

**Original article:**

## **A descriptive observational clinical study of secondary bacterial wound infection in burns patients in a tertiary care hospital**

<sup>1</sup>Vitthal R. Haramkar\* , <sup>2</sup>Santosh B. Dalavi, <sup>3</sup>Irshad Shaikh

<sup>1</sup>Junior Resident, <sup>2</sup>Associate Professor, <sup>3</sup>Junior Resident

Department of General Surgery , Government medical college , Miraj , Maharashtra

Corresponding author \*



This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License

Date of submission: 7 January 2023

Date of Final acceptance: 18 March 2023

Date of Publication: 30 March 2023

Source of support: Nil

Conflict of interest: Nil

### **ABSTRACT**

**Introduction:** Infection is a common cause of morbidity and mortality in burn patients. The skin, our body's natural defence against the outside world, is destroyed by thermal harm.

**Material and methods :** The present work includes the investigation of 50 burn cases admitted in the Burn Unit of tertiary care hospital, Govt. Medical college and hospital, Miraj and PVPGH Sangli between January 2021 to June 2022 for the duration of 18 months

**Results :** Out of 66 patients with 0-50% TBSA burns 19 patients had wound contractures (28.78%). Dressing with topical antibiotics and steroids for partial thickness second degree burns used in 12 patients prevented development of fibrosis and wound contractures of the scars. Patients with 0-15% TBSA burns has average duration of hospital stay of 16.6 days. Hydrocolloid dressings used for 0-15% TBSA burns patients for superficial first and second degree burns showed decrease in average duration of hospital stay (13.38 days).

**Conclusion:** The study shows that as the percentage of total body surface area burn increases the mortality increases with 100% mortality above 60% of TBSA burn.

**Keywords:** Wound infection, burn patients

### **INTRODUCTION**

Burn patients are ideal hosts for opportunistic infections.<sup>1</sup> The burn site remains relatively sterile during the first 24 hour; thereafter, colonization of the wound by gram negative bacteria is common.<sup>2</sup> Pseudomonas aeruginosa has emerged as a predominant member of the burn wound flora and in the absence of topical therapy is cultured from the burn injuries of 70% patients by the third week.<sup>3</sup> Microorganisms routinely isolated from burn wounds include aerobic organisms like Staphylococcus aureus, Streptococcus pyogenes, E.coli, Klebsiella spp., Proteus etc., anaerobic organisms like Bacteroides fragilis, Peptostreptococcus, Propionibacterium spp., Fusobacterium.<sup>4</sup> The surface of every burn wound is contaminated to some degree by bacteria.<sup>5</sup> Because of this, surface bacterial growth is routinely monitored in most centers to facilitate management and treatment. It has been found by many investigators that the distribution of various species of bacteria from burn wound surfaces is similar to

that from blood specimens.<sup>6</sup> Staphylococcus aureus remains a common colonizer and has developed resistance to several antimicrobial agents.<sup>7</sup>

The present study is undertaken to study the micro flora in burn wounds and blood of the burn patients from a tertiary care medical hospital. This study will help to assess the burden of infections at the center and antimicrobial susceptibility testing will help to formulate antibiotic policy for better management of these patients. The objectives of this study were to find out the bacterial profile for post burn infection in pus and blood. And to evaluate the antibiotic sensitivity of organisms cultured and isolated.

#### **MATERIAL AND METHODS**

The present work includes the investigation of 50 burn cases admitted in the Burn Unit of tertiary care hospital, Govt. Medical college and hospital, Miraj and PVPGH Sangli between January 2021 to June 2022 for the duration of 18 months. Wound swabs were collected on 3rd and 7th day. A total of 100 wound swabs were collected aseptically and brought to the laboratory. In this study, patients who were between 12 to 80 years of age and either gender were included. Patient of more than 20% burn or less than 20% burn but including facial or genital burns were admitted considered for the study. Burns due to heat, electricity, chemicals or radiation whether accidental, suicidal or homicidal were included in the study. Adult patients with partial thickness burns less than 10% body surface area were excluded. Immunocompromised patients with chronic diseases like tuberculosis, diabetes mellitus, HIV were excluded from the study.

#### **DETAILED PROCEDURE OF STUDY CONDUCT**

On admission, the percentage of burns calculated according to Wallace's Rule of 9.

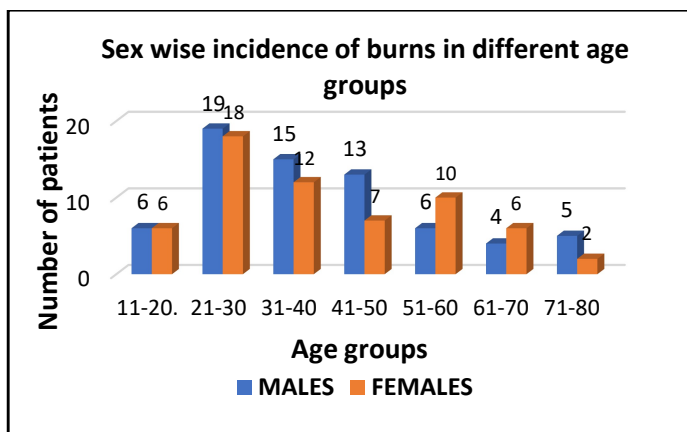
The patient were also categorized according to the degree of burns into superficial, deep or mixed burns. The burn patients usually presented in hypovolemic shock so resuscitative management with fluids calculated by Parkland's formula were given. Half of the calculated fluids were given within 8 hours of burn and remaining fluids were given in next 16 hours. Cleaning and dressing of the patient was done with silver sulfadiazine. And patient will be covered with warm cloths to prevent hypothermia. Daily dressings with eusol will be done.

Blood samples for complete blood count, renal function tests, HIV, HbSAg will be taken on 1st day. Blood transfusion with packed cell volume and/or fresh frozen plasma according to the CBC status were given. On 3rd day of admission the blood sample for blood culture sensitivity were taken. Simultaneously the urine sample and swab from the wound were also taken for the culture sensitivity to start appropriate antibiotics. The blood samples for detailed liver function tests (LFTs) were sent to know the serum protein levels. According to the culture sensitivity report the appropriate antibiotics were started for 7 days. Blood investigations like CBC, RFT were repeated after every 3 days. Blood and swab cultures repeated after 7 days. Wound assessment for slough formation was done. Treatment options for wound care like eusol dressing, silver sulfadiazine dressing, honey dressing, escharotomy, topical antibiotics with steroids, early excision with skin grafting were considered for the treatment and study.

**OBERVATIONS AND RESULTS**

Patients with age from 18 to 80 years were grouped according to the age. The total number of patients, number of male and female patients in these age groups are as follows. The highest number of patients (28.68%) were admitted from age group of 21 to 30 years.

**Fig. 1 : Sex wise incidence of burns in different age groups**



Study shows maximum number of both accidental and suicidal injuries in the age group of 21 to 30 years. And decrease in the incidence of accidental injuries in following age groups above 30 years of age.

**Mode of Burns :** Study shows maximum burn injuries occurred due to flame burns with 62% incidence. Followed by Scald burns with incidence of 29%. In this study out of 129 patients only one case of burns due to lightening.

**Table 1 : Mode of burns**

Mode of burn injury	Number of patients	Percentage
Flame	80	62.01
Scalds	38	29.45
Chemical	3	2.32
Electrical	7	5.4
Lightening	1	0.77
<b>Total</b>	129	100

**Degree of burn :** In this study patients were observed with multiple types of burn injuries. Majority of patients were observed with mixed type of burns, having different degrees of burns at different parts over the body. Also patients with maximum body surface area with a degree of burn injury were classified with that degree.

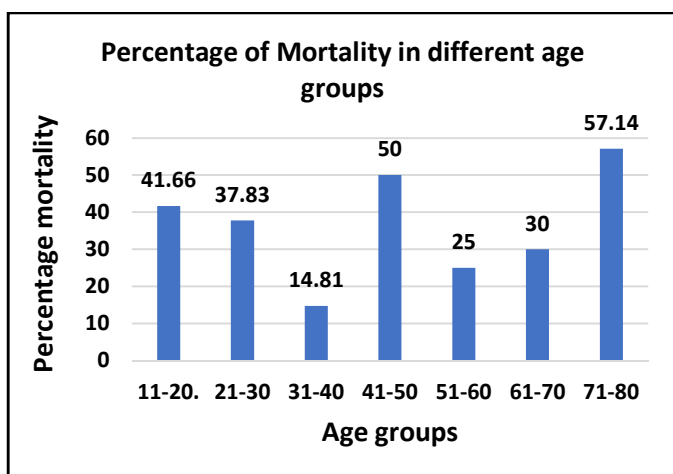
**Table 2 : Degree of burn**

Degree of burn	Number of patients	Percentage
Superficial	28	21.70
Partial thickness	25	19.37
Deep	17	13.17
full thickness	22	17.05
Mixed	37	28.68
<b>Total</b>	<b>129</b>	<b>100</b>

**Facial burns and Inhalational burns :** The study shows that 65.12% of patients shows facial burns and 38.76% patients shows inhalational burn injuries along with the external body surface area burn.

**Mortality in different Age groups :** Age group of 71 to 80 years shows the maximum mortality rate of 57.14%. With least mortality rate of 14.81% found in age group of 31 to 40 years.

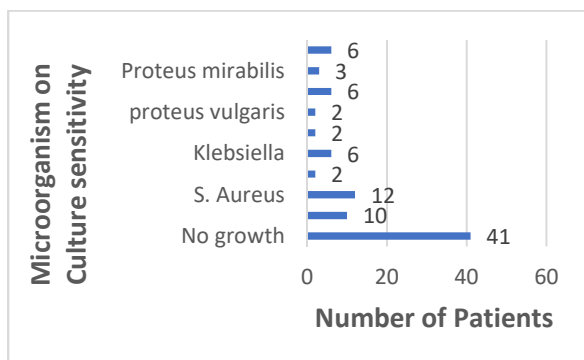
**Fig. 2 : Percentage of Mortality in different age groups**



**Secondary bacterial wound infection :** The study shows incidence of secondary bacterial wound infection in 54.44% out of 90 observed patients. The patients succumbed within a short period after burn injury and those who went DAMA were excluded for observation of secondary bacterial wound infection.

The study shows that out of the positive swab culture reports, maximum patients had secondary wound infection with Coagulase negative streptococci. Followed by Pseudomonas infection of the wounds.

**Fig. 3 : Microorganisms on culture sensitivity**



**Secondary bacterial wound infection vs % TBSA burn :** Maximum incidence of secondary bacterial wound infection was found in the group of 31 – 40 % total body surface area burn. Burns with more than 50% of involved total body surface area succumbed before secondary bacterial wound infection develops and it comes positive on the culture sensitivity report. Over all it is observed that the incidence of secondary bacterial wound infection increases as the burn surface area increases.

Table 3 : Secondary bacterial wound infection vs % TBSA burn

Percentage of TBSA Burn	Number of patients	Number of patients having infection	% of Secondary bacterial wound infection
0-10	19	2	10.53
11-20.	28	7	25.00
21-30	13	10	76.92
31-40	7	6	85.71
41-50	13	11	84.62
51-60	18	12	66.67
61-70	8	0	0.00
71-80	5	0	0.00
81-90	6	0	0.00
91-100	3	0	0.00

**Secondary bacterial wound infection vs degree of burns :** Maximum number of patients were observed with mixed type of burn injuries with all degrees of burn injuries and those patients showed maximum percentage (62.16%) of secondary bacterial wound infections.

Table 4 : Secondary bacterial wound infection vs degree of burns

Degree of Burns	Number of patients	Number of patients with Secondary bacterial wound infection	Percentage of secondary bacterial wound infection
Superficial	28	2	7.14
Partial thickness	25	11	44.00
Deep	17	9	52.94
Full thickness	22	4	18.18
Mixed	37	23	62.16

**Culture sensitivity reports of swabs of burn wounds :** Culture sensitivity reports of various patients showed antibiotic sensitivity and resistance to different antibiotics as follows :

**Table 5 : Culture sensitivity reports of swabs of burn wounds**

<b>Organism on Pus C/S or Wound swab</b>	<b>Antibiotic sensitivity</b>	<b>Resistant to</b>
Citrobacter Diversus	imipenem, piperacillin-tazobactam, amikacin, cotrimoxazole	ampicillin, cefepime, ceftazidime
Citrobacter Freundii	imipenem	piperacillin-tazobactam, amikacin, clindamycin, cotrimoxazole, gentamycin
Coagulase negative staphylococcus	tobramycin, teicoplanin, gentamycin, cotrimoxazole, ciprofloxacin	ceftazidime, penicillin, clindamycin, erythromycin
Escherichia Coli	imipenem, amikacin, gentamycin	piperacillin-tazobactam, ceftazidime, cefepime, cotrimoxazole, ampicillin, ceftioxcid
Klebsiella	imipenem, piperacillin-tazobactam, cotrimoxazole, cpm, amikacin	ampicillin, ceftazidime, ceftazidime
Proteus Mirabilis	imipenem, piperacillin-tazobactam	teicoplanin, linezolid, erythromycin
Proteus Vulgaris	imipenem, piperacillin-tazobactam, amikacin	ceftazidime, ceftazidime, cefepime, ceftioxcid, ciprofloxacin
Pseudomonas	cefepime, imipenem, piperacillin-tazobactam, gentamycin	ampicillin, erythromycin, ceftazidime
Staphylococcus Aureus	teicoplanin, gentamycin, cotrimoxazole, ceftazidime	ampicillin, erythromycin

**Mortality associated with Percentage of TBSA burn :** The study shows that as the percentage of total body surface area burn increases the mortality increases with 100% mortality above 60% of TBSA burn.

Fig. 23 : Mortality associated with percentage of TBSA burn

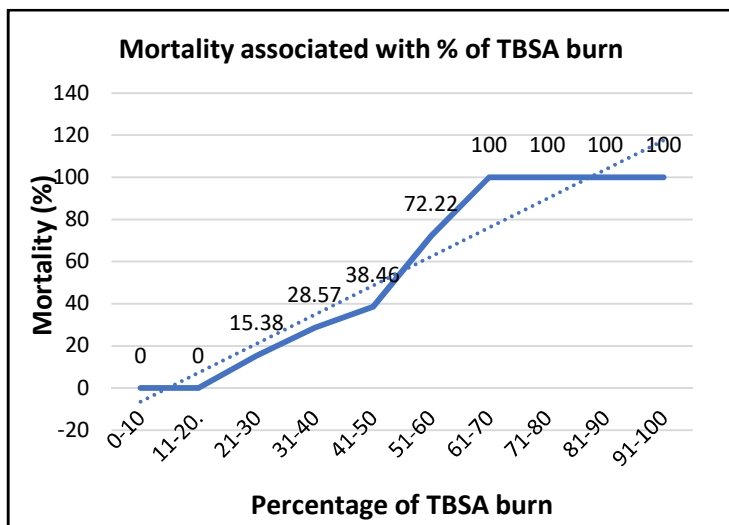


Table 6 : Different treatment modalities and dressing methods used

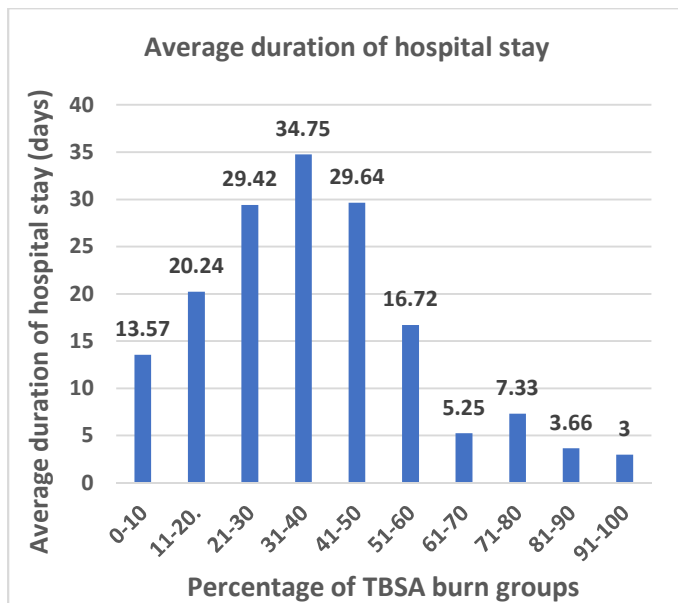
Treatment/Dressing modality	Number of patients	Percentage
Debridement	24	18.60
Dressing with topical antibiotics and steroids	12	9.30
Hydrocolloid dressings	13	10.08
Escharotomy	21	16.28
Early excision and STSG	6	4.66

Debridement with cleaning and dressing of wounds with betadine and eusol are used for all burn wounds.

- Out of 66 patients with 0-50% TBSA burns 19 patients had wound contractures (28.78%). Dressing with topical antibiotics and steroids for partial thickness second degree burns used in 12 patients prevented development of fibrosis and wound contractures of the scars.
  - Patients with 0-15% TBSA burns has average duration of hospital stay of 16.6 days. Hydrocolloid dressings used for 0-15% TBSA burns patients for superficial first and second degree burns showed decrease in average duration of hospital stay (13.38 days).
  - Early excision followed by split thickness skin grafting of the burn wounds showed decrease in the hospital stay of the patients.
1. Patients with 15-20% TBSA burn has average duration of hospital stay of 25.37 days. Two patients managed with early excision and STSG had average duration of hospital stay of 22.5 days.
  2. Patients with 21-30% TBSA burn has average duration of hospital stay of 35.8 days. One patient managed with early excision and STSG had average duration of hospital stay of 20 days.
  3. Patients with 31-45% TBSA burn has average duration of hospital stay of 47 days. Two patients managed with early excision and STSG had average duration of hospital stay of 31 days.

4. One patient with 60% TBSA burn managed with early excision and STSG had 40 days of duration of hospital stay while other patient with 60% TBSA burn had 50 days of duration of hospital stay.

Fig. 24 : Duration of hospital stay vs Percentage of TBSA burns



The mean average duration of hospital stay of the patients being 18.93 days. The maximum average duration of hospital stay (34.75 days) was seen in patients with 31 to 40 % TBSA burn. It decreases after 60% TBSA burn due to higher and early mortality of patients.

## DISCUSSION

In this study, 129 patients were included during period of January 2021 to June 2022 admitted in our tertiary care hospital. Age group considered for the study was 18 to 80 years. Patients from all age groups were observed coming to hospital with accidental and suicidal burns. Majority of the patients were from 21-30 age group. The average age of patients presenting with burn injury in this study was 40.13 years. In this study, the total number of patients with burns presenting to the hospital was 129. A study was conducted by El Hamzaoui et al<sup>8</sup> in Morocco and he observed the total number of patients observed were 126. The total number of patients with burns in different studies done by Sharma L et al<sup>9</sup>, Pujji et al<sup>10</sup> was 50 and 76 respectively.

Similar study was done by El Hamzaoui et al. <sup>8</sup> in 126 patients in morocco and found there were 50.8% males and 49.20% female patients. A study was done by Sharma L et al. <sup>9</sup> in India in 50 patients and observed 44% males and 56% females presenting with burns and had secondary bacterial wound infection. Pujji et al. <sup>10</sup> did another study in Nepal in 76 patients found 30% males and 70% females in his study. Present study of 129 patients showed 52.71% males and 47.28% females. Which is comparable with 2 of the above studies.

Study done by El Hamzaoui et al. <sup>8</sup> in morocco found there were 52.38% of flame burns, 38.08% of scalds and 7.93% of electrical burns. Sharma L et al. <sup>9</sup> study in India observed 76% of flame burns, 14% of scalds, 6% of electrical burns and 2% of chemical burns. Pujji et al. <sup>10</sup> did another study in Nepal found 73% of flame burns, 12% of scalds and 12% of electrical burns in his study. Present study showed 62.01% of flame burns, 29.45% of scalds, 5.4% of electric, 2.32% of chemical burns and 0.77% of lightening burn. Study is comparable with all other studies showing maximum incidence of flame burns followed by scald burns. A single case of lightening burn was also observed in present study which is a rare incidence.

El Hamzaoui et al. <sup>8</sup> study showed maximum patients with TBSA involvement in the group of 0-20%. Study by Sharma L et al. <sup>9</sup> showed maximum number of patients with burn involvement in 40-60% TBSA group. Present study shows comparable maximum incidence of 39.16% patients having 0-20% TBSA burned. Study done by El Hamzaoui et al. <sup>8</sup> in morocco found there



were 68.25% patients had positive reports on bacterial culture of burn wound swab. Sharma L et al.<sup>9</sup> study in India observed 95% positive rate for secondary bacterial wound infection. Present study differs from both these studies with secondary bacterial wound infection rate being 54.44%. Study by El Hamzaoui et al.<sup>8</sup> found maximum patients with mixed burn injuries.

Present study showed maximum incidence with second degree burns and followed by mixed burns. Mortality rate in admitted burns patients was 9.52% in El Hamzaoui et al.<sup>8</sup> study. A higher mortality rate of 23% was observed in the study done by Pujji et al.<sup>10</sup> Present study showed a mortality rate of 34.1% in the admitted burns patients, majority of which were due to multiple organ dysfunction syndrome and sepsis.

## CONCLUSION

- Maximum number of patients were observed with mixed type of burn injuries with all degrees of burn injuries and those patients showed maximum percentage (62.16%) of secondary bacterial wound infections.
- Mortality in this study was 34.10%, out of which highest number of deaths was in patients with age group 71 to 80 years (57.14%), followed by 41 to 50 years age (50%), lowest mortality rate (14.81%) was observed with age group 31 to 40 years.
- The study shows that as the percentage of total body surface area burn increases the mortality increases with 100% mortality above 60% of TBSA burn.

## REFERENCES

1. Cochran A, Morris SE, Edelman LS, Saffle JR. Systemic Candida infection in burn patients. *Surg Infect* Larch mt. 2002;3(4):367-74.
2. Pruitt BA, McManus AT, Kim SH, Goodwin CW. Burn wound infections: current status. *World J Surg*. 1998;22:135-45.
3. Church. Burn wound infections. *Clin Microbiol Rev*. 2006;19(2):403-34.
4. Revathi G, Puri J, Jain BK. Bacteriology of burns. *Burns*. 1998;24:347-9.
5. Lawrence JC, Lilly HA. A quantitative method for investigating the bacteriology skin: its application to burns. *J Exp Pathol*. 1972;50:550-9.
6. Li GH, Hua C, Hsing C, Wai S, Chih KT. Analysis of microbiological flora in the blood and wounds of burn patients. 1989;5:199-200.
7. Smith DJ, Thomson PD. Changing flora in burn and trauma units. *J Burn Care Rehabil*. 1992;13:276-80.
8. El Hamzaoui N, Barguigua A, Larouz S, Maouloua M. Epidemiology of burn wound bacterial infections at a Meknes hospital, Morocco. *New Microbes and New Infections*. 2020 Nov 1;38:100764.
9. Sharma L, Srivastava H, Pipal DK, Dhawan R, Purohit PM, Bhargava A. Bacteriological profile of burn patients and antimicrobial susceptibility pattern of burn wound isolates. *International surgery journal*. 2017 Feb 25;4(3):1019-23.
10. Pujji OJ, Nakarmi KK, Shrestha B, Rai SM, Jeffery SL. The bacteriological profile of burn wound infections at a tertiary burns center in Nepal. *Journal of Burn Care & Research*. 2019 Oct 16;40(6):838-45.