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ORIGINAL RESEARCH

Changing Pattern of Burns in a Private Hospital

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ABSTRACT

Burn injuries pose a significant risk of infection due to their nature, immune-compromising effects, and prolonged hospital stays. Despite advancements in burn care, infections remain a major cause of morbidity and mortality. Understanding the evolving patterns of burns is crucial for effective management. This study aimed to analyze recent trends in burn cases, identifying demographic shifts and high-impact areas. Objectives included assessing the incidence and demographics of burns, investigating microbial colonization of wounds, and analyzing antibiotic resistance patterns. A demographic survey of 124 patients over 14 months included history, clinical evaluation, and wound management was done. Microbial colonization was studied through periodic wound swabs, cultured on various media. The study focused on identifying trends in burn etiology, patient demographics, and infection patterns. The study observed an increasing trend in burn cases, particularly domestic incidents, with a rise in scalds and electrical burns. Most affected were women. Pediatric burns and burns exceeding 20% of total body surface area (TBSA) also increased. Urban burns were more prevalent but rural burns had higher mortality rates. Findings reflected changing infection patterns, with gram-negative organisms becoming predominant and multi-drug resistant. Variation in microbial sensitivity to antibiotics was noted, with Pseudomonas being the most common. The study emphasized the importance of tailored antibiotic therapy based on antibiograms. In conclusion, the study provides valuable insights into evolving trends in burn injuries, emphasizing the need for proactive measures to address infection and antibiotic resistance. The findings contribute to improving burn care strategies and patient outcomes.

Keywords: Burns, Escherichia coli, Infection

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INTRODUCTION

Burn patients are prone to infection due to the burn injury, immune-compromising effects of burn, extended hospital stays, and intensive diagnostic with therapeutic procedures. Despite many advances in suchpatient care, infectionis the prominentreasonfor morbidity and death.[1-3]

The objectives of the study were to find out the recent pattern of burns in a private hospital and to see if there are increasing and decreasing trends in the demography of burns and accordingly focus our attention on high-impact areas.

METHODOLOGY

A demographic survey with history, clinical evaluation, investigations and preliminary management of the burn patient was performed. A total of 124 patients were studied for 14 months, starting from November 2019 to December 2020. Inclusion criteria were the admitted patients who presented at the centre. All age groups were included. First-degree burns were excluded.

The microbial colonization of wounds was observed weekly from 1st day to the 4th week of hospitalization. Periodic wound swabs were collected at 1st, 2nd, 3rd, and 4th weeks of hospital stay or till the resurfacing was done.

The bandages after removal, the topical antimicrobial agent remnants were cleaned and the wound swabs were taken. Then after washing, topical antimicrobial agents were applied. Sterile cotton-tipped swabs were used to collect the pus and or any other purulent discharge. Specimens were then transferred to sterile test tubes. During collection of samples from dry surfaces, swabs were moistened with sterile normal saline. Gram stain and culture are performed.

All the wound swab specimens were then inoculated on the Blood Agar plate, MacConkey agar and Nutrient agar, and incubated at 37 degrees Celsius for about 18 to 24 hours.[4]

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Gram-negative rods were identified by performing a few biochemical tests suchasthe catalase test,the oxidase test, methyl-red (MR) test, Voges-Proskauer (VP) test, indole test, the motility test, the oxidative-fermentative (OF) test, hydrogen sulphide (H_2S) production test, citrate utilization test, triple sugar iron (TSI) reactions, and the urease test.[4]

Gram-positive cocci were identified depending upon how they prefer to grow on Blood Agar and Nutrient agar followed bycatalase test, OF test, oxidase test and coagulase test.[4]

RESULTS

There has been an increase in the number of patients presenting to the casualty in the last 5 years. Average admissions per month 2011-2015 was 39 compared to 2016-2020 being 68, winters have the highest rates. Domestic incidents have increased over time. Most affected patients in burns were women suffering burns due to domestic accidents(76%). We have observed an increased incidence of house fires.

Two major patterns were observed:

1. During cooking
2. Due to heaters and heating coils.

Most patients were in the young working age group (21 to 40 years). Most patients were females with a ratio of 54% (69 patients). There has been an increasing trend in pediatric burns (21% in year 2011-2015 to 26%, 32 patients in year 2016-2020). The percentage of burns as per TBSA presenting has increased over the period of time, from average 28% TBSA in year 2011-2015 to 32% TBSA in year 2016-2020.

Large burns (>20% TBSA) are becoming more common in recent times requiring more hospitalization, dressings, debridements, ICU care and surgeries.Urban burns are more common than rural burns (54%, 67 patients) but rural burns had higher mortality(12% higher).

Figure 1: Images showing large burns represent increasing incidence of large burns.

The average duration of stay has increased (from 27 days in year 2011-2015 to 38 days in year 2016-2020) and this includes two separate timelines for the patient:

(1) *Initial*: ICU care, fluid resuscitation, dressings, conservative management, debridement.

(2) *Late*: Surgery: including resurfacing and managing post-burn sequelae. Overall crude mortality has decreased by 5.3%, although the data was not significant (p>0.05).

Figure 2: Early Debridement and cover with Collagen based dressing.

TYPE OF BURN: Etiology(Figure 3)

- *Scald*: on a rising trend, mostly pediatric population. About 42%
- *Thermal* (excluding Scalds): On a decreasing trend, 47%
- *Electrical*: On an increasing trend, 8%
- *Chemical*: 2%

Figure 3: Etiology of burns.

- *Infection*: As large burns have increased with deeper burns, late referrals, inadequate primary management, patient-related causes with improper judgment, and injudicious use of antibiotics. The burn wound is colonized and teamed with more resistant strains of microorganisms with a much wider spectrum than previously seen, presenting with different sequelae and pathologies (Figures 4 and 5).

Figure 4: Infected burns presenting in casualty.

Figure 5: Burns and their sequelae with different pathologies.

Bacteriology

The bacteriology of the burns is represented in Figure 6.

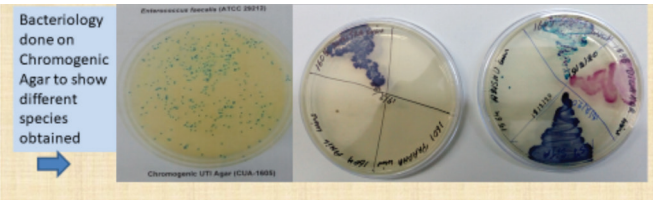

Figure 6: Bacteriology of burns, Chromogenic agar Petri dish, different colonies on the dish.

Antibiotics

Multi Antibiotic Resistance Index (MAR Index): It is identified as the ratio between the number of antibiotics, an isolate is resistant to and the total number of antibiotics the organism is exposed to. Most patients (65%) had many antibiotic-resistant infections, mostly Pseudomonas with other strains making it a multi-bacterial infection (Figure 7).

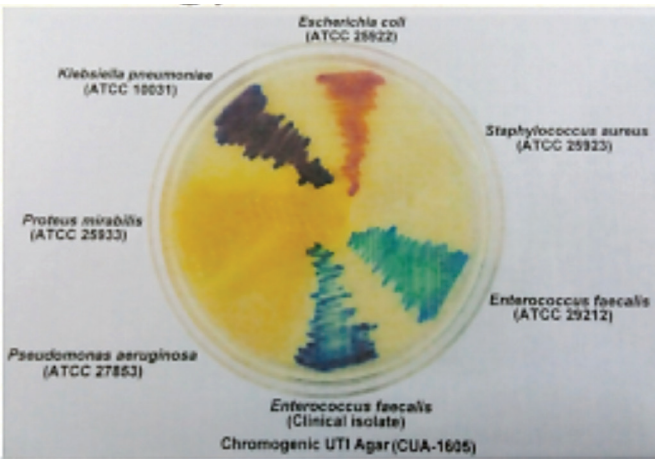

Figure 7: A Petri dish depicting different strains of bacteria found in the study.

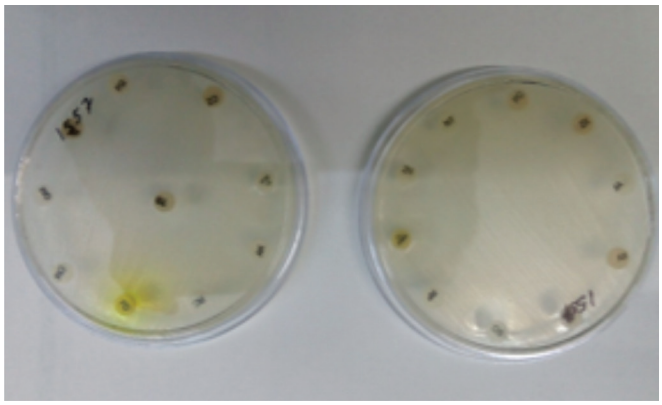

Figure 8: APetri dish showing different antibiotic inoculates. The therapy is targeted as per the antibiogram.

Due to late referrals (>72hours) the patients harbour significant infection and improper use of antibiotics resorting to resistant growths.Depending on the culture and resorted to a higher class of antibiotics (3rd or 4th Generation cephalosporins), Anti-ESBL antibiotics, such asMeropenem, Imipenem, with cilastin etc., with lesser used Aminoglycosides as Netilmycin was used as strategy to control infection and debridements at proper times (Figure8).

DISCUSSION

Many studies such as Fouzia *et al*., Patil *et al*., and Anwar *et al*. have shown the changing pattern in burns.Initially, gram-positive organisms prevail during the hospital stay of patients but later on, superseded by gram-negative opportunists due to their better propensity to invade. Over some time, the MAR index has been increasing. Similar results were found in other studies.[5-8]

Fouzia *et al*. reported Staphylococcus aureus as the most common infective agent, whereas our study reported Pseudomonas species as the most common agent.[6]

Pseudomonas species were found most sensitive to Polymyxin B. *Staphylococcus aureus* was found most sensitive to Vancomycin. Although, high levels of sensitivity were found with Levofloxacin. Coagulase-negative staphylococci showed similar sensitivity as *S. aureus*. Acinetobacter species, *Klebsiella* species, and *Escherichia coli* were most sensitive to Amikacin. Ctrobacter, Enterobacter and Proteus species were extremely sensitive to Gentamycin apart from Amikacin. Ciprofloxacin and Levofloxacin were extremely effective against Proteus and Citrobacter species. Netilmycin was used in cases resistant to Amikacin and Gentamycin. A similar pattern of sensitivity was found by Anwar *et al*. and Rajbahak *et al*.[8,9]

Our study had a few similar characteristics to the previously mentioned studies and reflected a regional variation in some features. These variations are unique to every setup managing burns at a defined demographic region but at the same time also contain some that are common to all centres. Younger working age group (21 to 40 years) are most commonly burnt. The age bracket has decreased as seen by other studies. Large burns (>20% total body surface area) have become more common which is in contrast to Anwar et al where they

Table 1: Types of infection in burns.

Types of infection					
Organisms	**Mixed**		**Organisms**	**Single**	
	No.	**%**		**No.**	**%**
P. aeruginosa +*Acinetobacter* spp.	19	12.9	*P. aeruginosa*	47	32.0
P. aeruginosa + *S. aureus*	10	6.8	*S. aureus*	20	13.6
P. aeruginosa+ CONS	7	4.8	CONS	3	2.0
P. aeruginosa+ *E. coli*	3	2.0	*Acinetobacter* spp.	10	6.8
P. aeruginosa + *Klebsiella* spp.	4	2.7	*Klebsiella* spp.	0	0
P. aeruginosa + *Citrobacter* spp.	2	1.4	*E. coli*	0	0
P. aeruginosa + *Proteus* spp.	4	2.7	*Citrobater* spp.	0	0
P. aeruginosa + *Enterobacter* spp.	1	0.7	*Enterobacter* spp.	0	0
P. aeruginosa +*S. aureus* + *Klebsiella* spp.	1	0.7	*Proteus* spp.	0	0
S. aureus + *Acinetobacter* spp.	4	2.7			
S. aureus + CONS	1	0.7			
S. aureus + *E. coli*	1	0.7			
S. aureus + *Proteus* spp.	1	0.7			
S. aureus + *Klebsiella* spp.	3	2.0			
Acinetobacter spp. + CONS	1	0.7			
Acinetobacter spp. + *Enterobacter* spp.	1	0.7			
Acinetobacter spp. + *Citrobacter* spp.	1	0.7			
Acinetobacter spp. + *E. coli*	2	1.4			
Proteus spp. + *E. coli*	1	0.7			
Total	**67**	**45.6**		**80**	**54.4**

reported a statistically significant trend of admitting lower percentage of burns.[8]

Table 1 depicts the types of infection in burn patients as per Rajbahak *et al*. Similar were the findings at our centre.[9]

Consent: All patients included in the study gave a written informed consent.

Conflict of interest: There is no conflict of interest.

CONCLUSION

The pattern of burn is changing as a dynamic process. Resorting to a single line of management over a sustained long period of time (>5 to 10 years, depending on the demography) may not be adequate.

The need of the hour is to reassess the problem, re-evaluate the present standards, re-formulate principles and re-strategize the management with changing requirements of the burned patient.

REFERENCES

1. Santucci, S. G., Gobara, S. and Santos, C. R. 2003. Infections in a burn intensive care unit: experience of seven years. J Hosp Infect. 53: 6-13.
2. Lari, A. R. and Alaghehbandan, R. 2000. Nosocomial infections in an Iranian burn care center. Burns. 26(8): 737-740.
3. Pruitt, B.A. 1984. The diagnosis and treatment of infection in the burn patient. Burns. 11: 79.
4. Benson, F. 2001. Microbiological applications lab manual, 8th edn. McGraw-Hill, p. 50-70.
5. Sandhu R, Dahiya S, Sayal P. Evaluation of multiple antibiotic resistance (MAR) index and Doxycycline susceptibility of Acinetobacter species among inpatients. Indian J Microbiol Res 2016;3(3):299-304.
6. Fouzia, Begum et al. "Changing patterns of burn infections." *IOSR Journal of Dental and Medical Sciences* 5 (2013): 11-14.
7. Patil, Sangeetha & Reddy, K. & Jeer, Mariraj & Krishna, Shiva. (2015). Aerobic Bacterial Isolates from Burn Wound Infection Patients and their Antimicrobial Susceptibility Pattern. Journal of Medical Science And clinical Research. 10.18535/jmscr/v3i9.10.
8. Anwar, U., Majumder, S., Austin, O., & Phipps, A.R. (2007). Changing Pattern of Adult Burn Referrals to a Regional Burns Centre. *Journal of Burn Care & Research, 28*, 299-305.
9. Rajbahak, Sushma & Shrestha, C & Singh, A. (2015). Bacteriological changes of burn wounds with time and their antibiogram. Scientific world. 12. 70. 10.3126/sw.v12i12.13601.