

# A Study to Evaluate Burn Wounds and their Microbiological Profile

Kumari Madhu<sup>1</sup>, Aju Kumar<sup>2</sup>, Shital Malua<sup>3</sup>

<sup>1</sup>Senior Resident, Department of General Surgery, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, India

<sup>2</sup>Junior Resident, Department of General Surgery, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, India

<sup>3</sup>Professor & Head of the Department, Department of General Surgery, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, India

<sup>2</sup>Corresponding author Email ID: [ajjukumar2009\[at\]gmail.com](mailto:ajjukumar2009[at]gmail.com)

**Abstract:** Introduction: Around 3,00,000 annual deaths occur due to burn globally. Southeast Asian region contributes to 57% of them. Sepsis is responsible for 75% of deaths due to burn injuries particularly in developing nations. Aims and Objectives: To assess the microbiological profile of burn wounds. Material and Methods: Total 60 patients admitted with thermal burn injuries involving more than 20% of total body surface area were included in this cross sectional observational study. Swabs taken from the burn wounds were sent for microbiological examination. Results: 71.1% of females were affected and *Pseudomonas aeruginosa* was the most common micro-organism isolated from burn wounds. Conclusion: As sepsis is the most common cause for death among burn patients, identification of the micro-organism responsible for sepsis among burn patients is important, so that micro-organism specific therapy can be initiated.

**Keywords:** burn wounds, microbiological profile, *Pseudomonas aeruginosa*.

## 1. Introduction

Exposure to heat, radiation, electricity, friction, or chemicals leads to burn injuries of skin and other tissues [1]. Around 3,00,000 annual death occurs due to burn as per world health organization, of which >95% occur in developing countries, the Southeast Asia region contributes to 57% of the deaths occurring in developing countries [2].

India records 16,00,000 cases of fire and 27,027 death in 2017 according to 195 nation analysis by global diseases burden published in the BMJ injury prevention journal. Sepsis is related to 75% of deaths due to burn injuries especially in developing countries [3].

Burn patients usually stay in the burn unit for prolonged period of time. Micro-organisms profile present in the burn wounds changes as the days passes. Large amounts of protein rich exudates present in burn wounds, form a favourable medium for bacterial growth. Initially gram positive organisms are found commonly on the burn wounds [4]. Later on gram negative organisms become more common as the stay in the hospital increases [5,6]. These infections are the major reason for prolonged hospital stay, delay in procedures like skin grafting and mortality associated with burn wounds. So, in the burn patients the changing anti-microbial profile of the burn wounds and their sensitivity pattern over time should be done for better results. Nosocomial organisms are commonly seen infecting the burn wounds and have multi-drug resistance antimicrobial profiles.

In this study, done at the tertiary care centre of Jharkhand, microbial profile of burn wounds has been studied.

## Aims and Objectives

To study the microbiological profile of wounds of burn patients admitted at tertiary care centre of Jharkhand.

## 2. Materials and Methods

Total 60 patients admitted in burn ward were included in the study.

Time period: November 2019 to August 2021.

Study Design: A hospital based cross sectional observational study.

**Inclusion Criteria:** Patients admitted to burn ward with thermal injuries involving more than 20% of total body surface area.

### Exclusion Criteria:

- 1) Patients treated elsewhere before admission to this hospital.
- 2) Patients with burn injuries other than thermal burn.
- 3) Patients suffering from immunosuppressive diseases or taking immunosuppressive drugs.

Using sterile cotton swab, samples were collected from burn wounds on day 7 of injury, then samples were transported to the microbiology department for culture. Swabs were inoculated evenly over two agar plates aerobically, MacConkey agar and 5% blood agar at 37 degree Celsius for 24 to 48 hours. After that the plates were examined for bacterial colony and growth was identified. Plates with no growth were discarded.

### 3. Results

**Table 1: Age and Sex Distribution**

S. No.	Age Group	No. of Patients	Percentage
1.	< 15 Years	7	11.66
2.	15-30 Years	24	40
3.	30-45 Years	15	25
4.	45-60 Years	11	18.33
5.	> 60 Years	3	5
		Total =60	

Majority of patients were in age group, 15-30 years i.e. 40% of total cases.

Out of total 60 patients 43 were female i.e. 71.1%.

**Table 2: Organisms Isolated**

Organisms Isolated	Total Number	Percentage
1. <i>Pseudomonas aeruginosa</i>	15	34.09
2. <i>Klebsiella pneumoniae</i>	10	22.72
3. <i>Staphylococcus aureus</i>	9	20.45
4. MRSA	5	11.36
5. <i>E. coli</i>	3	6.81
6. <i>Proteus mirabilis</i>	2	4.54

44 samples sent for culture were positive out of total 60 samples (73.33%).

*Pseudomonas aeruginosa* was the most commonly isolated organism from the wound swabs followed by *Klebsiella pneumoniae* and *Staphylococcus aureus*. Other organisms isolated were MRSA, *E. coli* and *Proteus mirabilis*.

### 4. Discussion

In this study most of the patients belong to age group between 15 to 30 years (40 %). Similar results were observed by Chakraborty *et al.* who reported that 56.6% of the cases were of 20-39 years age [7].

Likewise, Jaiswal *et al.* stated that most of the cases were between 21–30 years of age [8].

Incidence was more in females than males. The incidence in female was 71.1% and in male it was 28.9%. This is similar to findings by Kaur *et al.* [9], Rajput *et al.* [10].

In contrast, Ramakrishnan *et al.* and Ekrami *et al.* reported that the incidence was higher in males in their studies [11, 12]. Higher incidence of burns in females is probably due to working in the kitchen, as kitchen is the most common place to receive a burn injury.

#### Pattern of burn wound microbial colonization:

In the present study, the overall 73.3% of burn wound sample were found positive for microorganisms and 26.7% sample were negative. This was comparable with findings of Srinivasan *et al.* (86.3%) [13]. Others have reported higher isolation rates such as 93% by Ramakrishnan *et al.* and 95% by Kaur *et al.* [9, 11].

A total 44 (73.3%) wound swab were positive for organisms, of which *Pseudomonas aeruginosa* was the most common isolated organisms, it was found in 34.09% of study

population. *Pseudomonas aeruginosa* was most common isolated organism in a study conducted by Nagesha *et al.* and the incidence was 40% [14].

Similar results were also found in other studies conducted by Bairy *et al.*, Nagoba *et al.* and Lari *et al.* [15-17].

In contrast, study reports of Ozumba *et al.* indicated a decrease in burn wound colonization with *Pseudomonas aeruginosa* [18]. It has been opined that with the advent of antibiotics against Gram positive organisms, a significant rise in *Pseudomonas* infection among the burn patients had occurred [4]. Prevalence of *Pseudomonas* species in the burn wards may be due to the fact that the organism thrives in a moist environment [10].

The second most common isolate was *Klebsiella pneumoniae*. It was positive in 22.72% of the study population.

Nasser *et al.* in 2003 evaluated the pattern of burn wound colonization and found a high frequency of *Pseudomonas aeruginosa* (21.6%), followed by *Klebsiella pneumoniae* (15.2%) [19].

Ozumba *et al.* and Kehinde *et al.* observed that *Klebsiella pneumoniae* was the most common organisms isolated from their burn patients [18, 20].

As for *Staphylococcus aureus*, they accounted for 20.45% of all the organisms isolated in our study. The incidence of *Proteus* species is reported at frequencies as high as 11% to no incidence at all [21]. In the present study, we found *Proteus mirabilis* had incidence of 4.54% .

Contrary to the findings in the pre-antibiotic era, the isolation of beta haemolytic streptococci from burn wounds has now become rare [10, 22]. This was also confirmed in this study where we did not find any isolates of beta haemolytic streptococci.

### 5. Limitations

- 1) In this study as single wound swab was taken from every patient on day 7, changes of microorganisms profile during hospital stay did not assessed.
- 2) In this study sample size is small and the studied for limited duration of time, so further long duration study with bigger sample size is needed for accurate determination of microorganism.

### 6. Conclusion

It was seen that gram-negative organisms were more prevalent. *Pseudomonas aeruginosa* was the most common microorganism.

Conflict of interest: There is no conflict of interest among authors.

## References

- [1] Burns(2018).Accessed August 8, 2021: <http://www.who.int/news-room/factsheets/detail/burns>.
- [2] Baker CC, Miller CL, Trunkey DD. Predicting fatal sepsis in burn patients. *J Trauma*. 1979;19:641-8.
- [3] Donati L, Scammazo F, Gervasoni M, Magliano A, Stankow B, et al.. Infection and antibiotic therapy in 4000 burned patients in Milani Italy between 1976 and 1988. *Burns*. 1993;4:345-8.
- [4] Barret JP, Herndon DN (2003) Effects of burn wound excision on bacterial colonization and invasion. *Plast Reconstr Surg* 111: 744-750.
- [5] Wysocki AB (2002) Evaluating and managing open skin wounds: colonization versus infection. *AACN Clin Issues* 13: 382-397.
- [6] Manson WL, Coenen JM, Klasen HJ, Horwitz EH (1992) Intestinal bacterial translocation in experimentally burned mice with wounds colonized by *Pseudomonas aeruginosa*. *J Trauma* 33: 654-658.
- [7] Chakraborty S, Bisoi S, Chattopadhyay D, Mishra R, Bhattacharya N, Biswas B. A study on demographic and clinical profile of burn patients in a Apex institute of West Bengal. *Indian J Public Health*. 2010;54(1):27-9.
- [8] Jaiswal AK, Aggarwal H, Solanki P, Lubana PS, Mathur RK, Odiya S. Epidemiological and sociocultural study of burn patients in M. Y hospital, Indore, India. *Indian J Plast Surg*. 2007;40(2):158- 63.
- [9] Kaur H, Bhat J, Anvikar AR, Rao S, Gadge V. Bacterial profile of blood and burn wound infections in burn patients. *Proceedings of National Symposium on Tribal Health*. 2006;89-95.
- [10] Rajput A, Singh KP, Kumar V, Sexena R, Singh RK. Antibacterial resistance pattern of aerobic bacteria isolates from burn patients in tertiary care hospital. *Biomed Res*. 2008; 19(1):1-4.
- [11] Ramakrishnan MK, Sankar J, Venkatraman J, Ramesh J. Infection in burn patients – experience in a tertiary care hospital. *Burns*. 2006; 32:594-6.
- [12] Ekrami A, Kalantar E. Bacterial infections in burn patients at a burn hospital in Iran. *Indian J Med Res*. 2007; 126:541-4.
- [13] Srinivasan S, Vartak AM, Patil A, Saldanha J. Bacteriology of the 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):213-8.
- [14] Nagesha CN, Shenoy KJ, Chandrashekar MR. Study of burn sepsis with special reference to *Pseudomonas aeruginosa*. *J Indian Med Assoc*. 1996;94(6):230-3.
- [15] Bairy I, Shivananda PG. Aerobic bacterial flora of burn wound infection. *Ind J Surg*. 1997;59:215-8.
- [16] Nagoba BS, Deshmukh SR, Wadher BJ, Pathan AB. Bacteriological analysis of burn sepsis. *Indian J Med Sci*. 1999; 53:216-9.
- [17] Lari AR, Alaghebandan R. Nosocomial infections in an Iranian burn care center. *Burns*. 2000;26:737- 40.
- [18] Ozumba UC, Jiburum BC. Bacteriology of burn wounds in Enugu, Nigeria. *Burns*. 2000;26:178-80.
- [19] Nasser S, Mabrouk A, Maher A. Colonization of burn wounds in Ains Shams University burn unit. *Burns*. 2003; 29: 229-33.
- [20] Kehinde AO, Ademola SA, Okesola AO, Oluwatosin OM, Bakare RA. Pattern of bacterial pathogens in burn wound infections in Ibadan, Nigeria. *Ann Burns Fire Disasters*. 2004;17(1):12-5.
- [21] Agnihotri N, Gupta V, Joshi RM. Aerobic bacterial isolates from burn wound infections and their antibiograms – a five year study. *Burns*. 2004;30:241-3.
- [22] Komolafe OO, James J, Kalongolera L, Makoka M. Bacteriology of burns at the Queen Elizabeth Central Hospital, Blantyre, Malawi. *Burns*. 2003;29:235-8.