

Current Bacteriological profile in Fire-burn victims and their associated mortality at the Burns Centre, Karachi-Pakistan

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ABSTRACT

Objective: This study attempts to document the current bacteriological profile from pertinent specimens of fire burn victims in our setting with respect to the time related variations in the isolation of microbial species, extent of their burn injury and their effect on mortality rate.

Methodology: During a three year period (Jan 2008 to Dec 2010), a prospective study was conducted on 477 fire burn victims at the Burns Centre of Civil Hospital, Karachi, with the exclusions of electrical, chemical and other forms of burn injury. Blood, pus, urine and wound biopsy samples were collected and cultured according to standard laboratory protocols. The data was analyzed according to the age, gender, time related changes, percentage of burn surface and the mortality rate.

Results: Total 477 patients were included in our study. Multiple specimens were collected (n=732) of which 649 (88.7%) cultures were positive for different organisms. Staphylococcus aureus was the commonest organism isolated in fire burn patients. During 1st week S. aureus was predominant (31.6%) followed by Pseudomonas. After 1st week S. aureus (24.6%) and Pseudomonas (25.5%) isolation rate became similar. Mortality rate due to infections was 18.9% in the subjects

Conclusions: S. aureus was the commonest cause of infection in fire burn patients in our setting followed by Pseudomonas. These suggests that hygiene should strictly be maintained around burn patients to avoid opportunistic infections.

KEY WORDS: Burn, Infections, TBSA, Mortality, Staphylococci, Pseudomonas.

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INTRODUCTION

Burn injury is an issue of major concern, threatening public health world wide. Infection is a major cause of mortality in burn victims, accounting for an estimated 75% of sepsis related mortality.¹⁻³ The human skin, stratum corneum serves as a protective barrier against microbial colonization and the disruption of the skin mechanical integrity at the burn surface, along with large amount of necrotic tissue and coagulated proteins favors novel sites for the colonization of micro-organisms^{3,4}, in addition to the suppressed immune response of the host defense system.²⁻⁴ During the first 24 hours, the burnt area is considered relatively sterile⁵, after which the

Gram-positive bacteria from hair follicles and sweat glands may survive the heat of initial injury and colonize the wounds within 48 hours of thermal injury.^{6,7} The Bacteriological profiles reported in different studies suggest that there are time related variations in the isolation of dominant microbial species⁷, with Gram positive organisms particularly *Staphylococcus aureus* being found initially most prevalent. Thereafter, colonization by Gram negative organisms particularly *Pseudomonas aeruginosa*, *Klebsiella pneumoniae* and *E. coli* gradually sets in^{3,7,8}, with some fungi especially *Candida albicans* causing opportunistic infections.⁸

The demographic characteristics of patient's i.e., age, sex and the distribution of burn injuries by the total body surface area (TBSA) has a strong co-relation with bacterial colonization and sepsis.^{2,9} The rise in production of cytokines and other inflammatory mediators due to sepsis predisposes the victims to multiple organ failure, the most significant reason of mortality in thermally injured patients.^{7,10}

Regarding the significance of infection in burn victims, it is necessary for every burns unit to access the pattern and prevalence of dominant flora from relevant specimens of burn patients. The Burns Centre in Karachi is mainly responsible for catering burns victims of all classes from all over the province.

This study was designed prospectively to document the current profile of causative micro-organisms from different specimens of burn victims in our setup, with respect to the time related variations in their isolation, the TBSA involved and overall infection related mortality.

METHODOLOGY

The present study comprises of a prospective analysis of bacteriological profile from Jan 2008 to Dec 2010, at the Burns Centre of Civil Hospital, Karachi. A total of 477 fire burn victims were included in the study. The victims of Electrical, Chemical and all other forms of burn injury other than fire burns were excluded. The patients were tabulated for age, sex, length of hospital stay (from day of admission to day of discharge or death), type of specimen taken and the % of mortality. For the estimation of extent of injury, the Lund and Browder total body

Table-I: Age and Gender distribution of burn patients.

Age (years)	Males	Females	Total	(%)
Up to 20	70	85	155	32.5
21-40	133	125	258	54.1
41-60	32	20	52	10.9
Above 60	05	07	12	2.5
Total	240	237	477	100

surface area (TBSA) scale was used.

All the relevant specimens were collected as blood, pus, urine and wound biopsy samples. The samples were inoculated on 5% sheep blood agar, McConkey agar and Chocolate agar for 48 hours and isolates by Gram stain and identified by standard diagnostic microbiological techniques.¹¹ The term of diagnosis of bacterial isolation from the hospitalization was noted. Some relevant information was also extracted from patients' files.

RESULTS

In the present study, a total of 477 patients of fire burn injury were included. There was no significant variation in the incidence of burn injury by gender, with males accounting for 50.3% (n=240) and females, 49.7% (n=237) of the total cases (male female ratio= 1.01:1). Patients' age ranged from 2 to 100 years, with maximum number of cases in age group 21 to 40 years (n=258, 54.1%). (Table-I)

As multiple specimens were collected from majority of patients, the total number of specimens included were 732. Majority of specimens were collected from wound swab or pus (79.2%), followed by blood (16.4%), urine (2.0%) and others (2.3%). Out of these, 649 (88.7%) cultures yielded multiple organisms.

The organism profiles of the patients revealed that the predominant bacterial pathogen isolated was *Staphylococcus aureus* (31.6%) followed by *Pseudomonas* (24.7%) and *E. coli* (9.0%). Beside bacterial infections, *Candida* species were also opportunistic infections microbes in burn victims (3.8%) as shown in Table-II. The most common organism isolated during 1st week of burn injury was *S. aureus* (37.5%), followed by *Pseudomonas*. However, after 1st week, the isolation of *Pseudomonas* spp. (25.5%, n=90) and *S. aureus* (24.6%, n=87) was quite similar in frequency (Table-III).

The mortality rate of fire-burn patients due to infections was found 18.9%. Females showed high incidence of mortality (Females: 23.2%, Males: 14.6%, Female to male ratio= 1.57:1). The total body surface

Table-II: Organisms isolated from burn cases.

Organisms	Percentage (%)
<i>S. aureus</i>	31.6
<i>Pseudomonas</i>	24.7
<i>E. coli</i>	9
<i>Proteus</i>	8.1
<i>Enterobacter</i>	7.4
<i>Klebsiella</i>	6.3
<i>Candida</i>	3.8
Others	9.1

area involved in burns and the duration of hospital stay were the most significant predictors of mortality among burn patients with nosocomial infections. Out of 90 cases, the majority of patients died during the first ten days of hospitalization (38.9%), with TBSA involved mainly 21-40% (n=39 cases), and 41-60% (n=33 cases). The rest of the cases reported TBSA less than 21% or more than 60%.

In patients, who died due to fire burn injury, *S.aureus* showed high incidence of infections (27.4%) from gram positive+ve category. *Pseudomonas* (24.7%) followed by *Enterobacter* (12.4%), *E.coli* (11.3%), *Klebsiella* (7.5%) and *Citrobacter* (5.3%), were the most prevalent organisms from the gram negative category.

Overall the incidence of fire burn injury declined from 2008 to 2010 (due to more awareness of safety measures in people), with the associated mortality rate also, with 2010 having the least incidence (n=132 cases) and mortality rate (n=25, 18.9%), (Fig-1).

DISCUSSION

Infectious complications appear to be a significant reason for the morbidity and mortality in patients who have sustained burn injuries.^{4,8} The burn wound if not excised and grafted early, represents an ideal site for microbial colonization by organisms of endogenous and exogenous origin.¹² Thus it is mandatory for every clinician treating burn wound sepsis to have an awareness of the proper identification of burn wound microbial flora¹³, as the local and systemic clinical manifestations of burn wound infections varies widely.⁷

The present study reveals that the male to female ratio among the fire burn victims in our setting was of no significance i.e., 1.01:1, which is closely related to a study conducted at Islamabad, Pakistan where the ratio was 1.18:1.⁷ The age group most commonly affected was 21-40 (n=258, 54.1%) which is consistent with the result of Kaur et al, who also observed maximum number of patients between 20-40 years.⁵ The data of our study regarding the specimens col-

Table-III: Frequency of organisms isolated during 1st week and after 1st week of burn injury.

Organism	< 1 st week	>1 st week
<i>S.aureus</i>	186 (37.5%)	87 (24.6%)
<i>Pseudomonas</i>	123(24.8%)	90 (25.5%)
<i>E coli</i>	39 (7.9%)	34 (9.6%)
<i>Enterobacter</i>	33 (6.6%)	35 (9.9%)
<i>Proteus</i>	32 (6.4%)	39 (11.1%)
<i>Klebsiella</i>	29 (5.8%)	27 (7.6%)
<i>Citrobacter</i>	22 (4.4%)	16 (4.5%)
<i>B-hemolytic streptococci</i>	18 (3.6%)	08(2.3%)
<i>Candida</i>	14 (2.8%)	17 (4.8%)

lected indicates that the major route of nosocomial infections in the burn victims was burn wound, as majority of collected specimens appears to be positive. Similarly in our study, the positivity of the cultures for various organisms in the total specimens was 88.7%. these results were much higher than observed in a study at Jabalpur where the positive cultures constitute 74% of the specimens.⁵ This may be due to the cross infections in our hospital due to over crowding of patients as we cater the majority of cases from all over the province.

Microbial colonization of the burn victim may occur from normal resident flora on skin and throat like *Staphylococci*, from GIT like *Pseudomonas*, *E.coli*, and *Proteus* etc may also become involved.¹ Our findings regarding the microbial isolation of organism reveal that the *Staphylococcus aureus* (31.6%) appear to be the most frequent pathogen which is strongly correlated with a study done in National Burn Repository (NBR) where *S. aureus* constitute 32% of the total organism.¹⁴ This is also related with many studies done in Nepal and South Africa.^{1,9,15} The second most dominant flora cultured after *S.aureus* is *Pseudomonas* (24.7%), the organism also isolated in studies at J&K as the second frequent pathogen.^{10,16}

Different studies regarding the time related variations reveal that there is significant variation in the isolation of predominant flora in burn victim with time, usually from gram positive to gram negative bacteria.² In our study it was observed that *S.aureus* showed predominance in the isolation during the 1st week period of the burn injury which is consistent with the finding in Islamabad where *S.aureus* showed 39% isolation rate in 1st week among all microflora.⁹ The same study mentioned that during

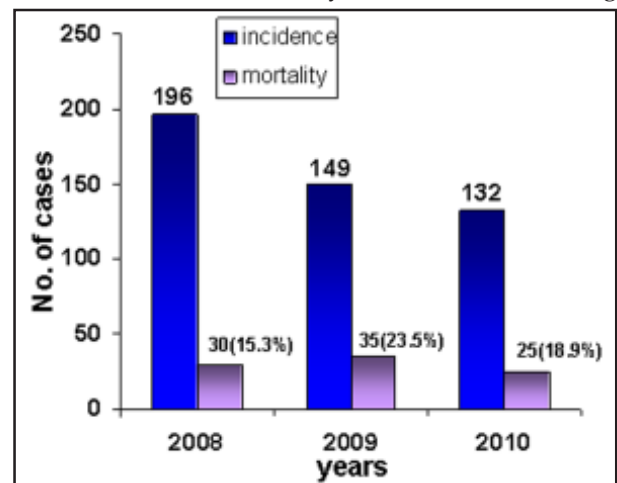


Fig-1: Year-wise comparison of Incidence and Mortality Rate among Fire burn victims.

2nd week the isolation rate of *S.aureus* decreased to 38%, while the second most common organism was *Pseudomonas* which is contrary to our study. In our study, *Pseudomonas* was the most common organism after 1st week onwards (25.5%), with *S.aureus* as the second most common organism which showed a slight decrease in its isolation rate (24.6%). Similarly, *E.coli* and *Klebsiella* has also shown an increase in the isolation rate after 1st week onwards.⁹

The comparison of our study culture reports of all the three years (2008-2010) showed a decline in the total organisms isolated in the year 2008 (43.4 %), in 2009 (35.0%) and in 2010 (21.5%). This overwhelming decrease may be due to the increase in resources and the better and specialized care.

Septicemia is an important complication of burn injury with a high risk of mortality.² The mortality rate found in our centre is 18.9% with confirmed bacteremia. PR Chalise et al reported 14% mortality rate in Nepal¹⁵, while the mortality rate was 33% and 45% in Kaunas and Libya respectively.^{3,10} This decrease in mortality suggests an effective antibiotic therapy according to C/S reports, advancements in resuscitation, sufficient nutrition, early removal of necrotic tissue and covering of wounds by authors.^{7,12} In our study females showed high incidence of mortality (23.2%) as compared to males (14.6%) in contrast to a study by Ahmed et al, where males showed dominance in mortality rate (18% males and 16% females).⁷ The patient with TBSA 21-40% and 41-60% showed a high degree of mortality in our study.

Among all organisms isolated from the burn patients who died in our centre, 27.4% were *S.aureus*, 24.7% were *Pseudomonas*, and 12.4% were *Enterobacter*. Hence these three organisms are most common etiological agents responsible for mortality in fire burn victims in our centre.

Thus, it is mandatory for every burns institution to maintain regular microbiological surveillance and monitoring of culture reports for prescribing proper empirical therapy in burns' patients.

CONCLUSION

Bacterial colonization is very common in burn patients making infection control measures extremely important. *S. aureus* has emerged as most common organism in our setting followed by *Pseudomonas*. Therefore to restrict the spread of infection visitors at burns unit should be limited and hand washing should be performed strictly before and after handling a patient (to limit cross-infections). Commonest organism causing mortality in our setting is *S. aureus* followed by *Pseudomonas*, *Enterobacter* and

E. coli. However, mortality rate among burns patients has declined during 2008-2010 at our centre. It is concluded that this could be achieved through increased awareness of our paramedics, better nutrition provided to the patients and effective antibiotic therapy.

REFERENCES

1. Bhat VG, Vasaikar SD. Bacteriological profile and antibiogram of aerobic burn wound isolates in Mthatha, Eastern Cape, South Africa. *South Afr J Epidemiol Infect* 2010;25(4):16-19.
2. Mashouf RY, Hashemi SH. The Epidemiology of Burn Wound Infections in Patients Hospitalized in Burn Center of Hamedan, Western Iran. *J Med Sci* 2006;6(3):426-431.
3. Zorhani A, Zaidi M, Franka R, Shahen A. The Pattern and Outcome of Septicaemia in a Burns Intensive Care Unit. *Annals of Burns and Fire Disasters* 2002;15(4):179-182.
4. Kehinde AO, Ademola SA, Okesola AO, Oluwatosin OM, Bakare RA. Pattern of Bacterial Pathogens in Burn Wound Infections in Ibadan, Nigeria. *Annals of Burns & Fire Disasters* 2004;17(1):12-15.
5. Kaur H, Bhat J, Anvikar AR, Rao S, Gadage V. Bacterial Profile of Blood and Burn Infections in Burn Patients. *Proceedings of Tribal Health Symposium*, 2007: 89-95.
6. Liwimbi OM, Komolafe IOO. Epidemiology & Bacterial Colonization of Burn Injuries in Blantyre. *Malawi Med J* 2007;19(1):25-27.
7. Ahmad M, Shahid Hussain S, Ibrahim Khan M, Malik SA. Pattern of Bacterial Invasion in Burn Patients at the Pakistan Institute of Medical Sciences, Islamabad. *Annals of Burns and Fire Disasters* 2006;19(1):18-21.
8. Ekrami A, Kalantar E. Analysis of the Bacterial Infections in Burn Patients at Taleghani Burn Hospital in Ahvaz, Khuzestan Province. *Iranian J Clin Dis* 2007;2(1):9-12.
9. Khan AR, Fatima N, Afridi Z, Khan BA. Prevalence of Various Pathogens and their Sensitivity Pattern in Patients with Burns at a Tertiary Care Hospital. *J Med Sci* 2008;16(2):64-67.
10. Vostrugina K, Gudaviciene D, Vitkauskienė A. Bacteremias in Patients with Severe Burn Trauma. *Medicina. (Kaunas)* 2006;42(7):576-579.
11. Murray PR, Baron E, Pfaller MA, Tenover FC, Tenover RH. *Manual for Clinical Microbiology*. ASM Press, 1995.
12. Imran M, Faheem M, Aslam V, Hakeem A, Rehman I, Shah A. Wound Infections and Culture Sensitivity Pattern in Pediatric Burn Patients. *JPMI* 2009;23(4):304-308.
13. Srinivasan S, Vartak AM, Patil A, Saldanha J. Bacteriology of Burn Wound at the Bai Jerbai Wadia Hospital for Children, Mumbai, India - A 13-year study, Part I-Bacteriological Profile. *Indian J Plast Surg* 2009;42(2):213-218.
14. Shupp JW, Pezzullo JC, Oetgen WJ, Anna R. Epidemiology of Bloodstream Infections in Burn Injured Patients: A Review of National Burn Repository. *J Burn Care Res* 2010;31(4):521-528.
15. Chalise PR, Shrestha S, Sherpa K. Epidemiological and Bacteriological Profile of Burn Patients at Nepal Medical College Teaching Hospital. *Nepal Med Coll J* 2008;10(4):233-237.
16. Dhars S, Saraf R, Singh K, Raina B. Microbiological Profile of Chronic Burn Wounds among Patients Admitted in Burn Unit. *JK Science* 2007;9(4):182-185.

Authors' contribution:

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Mir Saud Iqbal, Maria Khan: Data collection and interpretation.

Masood Hussain Rao: Editing and approval of manuscript.