

Cross Sectional Study for *Pseudomonas Aeruginosa* Prevalence in Septicemic Burn Patients

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ABSTRACT

Objective: To determine the bacterial profile in patients with burns that cause septicemia.

Study Design: Cross sectional study

Place and Duration of Study: This study was conducted at the Department of Microbiology, Basic Medical Sciences Institute (BMSI), Jinnah Postgraduate Medical Centre (JPMC), Karachi from February 2014 to June 2014.

Materials and Methods: A total of 100 burn patients were registered who were admitted to the Burns Ward, Civil Hospital Karachi over the 2 weeks' period.

Results: Only 42 blood specimens from patients were processed. 10 (23%) were culture positive. Specimens yielded 15 microorganisms. Of this number, 13 (86.66%) were Gram-negatives and 2 (13.3%) were Gram-positive. Among the Gram-negatives, *Proteus vulgaris* was 3 (20%) while *Staphylococcus aureus* was 2 (13.33%). *Pseudomonas aeruginosa* were the most common accounting for 7 (46.66%).

Conclusion: Complications due to sepsis still remain a remarkable cause of morbidity and mortality in severely burned patients. An adequate early treatment after an immediate diagnosis of causative organisms in these cases gives an encouraging outcome along with significant patient survival results.

Key Words: Burn patients, Septicemia, Gram positive bacteria, Gram negative bacteria

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INTRODUCTION

An infection due to microbes during thermal injury in burn patients is always a main problem in management (Kumar et al., 2010)¹. Thermal injury damages the skin barriers which likely stop the entry of microorganisms (Singh et al., 2003; Barret et al, 1999; Murray and Finegold 1984; Lari AKet al, 1998; Nasser et al, 2003)^{2,3,4,5,6}. Hemostatic changes due to severe burns are not comparable to other types of injuries where there is a high mortality rate in initial phase (Begum et al., 2011)⁷. Skin is the largest organs in body in terms of size and coverage. An intact human skin is vital in preserving the homeostasis, thermoregulation along with protection against infections.

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Burn injuries create a breach in skin surface and hinder vital functions that are essential for sustaining life thus allowing microbial colonization of burn wound (Chalise et al., 2008 & Naseer et al., 2003)^{8,9}.

Sepsis brought about in burn patients is common because of bronchopneumonia, pyelonephritis, thrombophlebitis and wound infections; most of the septic events occur during initial two weeks of the burns. Extensive burns cause of death in affected persons (Begum et al., 2011)⁷.

Fermentative gram negative bacilli, *Pseudomonas aeruginosa* is emerging as an important pathogen as causative agent in burn patients (Vidal et al, 2003)⁹ and persists as a major hospital-acquired infection threat to burn patients. It has been observed that resistance is arising against multiple antimicrobial drugs frequently complicates the treatment of *Pseudomonas aeruginosa* infection (Naqvi et al., 2005)¹⁰. Infections with *Pseudomonas aeruginosa* began to be seen in increasing numbers. From 11% to 30% of burns are contaminated by microorganisms of the gastrointestinal tract, skin and upper respiratory system, including *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella* species, *Enterococcus* species and *Candida* species (Begum et al, 2011)⁷.

MATERIALS AND METHODS

This cross-sectional study was conducted between February 2014 to June 2014 in the Department of

Microbiology, Basic Medical Sciences Institute (BMSI), Jinnah Postgraduate Medical Centre (JPMC), Karachi. Prior approval was in hand from the institutional ethical review committee and an informed written consent was obtained from each patient/guardian. Patients were registered for the study irrespective of age or gender, degree, percentage or duration of burn.

A total 239 culture samples were divided into two groups. 197 samples of pus were taken from wounds and 42 samples of blood were taken from suspected patients of septicemia were collected from 100 registered patients. After taking necessary aseptic measures, the samples were collected and necessary data was filled accordingly. Each wound swab was taken from infected wounds after cleaning of any ointment on day 7 and 14 after admission (Ekrami and Kalantar, 2007)¹¹ and it was inoculated on Blood agar, MacConkey agar and Sabourad Dextrose agar (SDA) (Alttoparlaket al., 2004)¹². These plates were incubated aerobically at $35\pm 2^{\circ}\text{C}$ for 24 hours. Inoculated blood culture bottles were incubated for 24 to 48 hours (and even up to one week where needed) at 37°C and then examined for turbidity indicative of positive growth. After overnight incubation, established microbiological methods, which include colonial morphology, Gram's staining and biochemical characteristics were used for identification according to CLSI (Clinical & laboratory standard institute) criteria.

Each significant isolate was identified by colonial morphology, Gram staining and biochemical reactions according to the standard procedure. Blood samples were collected after all aseptic measures and in case of suspected septicemia 5-10 ml of blood was collected in a disposable syringe aseptically. Blood was pushed into a bottle containing 50 ml of brain heart infusion broth where blood was mixed in broth by tilting or rotating the bottle gently and was transported to the Microbiology Department of BMSI in minimum time (Collee and Marr, 1999)¹³. The blood culture broth was incubated at 37°C for 7 days. Three sub cultures were made after 24 hours, 72 hours and on the 7th day over Blood, MacConkey and Sabouraud's dextrose agar respectively (Manoharan et al, 2010)¹⁴. Established microbiological methods, which include colonial morphology, Gram's staining and biochemical characteristics, were used for identification.

RESULTS

Table 1 shows the comparison of positive cultures, between wound swabs and blood specimens taken from 100 patients. A total of 239 specimens of wound swabs and blood were collected. Out of 197 wound swabs microbial growth was found in 185 (93.9%) cases. While on the other hand, out of 42 blood cultures microbial growth was found in 10 (23.8%) cases. Data shows higher percentage of positive cultures in wound

specimens as compared to blood specimens. However, 44 (18.41%) specimens did not show any microbial growth.

Table 2 shows different pathogens (n=15) isolated from patients suffering from septicemia. Most predominant pathogen isolated was *Pseudomonas aeruginosa* i.e. 7 (46.66%).

Table 3 shows that among 10 patients of septicemia 50% were suffering from infection due to single pathogen while 50% were having infection due to more than one pathogen.

Table 4 shows the comparison of bacterial isolates recovered from blood cultures with that of organisms recovered from wound specimens. Out of 10 cases of septicemia 7 (70%) isolates were similar to those recovered from burn wounds, while 3 (30%) were different to those, isolated from burn wounds.

Table No.1: Comparison of positive cultures between wound and blood specimens

Type of specimen	Number	Culture +ve
Wound	197	185 (93.9%)
Blood	42	10 (23.8%)
Total	239	195 (81.5%)

Table No.2: Microorganisms isolated from patients of septicemia (N=15)

Organisms	Number	Percentage
<i>Pseudomonas aeruginosa</i>	7	46.66
<i>Proteus vulgaris</i>	3	20.00
<i>Klebsiellapneumoniae</i>	2	13.33
<i>E.coli</i>	1	6.66
<i>Staphylococcus aureus</i>	2	13.33

Table No.3: Percentage of solitary and mixed growth from blood specimens in patients of septicemia

No. of blood culture	Solitary growth (%)	Mixed growth (%)
10	50%	50%

Table No.4: Similarity of bacterial isolates recovered from blood and wound specimens

No. of septicemia	Isolated organisms similar to burn wound	Isolated organism different from burn wound
10	7 (70%)	3 (30%)

DISCUSSION

Various studies show that burn patients are more vulnerable to infections. In the present study septicemia occurred in 10% of patients that is similar with the studies conducted by Oncul et al. (2009), Ekrami and Kalantar (2007) and Alp et al. (2011)^{15,11,16} in which septicemia occurred in 19.9%, 18.6% and 17% patients respectively, which is in accordance to this study. Another study done in tertiary care unit in

Bangladesh showed no growth in 5 blood samples (Begum et al., 2011)⁷. Also study done by Ressler et al. (2008)¹⁷ found 92/1258 (7.31%) bacteremia in burn patients. The most frequent pathogens were *Staphylococcus aureus* and *Pseudomonas aeruginosa* while this study revealed *Pseudomonas aeruginosa* as commonly isolated pathogen; these findings are partially similar to this study. Burn wounds remained the main source of sepsis in these patients which might be due to emergence of multi-resistant hospital-oriented pathogens that prevailed in the burn units and transformed to the normal flora in patients within few days after stay in hospital. The bacteriological profile of burn units in various hospitals has been changed worldwide according to various reports but *P. aeruginosa* is considered to be related with transportation of patients from one place to other. Murray et al. (2007)¹⁸ showed most recovered bacteria from blood culture were *Pseudomonas aeruginosa* (26.09%) 19/73. Mahar et al. (2010)¹⁹ observed 62.7% prevalence of NFGNB (Nonfermenting Gram-Negative Bacilli) in bacteremia. The finding of our study is in accordance to this study (70%). This variation in burn patients is showing the empirical use of antibiotics in their burn units. Overcrowding, massive contaminated environment, lack of isolation and improper hand washing are few common causes of increase rate of burn wound infections and sepsis (Saha et al., 2011)²⁰. In spite of advancements in primary wound care of burn patients, i.e. antimicrobial use (both topical as well as systemic), debridement of wound in early stages; the death still ensues due to the sepsis that still stays as a major cause in these cases. A dysfunctioning immune system along with bacterial colonization of skin and long-term hospital stay followed by invasive methods for diagnosis and treatment purposes all add to sepsis of burn individuals (deMacedo and Santos, 2005)²¹. Burn patients are at increased risk of hospital-acquired infections due to extended stay at burn units. By the time this change will be noticed by these units that there is a remarkable change in prevalence of common pathogenic organisms (Begum et al., 2011)⁷.

CONCLUSION

Complications due to sepsis still remain a remarkable cause of morbidity and mortality in severely burned patients. An adequate early treatment after an immediate diagnosis of causative organisms in these cases gives an encouraging outcome along with significant patient survival results.

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Concept & Design of Study: Rakhshinda Younus
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Conflict of Interest: The study has no conflict of interest to declare by any author.

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