

## Original Research Article

# Bacteriological profile of burn patients and antimicrobial susceptibility pattern of burn wound isolates

Latika Sharma, Harshit Srivastava\*, Dharmendra Kumar Pipl, Rohit Dhawan,  
Poojan M. Purohit, Anupam Bhargava

Department of General Surgery, Dr. S. N. Medical College, Jodhpur, Rajasthan, India

**Received:** 07 December 2016

**Revised:** 07 January 2017

**Accepted:** 08 January 2017

**\*Correspondence:**

Dr. Harshit Srivastava,

E-mail: [harsh.gsvm@gmail.com](mailto:harsh.gsvm@gmail.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

### ABSTRACT

**Background:** Infection is a common cause of morbidity and mortality in burn patients. Clinical diagnosis of bacteremia and/or sepsis in burn patients is difficult for a number of reasons. It could be symptomatic and/or asymptomatic as a result of immune deficiency secondary to thermal injury.

**Methods:** A retrospective study was conducted at Mahatma Gandhi Hospital Burn Unit Associated with Dr. S. N. Medical College, Jodhpur, Rajasthan. Fifty burn patients were investigated for bacterial profile of burn wound infections. Specimens were collected on 3rd and 7th day of burns in the form of wound swabs. The organisms were isolated and identified by standard microbiological methods. Antimicrobial susceptibility test was done by Kirby - Bauer disc diffusion method.

**Results:** Gram negative organisms were found to be more prevalent. The most common isolate was *Pseudomonas aeruginosa* (*P. aeruginosa*) -38%, followed by *Staphylococcus aureus* (*S. aureus*) -35%, *Klebsiella spp.* -8%, *Acinetobacter spp* -5%, *Staphylococcus epidermidis* - 5%, *Proteus spp.* -3% and *Escherichia coli* -1%.

**Conclusions:** *Pseudomonas* was the commonest cause of infection in fire burn patients in our setting followed by *S. aureus*. About 82% of the isolates showed multiple resistances. In light of our findings, regular antibiotic resistance test has to be done for each patient in order to select an appropriate antimicrobial agent.

**Keywords:** Antibiotic susceptibility, Bacteremia, Burn, Bacteriological profile, Sepsis

### 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 spp* and fungi like *Aspergillus niger*, *Candida spp.* and *Zygomycetes*.<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>

Use of antimicrobials has altered the flora that is found to colonize the wounds of patients with burns and trauma related injuries. *Staphylococcus aureus* remains a common colonizer and has developed resistance to several anti-microbial agents. Recent reports suggest that the incidence of *Pseudomonas* infections is decreasing, whereas multiple antimicrobial resistance has emerged in a number of gram negative organisms that were not therefore considered major pathogens.<sup>6</sup> Progress in this regard can be attributed towards improvements in antimicrobial therapy, wound management, and nutrition.<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.

**METHODS**

The present work includes the investigation of 50 burn cases admitted in the Burn Unit of Mahatma Gandhi Hospital Associated with Dr. S. N. Medical College, Jodhpur, Rajasthan between 1st May 2016 to 1st September 2016. 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 >12 years and either gender were included. Adult patients with partial thickness burns less than 10% body surface area were excluded. Patients with perineal burns and those with chronic diseases like tuberculosis, diabetes mellitus were excluded from the study.

Samples were cultured on nutrient agar, Mac-Conkey agar and Blood agar at 37°C for 24 hours. The isolates were identified by culture, staining and biochemical tests including oxidase, lactose and maltose fermentation, catalase and their antibiotic sensitivity determined using Kirby-Bauer disc diffusion technique.

**RESULTS**

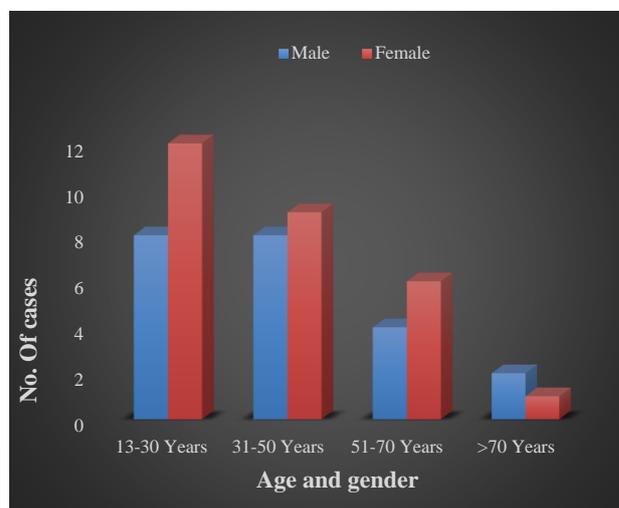
Infections remain the leading cause of death among patients who are hospitalized for burns. The risk of burn wound infection is directly correlated to the extent of the burn and is related to impaired resistance resulting from disruption of the skin’s mechanical integrity and generalized immune suppression.

In the present study females (56%) were affected more than that of males (44%). This may be because of the reason that accidental burns are more common in females

as they tend to spend more time near fire. Most common age group of females was 13 - 30 years.

**Table 1: Sex distribution of burn cases.**

	Male	Female	Total
No. of cases	22	28	50



**Figure 1: Age and gender distribution of burn cases.**

In this study culture positivity of pus was 95 % while in 5% of cases, pus samples were sterile.

**Table 2: Sensitivity of culture method.**

	Culture positive	Culture negative
Wound swab specimen	95%	5%

**Table 3: Pattern of organisms isolated on 3rd and 7th day of burns.**

Organisms	Wound swab specimens		Total	Percentage
	Day 3	Day 7		
<i>Pseudomonas aeruginosa</i>	16	22	38	38
<i>Staphylococcus aureus</i>	20	15	35	35
<i>Klebsiella spp.</i>	5	3	8	8
<i>Staphylococcus epidermidis</i>	1	4	5	5
<i>Acinetobacter spp.</i>	3	2	5	5
<i>Proteus spp.</i>	1	2	3	3
<i>E. coli</i>	-	1	1	1
Sterile	4	1	5	5

The age of patients ranged from 13 to 78 years. The frequency of burns was highest in the age group of 13 - 30 years. Body surface area burnt varied from 20% - 80%. In 18 patients, it ranged from 20% - 40%, 23

patients had 41% - 60% burns, while 9 patients had 61% - 80% burns. The burning agent was predominantly flame (76%) followed by scald (14%), electrical (6%), contact (2%) and chemical (2%).

In the present study *Pseudomonas aeruginosa* (38%) was the commonest isolate from burn wounds followed by *Staphylococcus aureus* (35%), *Klebsiella spp.* (8%) *Staphylococcus epidermidis* (5%), *Acinetobacter spp.* (5%), *Proteus spp.* (3%) and *E.coli* (1%). It is evident that *P. aeruginosa* has emerged as a great threat in burn wound infection and it's very important that antibiotic policy is formulated to keep a check on it.

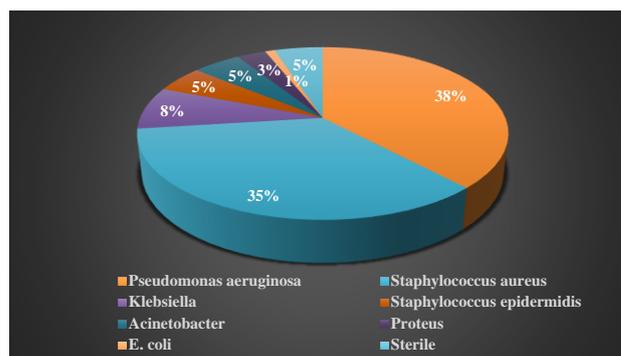


Figure 2: Organisms isolated from burn wound swabs.

Table 4: Antibiotic sensitivity pattern of gram negative isolates (in%).

Antibiotic	<i>P. aeruginosa</i> (n = 38)		<i>Klebsiella</i> (n = 12)		<i>Acinetobacter</i> (n = 5)		<i>Proteus</i> (n = 3)		<i>E. coli</i> (n = 1)	
	S	R	S	R	S	R	S	R	S	R
Amikacin	68.4	21.6	91.6	8.4	80	20	33.3	66.7	100	0
Piperacillin-tazobactam	63.1	26.9	50	50	40	60	33.3	66.7	-	-
Amoxicillin	-	-	33.3	66.7	-	-	-	-	-	-
Ciprofloxacin	52.6	27.4	58.3	21.7	-	-	-	-	-	-
Levo-ofloxacin	57.6	22.4	66.7	33.3	20	80	66.7	33.3	100	0
Ceftriaxone	60.5	39.5	-	-	-	-	33.3	66.7	-	-
Cefoperazone-sulbactam	63.1	26.9	33.3	66.7	-	-	-	-	100	0
Cefuroxime	-	-	41.6	58.4	-	-	-	-	-	-
Ceftazidime	-	-	66.7	33.3	-	-	-	-	-	-
Colistin	60.5	39.5	33.3	66.7	100	0	66.7	33.3	-	-
Imipenem	47.3	52.7	58.3	21.7	60	40	100	0	-	-
Aztreonam	65.7	34.3	100	0	20	80	66.7	33.3	-	-
Azithromycin	50	50	66.7	33.3	-	-	-	-	-	-

S= Sensitive; R= Resistant.

Table 5: Antibiotic sensitivity pattern of gram positive isolates (in%).

Antibiotic	<i>S. aureus</i> (n = 35)		<i>S. epidermidis</i> (n = 5)	
	S	R	S	R
Amikacin	68.5	31.5	60	40
Piperacillin- tazobactam	60	40	80	20
Amoxicillin	48.5	51.5	60	40
Ciprofloxacin	-	-	-	-
Levo-ofloxacin	-	-	20	80
Ceftriaxone	5	95	40	60
Cefoperazone- sulbactam	31.4	68.6	20	80
Cefuroxime	17.1	82.9	-	-
Ceftazidime	8	92	-	-
Colistin	11.4	88.6	40	60
Imipenem	45.7	54.3	60	40
Aztreonam	-	-	-	-
Azithromycin	-	-	-	-

S = Sensitive; R = Resistant.

With regard to the antimicrobial susceptibility/sensitivity pattern, all the isolates were tested against the following commonly prescribed drugs at the center and widely used in the country. *P. aeruginosa* was most sensitive to Amikacin (68.4%), whereas most of the gram-negative isolates obtained were found to be multidrug resistant. Resistance of *S. aureus* was 40% observed with and *Piperacillin-tazobactam* and 95% to Ceftriaxone. 40% isolates of *Staphylococci* from samples were MRSA (Methicillin resistant *Staphylococcus aureus*). List of antibiotics tested and the relative resistant pattern is presented in Table 4 and 5.

## DISCUSSION

Incidence of burn was higher in females because females mostly spend their time in kitchen where accidents happen. Highest incidence in our study was flame burn. This may be due to socioeconomic reasons in our society. The age group mostly affected by burn injury was between 13 and 30 years. This was consistent with the study conducted by Sapna G in which the most common age was 20-30 years.<sup>8</sup>

In the present study, very high culture positivity 95% was found in the samples from burn patients. In our study *Pseudomonas aeruginosa* was main culprit.<sup>9-11</sup> *S. aureus* was found to be the most common isolate on day 3 while *P. aeruginosa* on day 7. Prevalence of *Pseudomonas spp.* in the burn wards may be due to the fact that organism thrives in a moist environment.<sup>12</sup> The present study has shown that *P. aeruginosa* and *S. aureus* are the most common isolates in burn injuries, *Klebsiella spp.* was the third most common isolate, followed by *Acinetobacter spp.*, *S. epidermidis* and *Proteus*. In the present study no isolate of  $\beta$ -hemolytic *Streptococci* was seen which is in agreement with the previous studies. *E. coli* was found in single isolate on day 7. Ahmad et al in their study have demonstrated that infections by gram positive organisms were more common in first 5 days of burns while gram negative organisms dominate the infection scene thereafter.<sup>13</sup> A study conducted by Sharma S. and Hans C. in RML Hospital, Delhi concluded that *Pseudomonas* is the most common organism isolated in the burn wounds which is consistent with our finding.<sup>9</sup>

Antibiotic sensitivity patterns revealed that many of the isolates were resistant to commonly used antibiotics like cephalosporin group, quinolones etc. which are being indiscriminately used on empirical basis for prolonged duration of time. Resistance to various antibiotics routinely used has been reported from several studies. *S. aureus* and *S. epidermidis* were seen to be sensitive to Amikacin and *Piperacillin-tazobactam*.<sup>10</sup> MRSA prevalence in our hospital was high (40%). In a study by Buzaid N et al, MRSA prevalence was found to be 31%.<sup>14</sup> Amikacin a second generation aminoglycoside was effective against *Pseudomonas*, *E.coli* and *Klebsiella* in our study.<sup>10,15</sup> In a study by Agnihotri N, Gupta V, Joshi RM, *Pseudomonas* was the commonest isolate in

the burn wounds and amikacin was found to be the most effective drug against gram negative bacteria.<sup>10</sup>

The high percentage of multidrug resistant isolate is probably due to empirical use of broad-spectrum antibiotics and non-adherence to hospital antibiotic policy. The early detection of isolates is also very important to prevent treatment failure as the time involved in isolation, identification and performing antibiotic sensitivity can take as long as 48 hours from the receipt of the specimen. This time period may be enough to allow a sub clinical infection to become life threatening illness, secondly, in burn wound, because of the mixed infection, the potential virulence of one organism may affect another organism growing alongside. Another factor adding to the complication is multidrug resistance (MDR) of the organism. Once MDR strains become established in the hospital environment these can persist for months. Therefore, careful microbiological surveillance and in vitro testing before the start of antibiotic therapy and restrictive antibiotic policy may be of great help in prevention and treatment of MDR isolates in burn units and thus reduction overall infection related morbidity and mortality. The overcrowding in burns ward is an important cause of cross infection and must be avoided in order to control a hospital acquired infection. Superficial culture was used providing no information about the deeper layers of the burn wound and the actual status of the wound. It does not distinguish between colonization and infection. Use of topical antibiotics like 1% silver sulfadiazine influence the microbial environment of burns.

## CONCLUSION

*Pseudomonas aeruginosa* the main culprit in burn wound infections. *S. aureus* was the second commonest cause of infection in burn patients. These suggests that burn patients overcrowding and hygiene problem are main causes of these infections. The infection of burn wounds with multiple organisms, with superadded problem of drug resistance, indicate the institution of a drug policy by the hospitals for burns patients.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the institutional ethics committee*

## 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. Sapna G. Bacterial and fungal profile of burn wound infections in tertiary care center. *Indian J Burn.* 2015;23(1):71-5.
9. Sharma S, Hans C. Bacterial infection in burn patients: a three years study at RMI hospital Delhi. *J Commun Dis.* 1996;28:101-6.
10. Agnihotri N, Gupta V, Joshi RM. Aerobic bacterial isolate from burn wound infections and their antibiograms - a five -year study. *Burns.* 2004;30:241-3.
11. Mehta M, Dutta P, Gupta V. Bacterial isolates from burn wound infections and their antibiograms: an eight year study. *Indian J Plast Surg.* 2007;40:25-8.
12. Atoyebi OA, Sowemimo GOA, Odugbemi T. Bacterial flora of burn wounds in Lagos, Nigeria: a prospective study. *Burns.* 1992;18:448-51.
13. Ahmad M, Hussain S, Khan I, Malik SA. Pattern of bacterial invasion in burn patients at the Pakistan institute of medical sciences, Islamabad Ann *Burns Fire Disasters.* 2006;19(1).
14. Buzaid N, Elzouki AN, Taher I, Ghengesh KS. Methicillin resistant *Staphylococcus aureus* (MRSA) in a tertiary surgical and trauma hospital in Benghazi, Libya. *J Infect Dev Ctries.* 2011;5(10):723-6.
15. Bayram Y, Parlak M, Aypak C, Bayram I. Three year review of bacteriological profile and antibiogram of burn wound isolates in Van Turkey. *Int J Med Sci.* 2013;10(1):19-23.

**Cite this article as:** 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. *Int Surg J* 2017;4:1019-23.