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Original Research Article

Acinetobacter in Burn Wound Infection: Emerging problem in Central India

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ABSTRACT

Introduction: Burn patients are at greater risk of microbial infections. Gram positive and Gram negative organisms are responsible for burn wound infections. Emergence of multidrug resistance in Acinetobacter poses threat to the burn patients with increased morbidity and mortality.
Aims and Objectives: The aim of present study was to know the incidence of Acinetobacter infection in burn patient with its antimicrobial resistance.
Material and Methods: Prospective cross sectional study was carried out including 258 burn patients. Wound swabs are processed as per Standard Microbiological Procedure and infecting organisms were identified upto species level.
Observation and Results: Females are more prone to burn injury with majority of patients belong to 21-30 yrs. of age group. Overall, wound culture positivity is 68.51% with predominance of gram negative organisms. Acinetobacter species account for 5.37% burn wound infections. Acinetobacter spp. were resistant to commonly used antimicrobials. Although, Imipenem and Meropenem have some degree of sensitivity, there are chances of emerging resistance to them.
Conclusion: Therefore, with limited antimicrobials available against Acinetobacter spp. , one needs to be cautious in prescribing antimicrobials.
Key words: Acinetobacter, Antimicrobial resistance.

INTRODUCTION

Burn injury is major medico social problem and one of leading causes of deaths in India. [1,2] Thermal burns are skin injury caused by external heat sources. Radiation burns, chemical burns, electrical burns are other forms of burn injuries. [3] Although, skin protects entry of potential pathogen from the environment, burn provides large exposed protein rich avascular surface for microbial colonization and multiplication. [4,5] Infection remains the major complication in burn injury in spite of advances in the field of critical care. The majority of the factors responsible for increased occurrences of infections in burn patient are the nature of burn injury, immunocompromising effects of burns, prolonged hospital stays, intensive diagnostic and therapeutic procedures. [6] Burn patients are at greater risk of hospital acquired infections as many intravascular and other devices are placed. [7] Staphylococci and Streptococci species located in sweat glands and hair follicles may survive thermal insult and colonise the wound within first 48 hours of injury. [8] Gram negative organisms like E. coli, Klebsiella species, Proteus species are responsible for endogenous infection. [9] Pseudomonas and Acinetobacter species have a greater propensity to invade and may supersede the Gram positive organisms. [10,11]

Acinetobacter species exhibit multidrug resistance and are responsible for substantial morbidity and mortality in burn patients. [12] Therefore the present study was

undertaken to study the incidence of Acinetobacter species in burn wound infection with its antimicrobial resistant pattern.

MATERIALS AND METHODS

A prospective cross sectional study was carried out in tertiary care hospital after Ethics Committee approval during three year study period. A total of 994 wound swabs were collected from 258 burn patients.

Wound swabs were collected from sub-eschar exudates and from deep areas of burn wound, before cleaning and application of antibiotic or antiseptic. Swabs were collected from each patient on days 0,3,7, 14,21,28. Specimens were processed by Standard Microbiological Technique for Microscopy and culture. Antibiotic Susceptibility Testing was performed as per CLSI guidelines by Modified Kirby Bauer Disc Diffusion Method. Blood cultures were performed in burn patients with clinical signs of septicaemia.

OBSERVATION AND RESULTS

Of the 258 patients included in the study, 79(30.62) were males and 179(69.37%) were females with M:F ratio of 1:2.26.

Table1: Age and sex distribution of burn patients.

Age group(years)	Male	Female	Total
<10	23(45.09)	28(54.90)	51(19.76)
11-20	9(29.03)	22(70.96)	31(12.01)
21-30	16(19.51)	66(80.48)	82(31.78)
31-40	8(17.02)	39(82.97)	47(18.21)
41-50	9(47.36)	10(52.63)	19(7.36)
51-60	8(44.44)	10(55.55)	18(6.97)
>60	6(60.00)	4(40.00)	10(3.87)
Total	79(30.62%)	179(69.37%)	258(100)

Age of patients ranges from 8 months to 82 year (table 1). 82(31.78%) patients belong to 21-30 yrs of age group followed by 51(19.76%) of children of less than 10 yrs of age.

Table 2: Distribution of burn paients as per type of burns

Burn Type	No. of cases (%)
Thermal	232(89.92)
Electrical	15(5.81)
Chemical	11(4.26)
Total	258(100)

Burns caused by thermal origin were highest while that of electrical origin were least.

Table 3: Isolation of organisms with respect to date of admission

Post burn day	No. Of wound swab	Culture positivity (%)
0	258	20(7.75)
3	222	177(79.72)
7	185	182(98.37)
14	139	139(100)
21	114	99(86.84)
28	76	64(84.21)
Total	994	681(68.51)

Not all patients were followed upto 28 days. Overall wound culture positivity was (68.51%).

Wound culture positivity increased with hospital stay of patients.

Table 4 : Organisms isolated from wound specimens

Organism	Total
Gram Negative Bacilli	625 (69.98)
P. aeruginosa	323 (36.17)
K. pneumoniae	76 (8.50)
E. coli	58 (6.49)
Acinetobacter	48 (5.37)
P. mirabilis	46 (5.15)
P. vulgaris	5 (0.55)
C. koseri	13 (1.45)
C. freundii	16 (1.79)
Enterobacter spp.	30 (3.35)
S.marcescens	21 (2.35)
Gram Positive Cocci	268 (30.02)
S. aureus	187 (20.94)
CONS	23 (2.57)
S.pyogenes	27 (3.02)
Enterococcus spp.	31 (3.47)

Out of 681 (68.51%) positive wound culture, 509 (74.74%) showed monomicrobial growth while 172 (25.25%) showed polymicrobial growth. Of 893 organisms isolated from wound specimens, 625 (69.98%) were Gram negative organisms while 268 (30.02%) were gram positive organisms.

Within gram negative organisms, Pseudomonas aeruginosa 323 (36.17%), Klebsiella pneumoniae 76 (8.50%), E. coli 58 (6.49%) and Acinetobacter 48 (5.37%) were prominent isolates.

Table 5: Day wise isolation of Acinetobacter Spp.

Organism	Post Burn Day						Total
	0	3	7	14	21	28	
Monomicrobial	0	0	3	4	4	3	14
Polymicrobial	0	0	9	12	8	5	34
Total	0	0	12	16	12	8	48

Table shows isolation of Acinetobacter spp. as per the post burn days. Isolation is more towards later half of burn days, i.e. on 7th, 14th, 21st and 28th day.

Table 6: Antimicrobial resistance pattern of Acinetobacter spp.

Antimicrobial agents	Acinetobacter spp. (%) (n=48)
Ceftazidime	34(70.83)
Cefotaxime	39(81.25)
Cefepime	38(79.16)
Piperacillin+Tazobactam	34(70.83)
Imipenem	30(62.50)
Meropenem	28(58.33)
Gentamicin	48(100)
Amikacin	42(87.50)
Tobramycin	46(95.83)
Ciprofloxacin	43(89.58)
Colistin	0(0%)

All isolates of Acinetobacter were resistant to Gentamicin. There was increased resistance of Acinetobacter spp. to other antimicrobial agents like Piperacillin-Tazobactam, Ceftazidime, Cefepime, Ciprofloxacin and Amikacin. 60% isolates were resistant to Imipenem and Meropenem. All isolates were sensitive to Colistin.
Blood cultures were performed in burn patients with clinical signs of septicaemia. Acinetobacter species were isolated from 4 blood culture specimens.

DISCUSSION

Morbidity and Mortality associated with burn injury is high in developing countries like India. High risk of infection, prolonged hospital stays and extensive wounds surface usually associated with nosocomial infection due to resistant pathogens and thus become difficult to treat. [12]

Incidence of burn injury is higher in females in present study (69.37%). Females spend more time in kitchen doing household work with fire thus was more prone to burn injuries. [2,13-15] Most number of patients in our study belonged to the age group of 21-30 years. A number of studies in India have shown similar age distribution and attributed this to higher chances of exposure to burn accidents because of active age group. [16-18]

Culture positivity in our study is 68.51%. The culture positivity described in other studies ranges from 55% to 96%. [14,19-21] In our study, monomicrobial etiology was observed in 74.74% and polymicrobial etiology in 25.25% culture positive cases. This is in accordance with Macedo et al. [18]

69.98% Gram negative organisms and 30.02% gram positive organisms were isolated in the present study whereas Cilliers MCG et al [8] reported 57.74% gram negative organisms and 42.26% gram positive organisms. Preponderance of gram negative organisms were also given by other studies. [3,4,7] Within gram negative organisms, Pseudomonas aeruginosa (36.17%) is the most common isolate followed by Klebsiella pneumoniae (8.50%), E. coli (6.49%), Acinetobacter (5.37%) and others. [3-5,7,8]

5.37% Acinetobacter spp. were isolated in the present study. This finding is in accordance with other studies where isolation of Acinetobacter spp. ranges from 4-11%. [7,8,22,23,18,24] Some of the studies have isolation rate of 14% to 24%. [5,6,25] However, Peterson et al [26] and Keen et al [17] have higher isolation of 36% and 38% in their study respectively. In the present study, isolation is more after 1 week of hospital stay which is in accordance with study of Rajbhak et al. [3]

This is attributed to carriage of Acinetobacter spp. on human skin, particularly in tropical climate. [5] In addition, longer hospitalization and presence of intravascular lines act as independent risk factors for development of Acinetobacter infection. [27]

Acinetobacter is gaining concern in burn infections because of increased resistance to antimicrobials. Resistance to majority of antimicrobials tested in present study was 70% to 100%. These antimicrobials resistance include Cephalosporins (70-81%), Piperacillin-Tazobactam (70.83%), Ciprofloxacin (89.58%), Amikacin (87.50%), Tobramycin (95.83%) and Gentamicin (100%). Carbapenems such as Imipenem and

Meropenem showed 62.50% and 58.33% resistance respectively. All the isolates were uniformly sensitive to Colistin. Similar resistance pattern to majority of antimicrobials has been described by Bayram et al [5] and Rajbhak et al. [3] However, low resistance to Amikacin and high resistance to Imipenem as compared to our study has been observed by them.

Acinetobacter spp are increasingly associated with nosocomial infections. This is due to its multidrug-resistant status, its ability to survive in hospital environment and easy transfer of these organism because of their presence on normal skin. [5]

Enzymatic degradation of Beta lactamases and Acinetobacter Derived Cephalosporinases (ADCs), chromosomally encoded Amp-C Cephalosporinases are mainly responsible for Multidrug-resistant status of Acinetobacter strains. Although Carbapenems are active against Acinetobacter strains and can be used for serious acinetobacter infection. Emergence of enzymatic and membrane based mechanism of resistance hinders the clinical utility of this class of antimicrobials.

Isolation of Acinetobacter spp in blood cultures was 5.79%. Studies by Lari et al [28] and Kaur et al [14] state similar blood culture positivity. Lessava et al [29] reported increased isolation of Acinetobacter spp in blood cultures (9.9%). Antimicrobial resistance pattern of strains isolated from blood and wound specimens from the same patient were similar. [16,30]

CONCLUSION

Thus emergence of multidrug resistant Acinetobacter spp. in burn wound infection limits treatment options. Therefore it warrants judicious use of antimicrobial agents in our setup with proper hospital infection control measures.

Conflict of interest: None

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