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Original article

A study on bacteriology of burn wound, antibiotic sensitivity pattern and management

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ABSTRACT

Background: Infection is an important cause of mortality in burn patients. The microorganism causing burn wound infection may differ from one hospital to another, therefore it is necessary to review the bacteriological profile and susceptibility pattern to commonly used antibiotics. **Methods:** Bacteriological data and antibiotic sensitive pattern of 80 burn patients admitted in the department of General Surgery M.K.C.G.MCH,BERHAMPUR from AUGUST 2014 to JULY 2016 was obtained from the burn wound swabs .Wound swabs were collected from both male and female patients and sent to Microbiology Department for pus culture and sensitivity testing. **Results:** Pseudomonas was found to be most common isolates(51.25%) followed by Staphylococcus aureus(15%), E.Coli(3.75%), Proteus(2.5%), Klebsiella(2.5%), Acenetobacter(1.25%) and mixed organism (23.75%).Among 7 antibiotics , Imipenem was most effective drug for both gram negative and gram positive organisms. **Conclusion:** Pseudomonas was most common organism followed by Staphylococcus aureus and imipenem was most effective drug for both gram negative and gram positive organisms. This suggests that strict hygiene should be maintained in burn patients.

KEYWORDS: Antibiotic Sensitivity, Burn Wound, Nosocomial Infection.

INTRODUCTION

Burn injuries are among the most devastating of all injuries and a major public health crisis [1].Though survival has improved over the years in major burns all over the world, the situation in India is different [1]. Delay in arrival in a burn facility from remote villages, lack of early coverage of the wound and sepsis are the most important factors dictating the patient outcome in our country [1].

Infections are the main cause of morbidity and mortality in burn patients, in patients with burn over more than 40% of the total body surface area,75% of all deaths following thermal injuries are related to infections [2]. Severe burn covering more than 40% of the TBSA are typically followed by a period of stress, inflammation, and hypermetabolism, characterized by a hyperdynamic circulatory response with increased body temperature, glycolysis, proteolysis, lipolysis, and futile substrate cycling [3].These responses are present in all trauma, surgical, and critically ill patients, but their severity, length, and magnitude are unique for burn patients [3].The risk of burn wound infection is correlated to the extent of the burn and is related to impaired resistance resulting from disruption of the mechanical integrity of skin and generalised state of immune-suppression [4] .

Burn wound surfaces are sterile immediately following thermal injury, these wounds eventually become colonized with microorganisms ,gram-positive bacteria that survive the thermal insult, such as S.aureus located deep within sweat glands and hair follicles, heavily colonize the burn wound surface within first 48hour [5]. The denatured protein of the burn eschar provides nutrition for the organisms. Avascularity of the burned tissue places the organisms beyond the reach of host defence mechanisms and systemically administered antibiotics [5].

The rate of nosocomial infections is high in burn patients due to various factors such as type and number of organisms, enzyme and toxin production, colonization of the burn wound site, systemic dissemination of the colonizing organisms[5]. Moreover the large area of tissue is exposed for a longer time that renders patients prone to invasive bacterial sepsis [5].

The burn wound represents a susceptible site for opportunistic colonization by organisms of endogenous and exogenous origin [6]. Following colonization these organisms start penetrating the viable tissue depending on their invasive capacity, local wound factors and the degree of the patient's immune suppression [7]. If sub-eschar tissue is invaded, disseminated infection is likely to occur and the causative infecting organisms in any burn facility change with time [7].

Burn wound infections are largely hospital acquired and the infecting pathogens differ from one hospital to another [8].In addition ,cross-infection results between different burn patients due to overcrowding in burn wards [9]. Individual organisms are brought into the burns ward on the wound of new patients [10].These organisms then persist in the resident flora of the burn treatment facility for a variable period of time, only to be replaced by newly arriving microorganisms [10]. Introduction of new topical agents and systemic antibiotics influence the flora of the wound [10] .

Topical antimicrobials decrease microbial overgrowth but seldom prevent further colonization with other potentially invasive bacteria and fungi [10].These are derived from patients gastrointestinal and upper respiratory tract and hospital environment [10].

The spectrum of bacteria isolates varies with time and geographic distribution [10].To have an in-depth knowledge of the organisms that are predominant in that particular treatment facility during particular period along with their antibiotic sensitivity pattern is vital, as some septic burn patients may need to be treated with antibiotics before the results of the cultures are available [10] .Therefore, there is a need for every burn ward to determine the specific pattern of burn wound microbial colonization and their anti-microbial sensitivity profiles.

Aim: To study on bacteriology of burn wound , antibiotic sensitivity pattern and outcome in burn patients .

MATERIALS AND METHODS

Study area

This study was conducted in the Department of general surgery of M.K.C.G. MEDICAL COLLEGE & HOSPITAL, BERHAMPUR from August 2014toJuly2016. The study included all the burn patients admitted to the indoor surgical ward after applying exclusion and inclusion criteria.

Exclusion Criteria

1.Minor burns(second degree burn less than 10% and third degree burn less than2%).

2.First degree burns(only erythema).

3.Major burn victims admitted to hospital who died during the stage of shock (after 48to 72 hours).

4.Who referred to burn centre or died within seven days of admission.

Inclusion Criteria

1.Who survived from the stage of shock for minimum seven days.

Method of Collection of Samples

Samples were collected on admission and every week thereafter until the patient was discharged. Samples were collected with a sterile swab from clinically deep areas of the burn wounds prior to cleaning on the day of admission. After that swabs were taken twice weekly. The bandages were removed, the remnants of the previous days ointment were washed away and the wounds were swabbed. Swabs were taken from burn wound deep areas with discharge, thick eschar etc. Samples were sent to MICROBIOLOGY DEPARTMENT, M.K.C.G.MEDICAL COLLEGE & HOSPITAL, BERHAMPUR for wound swab culture and antibiotic sensitivity testing.

All burn victims admitted to hospital were resuscitated with Ringer's lactate solution according to parkland formula(4ml/kg/% of burn-Ringer Lactate in the first 24 hours).Half of the volume was given in first 8 hours ,rest given in 16 hours.After 24 hours colloid in the form of plasma was given.

All patients were also given tetanus prophylaxis (toxoid and antitetanus immunoglobin).A complete physical examination was done in all patients during admission and was repeated at frequent intervals. The percentage of burn surface area was calculated by "Wallace Rule of Nines". Depth of burn was assessed by the appearance of wound .This assessment was repeated every alternate day. Urinary catheter and nasogastric tubes were inserted as dictated by clinical condition(e.g .Shock, Oliguria and Paralytic ileus).Any one of the choosen topical cream was applied within two hours of admission.

After preliminary cleansing ,invariably all the patients received inj ceftriaxone on admission, ppi (pantoprazole) or H_2 blockers (Ranitidine) and analgesic like inj tramadol,pentazocine,promethazine. Subsequently empirical supplements of multivitamins and aminoacids were instituted. Inj Frusemide was given in oliguric patients . Patients who had sustained third degree burns greater than 10% TBSA were also transfused blood according to their haemoglobin status after 36 to 48 hours.Patients were encouraged to take their regular diet, as soon as the bowel motility retained. Escharotomies and grafting were done whenever required.

RESULTS

We included 80 patients in our study . Females were highest sufferers 61%(76.25%). Burn injuries are common in third decade of life 32(40%) cases. Out of total 80 cases, 60(75%) cases sustained fire injury ,out of which 40 cases were due to flame burns (66.66%) and 33 females sustained flame burns . This is evident from table -1. Table-2 shows a predominance of pseudomonas infection in 41(51.25%) cases followed byStaphylococcus(15%), E.coli(3.75%), Proteus(2.5%), and Klebsiella(2.5), Acinetobacter(1.25%) and mixed organisms (23.75%) .

Table-3 shows the antimicrobial susceptibility of wound culture of burned patients.Imipenem was found most effective antibiotic for both gram positive and gram negative organisms. Linezolid and Vancomycin was resistant to gram negative organisms and was sensitive to gram positive organism Staphylococcus aureus.

Ceftriaxone, Ciprofloxacin,combination of Ceftriaxone and Amikacin, combination of Piperacillin and Tazobactum showed verying degree of susceptibility to both gram positive and gram negative organisms. Table-4 shows that 87.5% mortality rate in >70% of burns .From the table it is evident that mortality increases as the extent of burn increases.

Table :1 Incidence of burns in different age and sex among the study subjects

Age	Male	Percentages	Female	Percentages	Total	Percentages
5-10	01	1.25	03	3.75	04	**5**
11-20	04	5	07	8.75	11	13.75
21-30	06	7.5	26	32.5	32	40
31-40	5	6.25	18	22.5	23	28.75
41-50	02	2.50	04	5	6	7.5
>50	01	1.25	03	3.75	04	5
TOTAL	19	23.75	61	76.25	80	-

Table :2 Organisms isolated from pus culture and sensitivity examination among study subjects

Microbial Organisms	Organism isolated	Percentage
Pseudomonas aeruginosa	41	51.25
Staphylococcus aureus	12	15
E.coli	03	3.75
Proteus	02	2.5
Klebsiella	02	2.5
Acinetobacter	1	1.25
Mixed Organisms	19	23.75

Table: 3 Antibiotic Sensitivity Pattern of Cultured Organisms

Antibiotics	**P.aeruginosa** N=41 Sensitivity (%)	**S. aureus** N=12 Sensitivity (%)	**E.coli** N=03 Sensitivity (%)	**Proteus** N=02 Sensitivity (%)	**Klebsiella** N=02 Sensitivity (%)	**Acinetobacter** N=01 Sensitivity (%)	**Mixed** N= 19 Sensitivity (%)
Imipenem	40(97.56%)	10(83.33 %)	02(66.66 %)	01(50%)	01(50%)	I	14(73.68 %)
Vancomycin	R	08(66.66 %)	R	R	R	R	10(52.63 %)
Linezolid	R	09(75%)	R	R	R	R	09(47.63 %)
C+A	24(58.53%)	05(41.66 %)	01(33.33 %)	01(50%)	I	NT	08(42.10 %)
Ceftriaxone	18(43.90%)	03(25%)	R	NT	R	I	07(36.84 %)
Ciprofloxacin	20(48.78%)	04(33.33 %)	01(33.33 %)	I	NT	I	06(31.57 %)
P+T	26(63.41%)	06(50%)	01(33.33 %)	01(50%)	01(50%)	NT	12(63.15 %)

P.aeruginosa=Pseudomonas aeruginosa , S.aureus=Staphylococcus aureus, C+A=Ceftriaxone+Amikacin
P+T=Piperacillin+Tazobactum, N=no of organisms, R=Resistant, I=Intermediate sensitive, NT=Not tested

Table: 4 Mortality in burn patients

Extent of burn (percentage)	Total No. of Cases	Total No. of patients improved		Total No. of patients succumbed		mortality in each group(percentage)
		Male	Female	Male	Female	
11-20	04	01	03	00	00	00
21-30	07	02	05	00	00	00
31-40	06	02	03	00	01	16.66
41-50	22	02	11	03	06	40.9
51-60	25	02	10	04	09	52
61-70	08	00	02	02	04	75
>70	08	00	01	01	06	87.5
Total	80	09	35	10	26	45

DISCUSSION

The burn wound is considered one of the major health problems in the world and infection is frequent and severe complication in burn patients. In our study , it is evident that burn injuries are common in third decade of life i.e.32(40%) cases and females 61(76.25%) cases and coincides the study done by Sinha JK et al. [11].

Pseudomonas aeruginosa was the commonest organism 41 (51.25%) infecting burn wounds followed by Staphylococcus aureus 12(15%), E.coli 03(3.75%), Proteus 02(2.5%) , Klebsiella 02(2.5%) and Acenetobacter 01(1.25%). Wound colonised with mixed organisms in this study was 19(23.75%).The mixed colonisation was mostly associated with Pseudomonas aeruginosa, Staphylococcus aureus and E.coli. Our study coincides with the study done by Revathi G,Puri J, Jain BK [12] , Nasgoba BS etal [13], Rastegar Lari A etal [14].

New generation antibiotic Imipenem was found sensitive to both gram positive and gram negative organisms. Linezolid and Vancomycin were found to be more sensitive to gram positive Staphylococcus aureus and resistant to gram negative organism. Imipenem was most sensitive to Pseudomonas aeruginosa (97.56%) followed by Staphylococcus aureus(83.33%) , E.coli (66.66%),Proteus(50%),Klebsiella (50%) .Piperacillin+Tazobactum was sensitive to to Pseudomonas aeruginosa(63.41%) , sensitive to Staphylococcus aureus(50%), sensitive to E.coli(33.33%),sensitive to both Proteus and Klebsiella(50%) .Ceftriaxone+Amikacin was sensitive to Pseudomonas aeruginosa(58.53%), sensitive to Staphylococcus aureus(41.66%), sensitive to E.coli(33.33%) and to Proteus(50%).Ceftriaxone was sensitive to to Pseudomonas aeruginosa(43.90%), sensitive to Staphylococcus aureus(25%),Ciprofloxacin was sensitive to Pseudomonas aeruginosa(48.78%), sensitive to Staphylococcus aureus(33.33%) and sensitive to E.coli(33.33%) . Our study coincides with study done by Mehta M etal, [15],Sharma S etal, [16], Kamaria P.A etal [17].

We showed that Shows that >70 % TBSA of burn mortality was 87.5%.This shows that the mortality increases as the extent of burn injury increases and correlates with the study done by Vittorio Pavoni et al [18].

CONCLUSION

Pseudomonas aeruginosa was most common organism in burn wound infection and new generation antibiotic imipenem was most effective antibiotics for both Gram negative and Gram positive organisms. Mortality increases as the extent of burn increases. These suggests that burn patients overcrowding and hygiene problem are main causes of these infections. So repeat swab culture and antibiograms are advised for proper selection of antibiotics to control infections.

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