

# A Prospective Study of Microbiological Pattern in BurnWound and Burns ward in a Tertiary Care Center

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## ABSTRACT

**Background:** Burns are one of the most common and devastating forms of trauma. Patients with serious thermal injury require immediate specialized care in order to minimize morbidity and mortality. Infection causes 50% to 60% of deaths in burn patients in spite of intensive therapy with antibiotics both topical as well as intravenous.

**Aim:** The aim of study was to study the bacteriological pattern of burn wound in a tertiary care center.

**Materials and Methods:** This is an observational prospective study, a total number of 112 swab culture samples, 56 blood culture samples were collected from 56 patients with burns wound admitted at Gandhi Medical college Hospital, Secunderabad. The samples were processed in the Central Service Laboratory, Gandhi Medical College Hospital.

**Results:** Out of 56 swab culture isolates, 15 samples (28.30%) were gram positive and 38 samples (71.70%) were gram negative. Gram negative bacteria *Klebsiella* was the predominant isolate 16(28.50%) in second week in this study.

**Conclusion:** This study focusses on aspects of history, pathophysiology, microbial etiology and microbial analysis of burn wound infection with special emphasis laid on the surveillance of burn wound infections and its culturing techniques.

**Keywords:** Burn wound, infection, colonization, septicemia, swab

## INTRODUCTION

Since the discovery of the first flame, the exothermic combustion reaction of oxygen and carbon have exposed human flesh to significant destruction and disfigurement in the form of burns.<sup>[1]</sup> The history of the treatment of burn injuries and burn care has slowly evolved as a rational treatment process from ages unknown. Burn wounds are highly susceptible to colonization and infection and this is the major problem in the management of burn victims. Initially, the burnt area is considered free of microbial contamination. Factors responsible for burn wound infection are colossal skin loss, coagulative

necrosis of tissues, continuous contamination, copious discharge, compromised immunity.

Initially, the burnt area is considered free of microbial contamination. Major burn wounds usually become infected within 3-5 days after admission, so it is obvious that the infection arises from the patient's own bacterial flora and is not an exogenous occurrence. Colonization arises from the patient's own resident and transient flora.<sup>[3-7]</sup> About 75% of the mortality associated with burn injuries is related to sepsis, especially in developing countries.<sup>[1]</sup> When the level of bacterial growth exceeds 10<sup>6</sup> or 10<sup>7</sup>, then microbial invasion into the bloodstream

occurs. This is the most important cause, leading to septicaemia.<sup>[1]</sup>

In particular, immune suppression caused by impaired neutrophil function, cellular and humoral immune system can facilitate multiplication and colonization of burn wounds by different microorganisms.<sup>[8]</sup> Infection of burn wounds may be associated with bacteremia, and interfere with the acceptance of skin grafts.<sup>[6]</sup> Despite effective topical chemotherapy, the burn wound infection still contributes to 50–75% of mortality.<sup>[7]</sup> Spectrum of bacterial isolates varies with time and geographical area.<sup>[9]</sup> So the main aim for any strategy dealing with burn wounds should have definite goals in achieving an effective infection control.

This necessitates periodic review of the isolation pattern and anti biogram of the burn ward, which forms the basis for modification of drug regimen strategy.<sup>[9]</sup> Keeping this in mind, the present study was planned to determine the bacteriological profile and the resistance pattern from the burn ward. Surface wound swabs are currently used in many centres in India do not give the exact count of pathogens involved in burn wound sepsis; they throw light on results at times.<sup>[10,11]</sup>

Evaluation of the burns wound by a surface swabbing has been the principle method in my institution till date. This study emphasizes surface swabbing, blood culture and leucocyte count for a more accurate method of assessing the burn wound sepsis. Surface swabbing gives surface colonization and may not accurately reflect the organism causing wound infection while blood culture and leucocyte count were likely to develop sepsis and also to predict graft Bed receptiveness and safety of wound closure.

#### ***Aim and Objectives***

- To study the bacteriological profile of burn wound infections in Gandhi Medical College and Hospital, Secunderabad.
- To study the importance of blood cultures and leucocyte count in burn wound sepsis.

## **MATERIALS AND METHODS**

The present study was conducted in Gandhi Medical College, Secunderabad for a period of two years in the Department of Plastic Surgery. The study design was an observational prospective study. Prior approval of Ethical Committee Clearance obtained from Ethical Committee.

Informed Consent Obtained from each patient Sample taken and sent for Swab culture, Blood culture and Leucocyte count The samples were processed in the Central Service Laboratory, Gandhi Medical College

Hospital.

A total number of 112 swab culture samples, 56 blood culture samples were collected from 56 patients with burns wound admitted at Gandhi Medical college Hospital, Secunderabad. In the present study patients of all age groups and gender with burn wounds ranging from 15% to 70%.

Total body surface area burns are included. Children with burns <5% TBSA, Adults <15% TBSA, Burns above 70% TBSA and Facial/ hands & feet/perineal burns are excluded.

#### ***Specimen Collection***

According to the above criteria the samples were collected. Samples from the burn wounds were collected by surface swab culture, blood culture for aerobic bacterial culture and blood samples for leucocyte count.

#### ***Surface Swab***

To obtain a culture of burn surface, topical agents were first removed with a gauze soaked in sterile saline. The method of collection was deep swabbing, or aspiration of the bleb. Then the sample was collected by two sterile swab sticks. For dry wounds the swab was moistened with sterile saline. After the collection, the swabs were immediately transported to the laboratory for further processing.

#### ***Blood Sample Collection***

Blood samples were collected from patients with suspected Sepsis, preferably before administration of antimicrobial therapy. About 5-10 ml of blood from adult patients and 2 ml of blood from pediatric patients was collected from a peripheral vein under strict aseptic precautions.

The samples were collected in blood culture bottles containing Brain Heart infusion broth and immediately transported to the laboratory for further processing.

#### ***Blood Culture***

The inoculated blood culture bottles were incubated overnight at 37°C aerobically and subcultured on day 2, day 3, day 4 and finally on day 7. Subcultures were done on Blood agar, Chocolate agar and MacConkey agar.

The specific identification of Aerobic bacterial pathogen was done based on microscopic morphology, staining characteristics, cultural and biochemical properties using standard laboratory techniques as follows.

Colonies on Blood/ Chocolate and MacConkey agar were initially processed by performing a Gram stain.

## RESULTS

Among the total population, the age and sex distribution were studied in burn wound infections. Out of 56 cases, the most common age group affected was 21-30 years (39%) followed by the age group <10 years (25%). Least number of cases was seen in the age group of more than 60 years (1.7%) (Chart 1)

**Table 1: Shows prevalence of total body surface area Burns**

% TBSA	No of cases	Percentage
<15	6	10.71%
16 - 30	23	41.07%
31 - 45	11	19.64%
46 - 60	13	23.21%
> 60	3	5.35%

Table 1 shows 16 -30 % of the TBSA is the maximum percentage of burns cases 41.7% least being 5.3% involving >60% TBSA .

**Table 2 : Shows weekly distribution of isolates in Swab cultures**

Isolates	1st Week	1st Week %	2nd Week	2nd Week%
Staphylococcus aureus	11	19.60%	3	5.30%
Klebsiella pneumonia	2	3.50%	16	28.50%
Escherichia coli	2	3.50%	7	12.50%
Pseudomonas aeruginosa	1	1.70%	6	10.70%
Strepto coccus	1	1.70%	0	0
Citrobacter freundii	0	0	4	7.14%
Polymicrobial	21	37.50%	4	7.14%
Contaminants	8	14.20%	3	5.30%
Nobacterial growth	10	17.80%	13	23.20%

**Table 4: Shows prevalence of organisms in Blood culture technique**

Isolates	No of Isolates	Percentage
Staphylococcus aureus	6	10.71%
Pseudomonas aeruginosa	1	1.79%
CONS	1	1.79%
MR CONS	1	1.79%
MRSA	1	1.79%
POLYMICROBIAL	2	3.57%
Nobacterial growth	44	78.57%

Common organism isolated in blood culture was Staphylococcus aureus 10.71% followed polymicrobial growth 3.57% followed by Staphylococcus aureus, CONS, MR CONS, MRSA with each 1.79% and no growth bacterial growth seen in 78.57 (Table 4).

**Table 3 : Shows prevalence of Gram staining in Swab culture**

Specimen	1st week	Percentage	2nd week	Percentage
Positive	12	70.00%	3	8.34%
Negative	5	30%	33	91.67%

Table 2 shows Among isolates of swab cultures during 1st week- poly microbial growth shown maximum prevalence 37.5%, followed by Gram positive bacteria-staph aureus 19.6%, Gram negative bacteria-Klebsiella, E.coli 3.5%. No growth 17.8%. Second week common organism isolated are Gram negative bacteria Klebsiella 28.5% followed by Escherichia coli 12.5% and Pseudomonas aeruginosa 10.7%. Among Gram positive Staphylococcus aureus shown least prevalence -5.3%. No growth 23.20%.

Table 3 shows Among positive swab culture during 1st week 70% were gram positive bacteria 30% were gram negative. During 2nd week 8.34% were gram positive bacteria with 91.67% were gram negative.

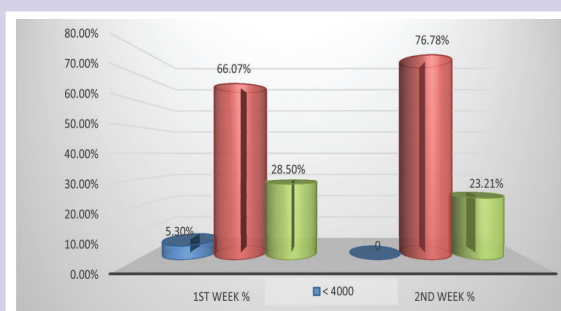
Table 5 shows among swab cultures Staphylococcus aureus and Klebsiella pneumonia were the common bacteria isolated with each 12.5% and in blood cultures Staphylococcus aureus is the commonest bacteria 10% followed by Escherichia coli 8.03% , Citrobacter freundii and Klebsiella oxytoca 3.5% in swab cultures and Pseudomonas aeruginosa, MRSA, CoNS, MR CoNS were next common bacteria isolated with each 1.7%.

Graph 1 shows Among CBP counts during the 1st week 33.8% of the samples were positive samples were significant (leucopenia +leucocytosis) for patients with sepsis during the 2nd week 23.21% of the samples were significant (leucopenia +leucocytosis)

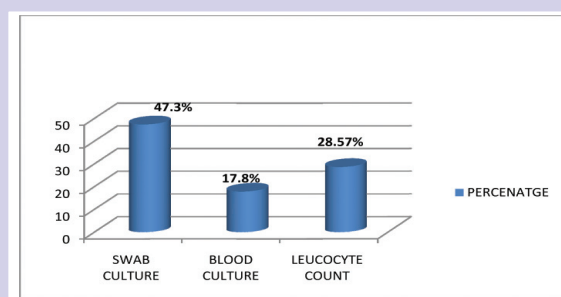
Graph 7 Shows Among patients with sepsis Swab cultures 47.3% showed positive culture, Blood cultures showed 17.8% positive results, Leucocyte count were significant in 28.57%.

Table 5: Shows Comparison of isolates by Swab and Blood cultures

Organisms	Swab culture (n=112)	Swab culture %	Blood Culture (n=56)	Blood Culture %
Staphylococcus aureus	14	12.5	6	10.7
Klebsiella pneumoniae	14	12.5	0	0
Escherichia coli	9	8.03	0	0
Pseudomonas aeruginosa	7	6.25	1	1.7
Klebsiella oxytoca	4	3.5	0	0
Citrobacter freundii	4	3.5	0	0
Streptococcus non BH	1	0.89	0	0
MRSA	0	0	1	1.7
CoNS	0	0	1	1.7
MR CoNS	0	0	1	1.7
No Growth	60	53.57	46	82.14



Graph 1: Shows weekly Distribution of CBP Counts



Graph 2: Shows Correlation between Swab Culture, Blood Culture and Leucocyte Count in Burn Wound Sepsis

## DISCUSSION

Infection in the burn wound continues to be the main cause of morbidity and mortality in patients who are admitted to hospital with major thermal burns.<sup>[12]</sup> Burns provide a suitable site for bacterial multiplication because of persistent rich source of nutrition for the microbes, larger areas of involvement on longer duration of stay of the patients in the hospital. Surface swab culture is done as a routine investigation to know the bacterial isolates and its sensitivity to antimicrobial drugs in the management of burn wounds. Blood culture is the other investigation done to know the organism responsible for sepsis in burn wound.

Sepsis is a major challenge in burns and cause substantial morbidity and mortality. Changing pattern of isolates increasing rates of antimicrobial resistance are a concern in the management of burn wound and have a role in the outcome of sepsis<sup>[13-16]</sup>. It is therefore important to continually review and update the epidemiology of sepsis

in burns mainly with respect to the bacteriological profile and antibiotic susceptibility pattern of burn wound pathogen by sending serial surface swab cultures and blood cultures in patients with symptoms of sepsis. Complete blood picture was done along-side to predict the sepsis, and to have appropriate treatment of the patients.

In this study a total of 112 Surface swabs, 112 Blood samples for Leucocyte count and 56 Blood culture samples were collected from 56 patients with burns and were admitted in burns ward with symptoms of suspected sepsis. This study was done to know the aerobic bacterial profile of clinically suspected sepsis in burns and antibiotic susceptibility pattern of isolates. Results obtained in this study were analyzed and compared with other studies.

Burn wound infections were common in the age group between 21-30 years. This age group had sustained mixed thermal burns who were about 39%. The next age group between 0-10 years sustained scald injuries they accounting up to 20%. This could be due to deep burns

and larger % of TBSA. Among 56 patients, 34(60.70%) were female and 22(39.20%) were male who had burn wound infections. Females were common because they sustained deep thermal burns.

No isolates of non-beta hemolytic streptococcus encountered in this study. Similar results were found in the studies by Tahir Saleem et al<sup>[17]</sup> and Koushak et al.<sup>[18]</sup> Among Present study and the study by Tahir Saleem et al. two similar results were found those were the Positive culture results and no growth %. Polymicrobial growth and contaminant growth could be because of the colonization of bacterial organisms. No growth could be because of sterile status of the burn wound in the first week. Polymicrobial growth pattern in both the studies were almost near equal. According to Ozumba Jiburum et al Organism isolated was *Kebsiella pneumonia* 24%. This was similar to the present study. Commonest organism isolated was *Staphylococcus aureus* in both the studies. Out 56 swab culture isolates, 15 samples (28.30%) were gram positive and 38 samples (71.70%) were gram negative. These findings are consistent with those reported by Koushak et al and Tahir saleem et al who did weekly swab cultures.

During the 1st week in this study Gram positive bacteria *Staph aureus* was predominant isolate 19.6% where as 25% reported by Koushak et al and Tahir saleem et al.<sup>[17]</sup> Gram negative bacteria *Klebsiella* was the predominant isolate 16(28.50%) in second week in this study and is consistent with study done by Ozumba and Jiburum isolated *Klebsiella* 26.7%. A study done by Koushak et al and Tahir saleem et al it was *Pseudomonas* isolated in 56.26% in consistent with this study.

There was significant leucocytosis in 28.5% patients and leucopenia in 5.3% of patients which amounted a total of 33.6% in the first week. Counts were normal in 66.4% though they had symptoms of suspected sepsis. In second week among the samples 23.2% showed leucocytosis and 76.8% had normal leucocyte count though they had fever spikes. Complete blood picture counts were reliable to diagnose sepsis during the first week when done along side of swab culture. In a study done by Clinton Murray et al<sup>[19]</sup> observed that 68% of the patients had leucocytosis and leucopenia and 32% of them have normal counts though they had fever spikes

Studies done by Krejci NC et al<sup>[20]</sup> were unable to detect an association between CBP and gram positive and Gram negative blood stream infection. Study done by Keen A. Knodock<sup>[21]</sup> L Edlman Saffle et al observed that mean WBC on the day of culture were identical for both positive and negative blood culture episodes. Complete blood picture count (CBP) or leucocyte count alone is not reliable investigation in burn wound sepsis. But complete blood picture count (CBP) with surface swab, and blood culture

had more reliable in predicting sepsis. CBP count + swab culture = 4.5% raise in culture positivity. CBP count + Blood culture = 3.5% raise in culture positivity.

## CONCLUSION

The most common age group were between 21-30 years had symptoms of burn wound sepsis. Female predominance was seen, and had more than 15% TBSA involved with higher degree of depth of burns. The commonest organism isolated in first week was *Staphylococcus aureus*. In second week swab cultures showed Gram negative bacteria *Klebsiella* was the common isolate. In this study swab culture proved to be more reliable during the second week in management of sepsis compared to the Blood culture.

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## CONFLICT OF INTEREST:

The authors declared no conflict of interest.

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