

Bacterial Growth and Antibiogram in Burns Patients Admitted to a Tertiary Care Hospital

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Abstract

Original Research Article

Burns is one of the most devastating traumas that an individual can sustain. Burn patients are susceptible to infection which is the commonest cause of death in these patients [1,2]. This study attempts to know the bacterial profile and antibiotic sensitivity patterns in burn patients admitted to a tertiary care hospital. 137 patients were admitted in this period. 136 patients were included in the study. Wound swabs were collected at or within 24 hours of admission and repeat swabs were taken at postburn day3 and once a week until discharge. Tissue, blood and urine cultures were also sent as appropriate. 395 wound swabs were collected from 135 patients. 56.7% had growth. Gram positive organisms were sensitive to the antibiotics tested. Most gram negative organisms were Multi Drug Resistant. Pseudomonas was the commonest organism grown followed by Methicillin Resistant Staphylococcus Aureus and Acinetobacter.

Keywords: Gram positive, early colonisation, gram negative, multi drug resistant.

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INTRODUCTION

Fire was perhaps man's first double edged sword, a friend and a foe, both serving and destroying mankind [3]. Burns is probably the most devastating trauma that can be sustained by an individual [4]. In burns, because of the loss of the protective function of the skin and the development of immune suppression, patients are prone to wound and systemic infection [5]. Burn wound infection is the commonest cause of death in burn patients [1, 6]. Therefore, knowledge of the bacterial flora colonising and infecting the burn wound and their antibiotic sensitivity is crucial for fast and reliable therapeutic decisions [7]. Antibiotic resistance, especially multidrug resistance of the gram negative organisms is a major hurdle in treating these infections. Hence judicious use of antibiotics is essential. This study was undertaken to identify the organisms isolated from burn wounds (swabs and deep biopsies of the burn tissue), blood and urine of burn patients admitted to our hospital, and the antibiotic sensitivity pattern of these isolates.

MATERIAL AND METHODS

137 burn patients were admitted during the one year study period. Of these, one child presented in septic shock and died within 24 hours of admission and hence was excluded. After obtaining Ethical committee clearance (IERB Study Ref No 67/2013), patient

demographics of the 136 patients were collected from the system records. Microbiological reports were taken from the computerised hospital wide data base. All data were entered on excel sheets and the analysis was done using simple mathematical formula.

Initially, wound swabs were collected at admission or within 24 hours of admission and subsequently on day 3 and once a week. Blood and urine samples were collected when there was a clinical indication. (Fever, tachycardia, tachypnea, hypotension) Burn wound tissue was taken when tangential or burn wound excision was done or when there was suspicion of sepsis. All samples were sent immediately to microbiology laboratory and processed.

Wound swabs and blood samples were cultured on blood agar and MacConkey agar. After overnight incubation at 37^o Celsius, checked for colonies and then antibiotic susceptibility test was done, using Kirby Bauer diffusion method. Thioglycolate broth was used for anaerobic cultures. Urine samples were cultured on CLED and blood agar. The wound swabs were reported as having scanty, moderate or heavy growth, where the heavy growth corresponds roughly to 10⁵ organisms. Burn tissue cultures were quantitative cultures. The sample was weighed and minced; then diluted to one ml and 100 micro litres was

plated on the Petri dishes using appropriate culture media. The colony counts were done and reported. Antibiotic sensitivity was reported as sensitive, resistant or intermediately sensitive.

RESULTS

In all, 136 patient data were studied (male=86; female: 50) (figure 1). The patients were aged between 4 months and 80 years (median age=35). 40 patients were in the paediatric age group (0-14). A Maximum

number of 93 patients were in the 15-60 (68.38%) age group, the most productive age. Out of this 93, 88 were aged between 15 and 50. 5 patients were aged between 51 and 60. One patient was aged more than 60, and two were more than 70 years of age. Scald burns were commonest (n=53; 39%), followed closely by flame burns (n=48; 35%)-(figure 2). Burn percentage ranged from 2-72 %. (Mean Total Body Surface Area Burn: 16.25%) There were five deaths in the study period.

Gender

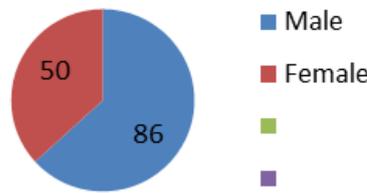


Fig-1: Gender distribution

mode of injury

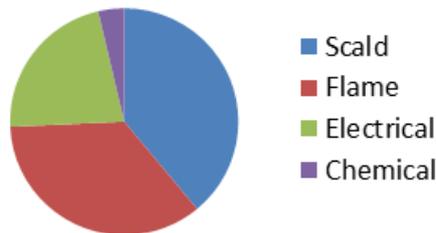


Fig-2: Mode of injury distribution

395 wound swabs were collected from 135 patients. Wound samples were positive in 85 patients and negative in 50. 171 swabs had no growth (43.3%). 224 swabs had bacterial growth (56.7%). The 3 most frequently isolated organisms were Pseudomonas Aeurogenosa (76), Methicillin Resistant Staphylococcus Aureus- MRSA (69) and Acinetobacter

(62). Other gram positive isolates were Methicillin Sensitive Staphylococcus Aureus – MSSA (14), Enterococcus Fecalis (2) and Coagulase Negative Staphylococcus-CONS (2) (figure 3). Other gram negative isolates were Enterobacter (12), Klebsiella (16), Escherichia Coli (11), Proteus (2), Citrobacter (2) and Aeromonas (1) (figure 4).

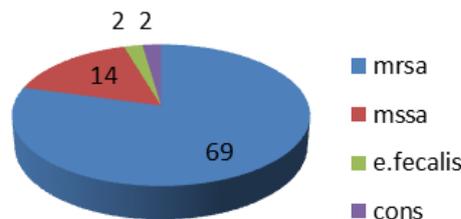


Fig-3: Gram positive isolates-wound swab

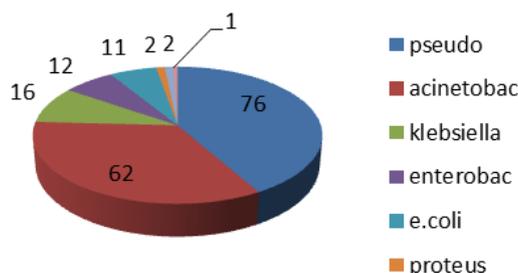


Fig-4: Gram negative isolates-wound swab

71 blood samples for microbiological culture were collected from 37 patients. Of these, 22 samples were positive in 12 patients. Out of this 12, 5 died. 63 urine samples were collected for culture from 40

patients. Of these, 22 samples were positive in 15 patients. 17 burn tissue samples were collected from 15 patients. 8 samples were positive from 7 patients. 1 patient died (tables 1 and 2).

Table-1: Gram positive growth

organism	wound	Burn tissue	blood	urine
MRSA	69	00	02	01
MSSA	14	00	00	00
E.fecalis	02	00	01	01
CONS	02	00	06	00
total	87	00	09	02

Table-2: Gram negative growth

organism	Wound++ve	Burn tissue	blood	urine
Pseudomonas	76	02	02	06
Acinetobacter	62	03	08	05
Klebsiella	16	00	03	04
e.coli	11	01	00	03
Enterobacter	12	01	00	00
Citrobacter	02	00	00	00
aeromonas	01	00	00	00
Proteus	02	00	00	00
total	182	07	13	18

The predominant gram positive isolate, MRSA, was 100% sensitive to Teicoplanin and more than 90% of isolates were sensitive to Netilmicin, Chloramphenicol and Tetracycline (figure 5). 34% of the gram negative organisms grown from wound swabs were Multi Drug Resistant and 32% were Pan-Resistant (table3). Pseudomonas was susceptible to Amikacin in

56% of the isolates, which was the most sensitive antibiotic for this organism (figure 6). Acinetobacter was susceptible to Netilmicin in 55% of the isolates, making it the most sensitive antibiotic to use in Acinetobacter infections (figure7). These trends were reflected in other body fluid cultures too.

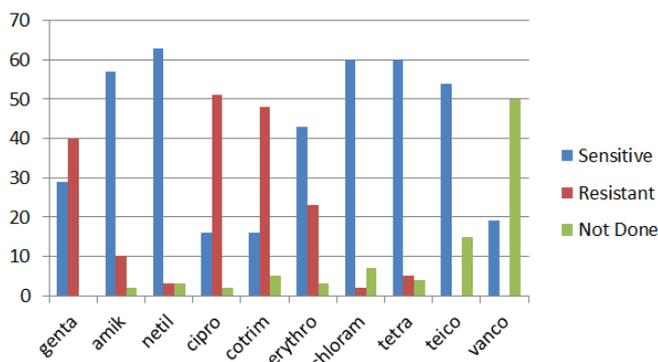


Fig-5: MRSA-antibiotic susceptibility pattern

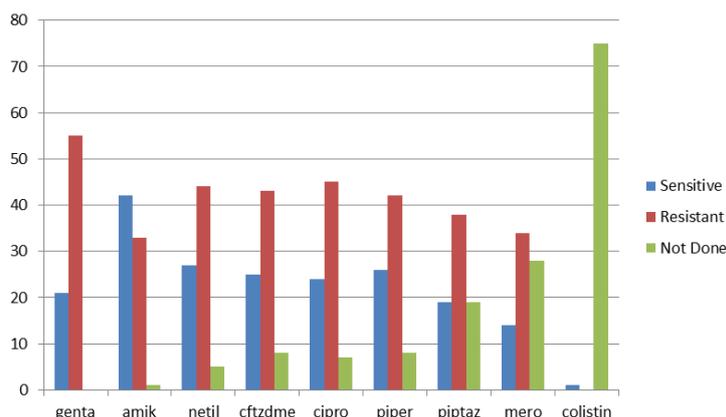


Fig-6: Pseudomonas- antibiotic susceptibility pattern

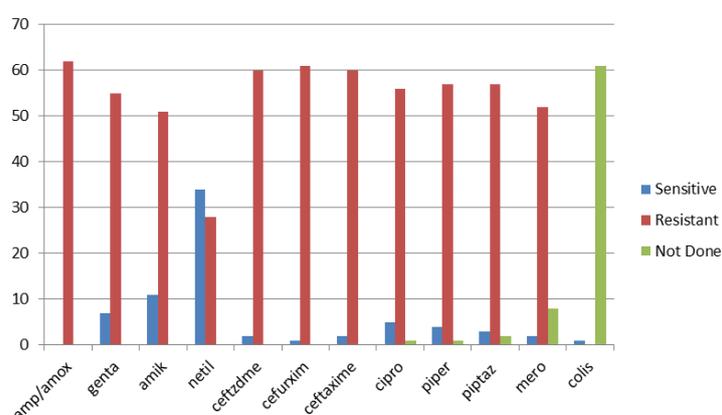


Fig-7: Acinetobacter-antibiotic susceptibility pattern

Table-3: Antibiotic susceptibility pattern of gram negative organisms: wound swab

Antibiotics	Pseudomonas(n=76)		Acinetobacter (n=62)		Klebsiella N=16		E.coli		Enterobacter	
	S- %	R- %	S-%	R -%	S-%	R-%	S-%	R-%	S-%	R-%
Gentamicin	27.6	72.4	11.3	88.7	31.25	68.75	45.5	54.5	17	83
Amikacin	56	44	18	82	68.75	31.25	54.5	45.5	42	58
Netilmicin	38	62	55	45	53	47	54.5	45.5	25	75
Ceftazidime	36.7	63.3	3.3	96.7	20	80	20	80	25	75
Ciproflox	35	65	8.2	91.8	40	60	44.5	55.5	17	83
Piperacillin	38	62	6.6	93.4	14	86	20	80	25	75
Pipera+tazo	33.4	66.6	5	95	31	69	62.5	37.5	20	80
Meropenem	29	71	3.7	96.3	70	30	87.5	12.5	25	75

90 patients (66%) presented to our centre within 24 hours of the burn; 46 patients (34%) presented after 24 hours. 19 patients had a positive wound culture within 72 hours of the burn, suggesting presence of colonization/ infection of the wounds at the time of admission to our centre. Three patients had grown MSSA and 16 had grown gram negative

organisms. Of the 19, 3 had positive culture on day0, 8 had positive culture on day1, 5 had positive culture on day2 and 3 had positive culture on day3 (figure 8). 26 patients had a positive wound culture between 3rd and 7th postburn day. The predominant organisms grown in the first week were gram negative.

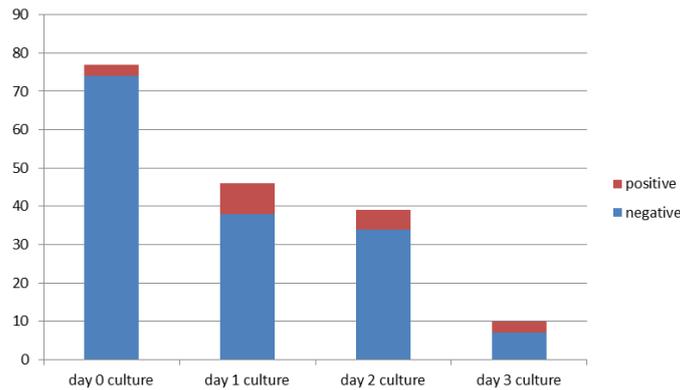


Fig-8: Early wound culture pattern

DISCUSSION

The skin is the largest organ of the body with various functions. Skin acts as a protective barrier against infection. The pathophysiological changes that occur in burn injury lead to immune suppression. Hence such patients are prone to develop infection. A burn wound remains sterile for few hours after injury. It is then colonized by the patient's endogenous flora from the gut and skin. The external sources of colonization/infection are the environment and contact. These organisms then proliferate and if the burn wound is not treated, they cause local and systemic infections and lead to multi organ failure and death [8-14]. Early excision and wound closure has significantly reduced the rate of invasive infection and mortality in burns [15-17]. This study was undertaken to identify the organisms that colonize and infect the burn patients and the antibiotic susceptibility profile of these organisms, at a tertiary care hospital located in a city in South India.

In our study, 29% patients were children (0-14 yrs) and 68.3% patients were in the age group 15-60. Tang and others have reported 73% of their burn admissions were aged between 15 and 64 [18] almost similar to our study. Though most studies from the Asian regions report a female preponderance [19-21], we found the number of male patients slightly more than the females. This has also been reported by Saad Javed *et al.* in their study, where 59 of 106 burn patients were men [4]. This could be due to two reasons: we cater predominantly to an urban population; we see a significant number of electrical burns.

The commonest mode of burn in our study was scalds (39%) of which more than half were in the paediatric age group, thus explaining the highest number of admissions with scalds (32/53). Flame burns were the second commonest (35%). We had a significant number of electrical injuries (22%). A similar incidence has been reported by Aman Allah *et al.* The incidence of electrical burns in their study was 27% [22]. This is in contrast to other studies where the incidence of electrical burns is lower. [23] 3.6% admissions were chemical burns.

In our study we found the most common organisms grown from burn wounds were *Pseudomonas* (33.9%) MRSA (30.8%) and *Acinetobacter* (7.6%). Agnihotri *et al.* have reported a similar incidence: *Pseudomonas aeruginosa* (59%) *Staphylococcus aureus* (17.9%), *Acinetobacter spp.* (7.2%) [24]. The predominance of *Pseudomonas* colonization or infection which we found in our study has also been reported by studies in other centres of the world. Estahbanati and others [25], in a study conducted in Teheran, Iran have reported *Pseudomonas* (57.1%) as the most prevalent organism infecting burn wounds. Ganesamoni *et al.* [26] have reported *Pseudomonas* in 81% of their isolates. The significant incidence of *Acinetobacter* that was found by us was also reported by Edward Keen, Brian Robinson *et al.* [27] who had reported *Acinetobacter* as the predominant isolate in their patients (780 in 182 patients). MRSA remains a significant organism isolated from burn wounds. Though Komalefe *et al.* have reported a 13.6% incidence of *b streptococcus* [28], we only found growth of *b streptococcus* in one patient.

A burn wound is initially colonized by gram positive organisms and 4 to 10 days after the burn, changes to gram negative organisms [29-30]. However in our experience, gram negative organisms were isolated in the early postburn period (within 3 days after the injury). 19 patients had a positive culture within 72 hours of the injury; 16 of these had 18 gram negative organisms isolated - two isolates were poly-microbial and 14 had mono-microbial growth. Only 3 had gram positive growth. Ezatollah and others have reported colonisation by gram negative bacteria on day one, in 13.6% of the patients in their study, though the time from burn is not mentioned [31].

In our series, 17 of the 135 patients (11.8%) had growth from wound swab taken on first postburn day, in which 11 patients had grown gram negative and 5 had grown gram positive organisms. Out of this 17, 3 patients had a positive culture on the day of the burn. One had MSSA and 2 had *Acinetobacter*. This is suggestive of early colonisation by gram negative organisms, contrary to literature. Larger number of

patient data has to be studied to determine statistical significance. Pseudomonas is a ubiquitous organism, which exhibits a high degree of resistance to chemical agents, including the disinfectants and antiseptics used in hospitals. It can grow in bottles of antiseptic lotions. The preeminent role of Pseudomonas aeruginosa in hospital infection is due to its resistance to many commonly used antibiotics, which is also shown in our study, and its ability to establish itself widely in hospitals. Prevention of cross-infection requires strict attention to asepsis and constant vigilance. Acinetobacters are opportunistic pathogens and can be present on normal skin. They can survive for long in hospital environment. Therefore they can colonise almost all patients whose duration of hospital stay is long. The burn patients usually require prolonged hospital stay. Prevention is by following standard precautions. Staphylococci are heat resistant organisms and remain viable for upto 3 months in dried pus. Methicillin resistant staphylococcus aureus is a frequent cause of infection. They also spread easily through carriers and contact. Prevention is by isolation and adherence to hand washing protocol [32].

Limitations of this study

Only the microbiological data were analysed. Clinical correlation was not studied. Antibiotics administered to these patients was not included in this study

CONCLUSION

Commonly reported literature says that a burn wound is initially colonized by gram positive organisms and 4 to 10 days after the burn, changes to gram negative organisms [29, 30]. In contrast to the literature, in our study, we found growth of gram negative organisms from the burn wound, as early as the day of burn injury and within 72 hours of the burn. This early colonization may be due to the delay in reaching the hospital or inappropriate wound care given until patient reaches the hospital.

Staphylococcus aureus, specifically MRSA, is the most predominantly isolated gram positive organism and is still susceptible to the commonly used antibiotics. However the predominance of multi drug resistant gram negative organisms we found growing from burn wounds and other body fluids is of concern. Stricter infection control measures have been implemented in our unit. Further studies are required to assess the effectiveness of these measures. Periodic evaluation of the microbiological data, including microbiological growth and antibiogram, adherence to the infection control protocol and judicious use of antibiotics will help reduce the infections and control drug resistant organisms.

Education of all burn care givers in wound care and fluid resuscitation may help mitigate the early colonization and probably subsequent infection of the

burn wounds. This would eventually improve the outcome, including increase in survival rates. Creation of public awareness in first aid measures and transport measures will go a long way in minimizing infections.

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