae	3	5
Acinetobacter	4	7

Table 6: Antibiotic Susceptibility of Gram Positive and Gram Negative Isolated Strains

Antimicrobial agents	*Staphylococcal* Species (n=27)	*Enterococci.* Species (n=8)	*Pseudomonas* (n=12)	*E. coli* (n=6)	*Klebsiella* (n=3)	*Acinetobacter* (n=4)
Erythromycin	2/27	0/8	----------	----------	----------	----------
Penicillin G	4/27	6/8	----------	----------	----------	----------
Tetracycline	2/27	4/8	----------	----------	----------	----------
Oxacillin	6/27	4/8	----------	----------	----------	----------
Clindamycin	14/27	6/8	----------	----------	----------	----------
CoTrimoxazole	14/27	2/8	----------	----------	----------	----------
Amikacin	--------	6/8	6/12	2/6	1/3	4/4
Gentamycin	20/27	6/8	8/12	4/6	2/3	4/4
Ciprofloxacin	18/27	6/8	4/12	2/6	2/3	2/4
Cefoxitin	20/27	6/8	----------	----------	----------	----------
Vancomycin	27/27	8/8	----------	----------	----------	----------
Linezolid	27/27	8/8	----------	----------	----------	----------

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Antimicrobial agents	*Staphylococcal* Species (n=27)	*Enterococci.* Species (n=8)	*Pseudomonas* (n=12)	*E. coli* (n=6)	*Klebsiella* (n=3)	*Acinetobacter* (n=4)
Piperacillin Tazobactum	---------	----------	8/12	6/6	3/3	4/4
Cefotaxime	----------	----------	4/12	3/6	2/3	3/4
Ceftazidime	---------	----------	6/12	4/6	3/3	2/4
Imipenam	----------	----------	10/12	6/6	3/3	4/4
Colistin	---------	----------	10/12	3/6	3/3	3/4

The types of isolates from blood cultures are shown in table 5. Of the 110 cases, 60 samples yielded growth. The most common isolates were *Staphylococci* (45%) followed *by Pseudomonas aeruginosa Enterococci* species, *E. coli, Acinetobacter* and *Klebsiella pneumoniae* species. Table 6 shows the antibiotic sensitivity of Gram positive and Gram negative bacteria isolated from burn wounds.

Table 6 (i): Gram Positive Organisms Colonizing and Infecting Burn Wounds

Gram positive organisms	Number
Staphylococcus epidermidis	20
Staphylococcus aureus	15
Streptococcus pyogenes	10
Enterococcus faecium	05

Gram positive organisms infecting burn patients are shown in Table 6(i).*Staphylococcus epidermidis* was predominant gram positive organism having affected 20 patients, followed by *Staphylococcus aureus* affecting 15 patients, *Streptococcus pyogenes* affecting 10 and *Enterococcus faecium* affecting 5 patients .

Table 6 (ii): Gram Negative Organisms Colonizing and Infecting Burn Wounds

Gram-negative Organisms	Number
E Coli	14
Pseudomonas aeruginosa	12
Klebsiella pneumoniae	20
Moragnella	4
Acinetobacter	8
Proteus mirabilis	6

The gram negative organisms affecting burn wounds are shown in Table 6(ii).*Klebsiella pneumoniae* was predominant gram negative organism infecting 20 patients, followed by *Pseudomonas* and *Morganella* together accounting for 16 cases, *E. coli* 14, *Acinetobacter* species 8 and *Proteus mirabilis* 6.

Table 7: Type of Fungi Affecting Burn wounds

Yeast and fungal bodies	Number
Candida glabarta	05
Aspergillus	03

Only *Candida glabarta* and *Aspergillus* were fungi with low incidence as shown in above table.

Discussion:

Burn injuries are the most common and devastating form of trauma with unpredicted outcome. Patients with severe injuries require immediate specialized care to reduce mortality and morbidity by infection and septicemia. Septicemia is defined as a clinical syndrome characterized by fever, chills, malaise, tachycardia, hyperventilation and toxicity or prostration which results when circulating bacteria at a rate that exceeds removal by phagocytes[18]. Due to availability of empirical antibiotics and tertiary care there is significant fall in morbidity and mortality of burns cases. A study by Ghaffar *et al*. [19] reported sepsis among 189 (62.4%) males and 114 (37.6%) females. Studies by Vostrugina *et al*. [20] and Santos *et al*. [21] also showed similar incidence and increased risk of sepsis among males compared to females.

In the present study, majority of victims were the age group of 16-30 year (50.90%), followed by 31-45 age group (20%). While the remaining were 46-60 age group (16.37%), 12 cases below 15 years (10.90%). Wong *et al*. [22] found that age group 19-40 years (55%) was more susceptible for wound infection than other age group.

Predominant causes of burn infection in the study were accidental burns 75(68.18%), followed by infliction of burns by hot water 20(18.18%), steam 05 (4.55%) and hot food related incidents 10 (9.10%). These findings are almost similar to Ghaffar *et al*. [18] with very little alteration in numbers.

Main group of burns was second degree 80(72.72%), while first degree followed a rate of 25(22.73%). In comparison third and fourth degree burns were 3(2.72%) and 2(1.81%) respectively. Similarly Al-Akaylesh [23] showed that highest distribution of burn patients with second degree burns (53.9%).

In our study, *Staphylococcus epidermidis* was predominant gram positive organism with rate of 20, followed by *Staphylococcus aureus* 15 which is known to be the predominant organism to affect burns cases in Europe[27] (20%) and *Enterococcus Facium* 5 (4.54%). Similar results were observed by Bagdonas *et al*. [24] and Elsayed *et al*. [25]. Study by Al-Akaylesh found most prevalent organism was *P. aeruginosa* [23]. *Klebsiella pneumonia* was predominant gram negative organism with high rate 46 (41.81%), followed by *E coli* 44 (40%), *Proteus mirabilis* 18(16.36%), *Acinobacter* 21 (21%), *Pseudomonas* and *Morganella* together accounting for 24 cases. while gram negative organisms and fungi showed altered numbers in comparison to above studies. *S aureus* has special characteristic of spreading quickly in hospital environment [26]. This pathogen has been reported as major nosocomial infection in Europe [27]. This can be attributed to immune-suppressive status and immediate lack of antibodies that favours organisms to multiply and cause sepsis locally and systemically. There are

various physical parameters like necrotic tissue, gaseous contents in necrotic tissue, temperature that favours growth of organisms. A single bacterium can increase in number to over 10 billion cells in a span of 24 h in above said favorable conditions.

Conclusion:

Our study concludes that the prior knowledge of commonly affecting organisms of burn wounds with their susceptibility to antibiotics in our locality would greatly help in reducing the mortality and morbidity of burn patients.

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