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Microbiology

BACTERIOLOGICAL PROFILE OF ISOLATES FROM BURN WOUNDS IN A TERTIARY CARE HOSPITAL.

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ABSTRACT

Background: Three fourth of deaths in burn patients occur due to infections the objective of the study was to find out the aerobic pathogens of burn wound cases and their antibiotic sensitivity pattern.

Materials and Methods: This prospective observational descriptive study was conducted on 144 pus specimens from patients admitted to burn unit at Shri Mahant Indiresh Hospital Dehradun, over a period of 2 years. The identification and antibiotic sensitivity testing of pathogens was performed using automated method

Results: Of 144 cases studied, males dominated with 75.8%. The highest distribution of burn cases (50.7%) were within 11 to 40 years of age. The 110 aerobic pathogens were grown, of which 9 were Gram-positive cocci and 101 Gram-negative bacilli. The predominant bacteria as mono-microbial etiology isolated from the specimens was *Pseudomonas aeruginosa* 28/72 (29.5%). While of the 95 specimens examined, 23 (24.21%) had poly-microbial pathogens reported. Of which the combination of *Pseudomonas* and *Proteus spp* dominated (10/23).

Conclusion: It is important for every hospital to analyse prevalent organisms and their antibiotic susceptibility pattern to formulate an effective antibiotic policy for ailments like burns.

KEYWORDS : Burns, Monomicrobial, Polymicrobial, Resistance Pattern

INTRODUCTION

Thermal injury is a serious type of trauma requiring care in specialized units. Burn patients are ideal hosts for opportunistic infections which is a major cause of morbidity and mortality in hospitalised burn patients. It has been estimated that about 75% of the mortality associated with burn injuries is related to sepsis especially in developing countries.[1] Burn patients have high risk of local and systemic infections like wound infections, pneumonia, urinary tract infections, catheter related infections and thrombophlebitis.[2]

The breached skin barrier is the hallmark of thermal injury. The body tries to maintain homeostasis by initiating a process of contraction, retraction, and coagulation of blood vessels

immediately after a burn injury. Three distinct zones have been defined within the burn wound namely, zone of coagulation, zone of stasis, and zone of hyperaemia. [3,4] The risk of infection in burn wound depends on the mechanism and extension of thermal injury, and also on the pathogenic potential of microbes and intensity of colonization.[4]

Types of burn wound injuries include a)Thermal injury: Direct contact with flame, a hot surface or hot liquid (scald), or a source of heat conduction, convection, or radiation causes a degree of cellular damage to the skin that varies with the temperature and duration of exposure.[5,6]

b) Chemical injuries: Interaction with certain chemicals may also damage protein structures. A classification system was described in 1974 by Haberal, Hamshel et al .[7, 8] Injuries due to some chemicals according to their mode of action are Reducing agents (HCl) bind free electrons in tissue proteins, Corrosive agents (phenol) Denatures tissue proteins & Desiccants (Sulphuric acid) damage by dehydration, exothermic reaction.[9,10,11]

The pathogens that infect the burn wounds are primarily Gram positive bacteria such as *Staphylococcus aureus &* Gram negative bacteria such as *Pseudomonas aeruginosa, Proteus* species, *Klebsiella* species and *Acinetobacter* species.[2]

The present study was undertaken to determine the micro flora in burn wounds of the patients admitted in a tertiary care hospital. With the objective of identifying & determining the antibiotic susceptibility pattern of the isolates and to assess the evolving trend of antibiotic resistance pattern of those isolates from burn cases in our hospital settings.

MATERIAL & METHODS

Study design: This prospective observational descriptive study was conducted in the department of Microbiology & Immunology on isolates from patients admitted to burn unit at Shri Mahant Indiresh Hospital, to determine the pattern of aerobic isolates and their antibiotic susceptibility over a period of 2 years (August 2016 to July 2018).

The study was carried out on 144 burn injury cases among all age groups and both genders. Pus and wound swabs were taken aseptically using readymade sterile swabs (HiMedia Pw003). A preliminary Gram staining was performed after culturing on Colombia Blood Agar (BA) (bioMerieux), Mac-Conkey Agar (MA) and Brain Heart Infusion (BHI) Broth. The culture media were incubated aerobically at 37ºC for 16-18hours. In case of no growth, plates were re-incubated for 48 hours and subculture was done from BHI broth on BA and MA and incubated at 37ºC for 24 hours. Growth thus obtained was processed as per standard protocol with preliminary tests like colony characteristics, Gram stain, catalase, oxidase, coagulase and motility test.[12] Final identification of the pathogen and their antimicrobial susceptibility testing was done using automated method (Vitek2 Compact system of bioMèrieux).

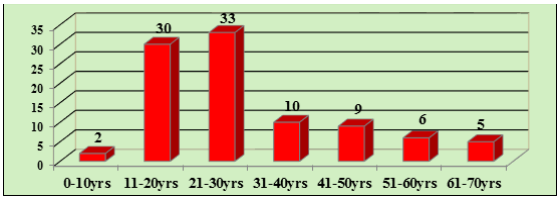
The results thus obtained were analysed using Chi square test for their statistical significance.

RESULT

In this study, of the 144 cases studied, males dominated with 75.8% (109/144) while 24.2% (35/144) were females. This male predominance was found statistically to be highly significant (p value > 0.01). The highest distribution of burn cases (50.7%) were within the

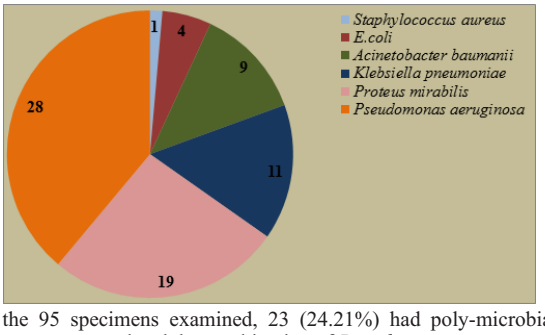
age group of 11 to 40 years (Figure. 1).

Figure 1: Age wise distribution of cases studied



Out of the 144 cases studied, pus culture was positive in 95 patients (65.97 %) while in 49 patients (34.03%), no aerobic growth was observed. The aerobic pathogens were found to be 110 in number, of which 9 were Gram-positive cocci and 101 Gram-negative bacilli. Among the 95 patients with culture positivity, 72/95 (75.8%) specimens had mono-microbial etiology while 23/95 (24.21%) specimens had poly-microbial etiology i.e., more than one pathogen was reported from the specimen. The predominant bacteria as mono-microbial etiology isolated from the specimens were *Pseudomonas aeruginosa* 28/72 (29.5%) and least was *Staphylococcus aureus (1.05%)* as depicted in Figure 2.

Figure 2: Monomicrobial pathogens isolated from burn wound cases studied

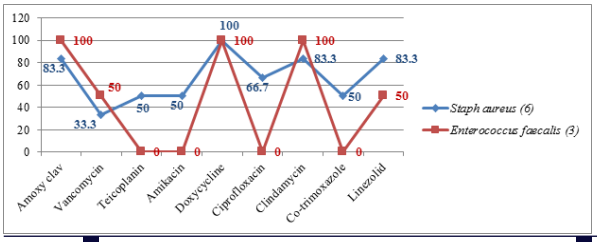


Of the 95 specimens examined, 23 (24.21%) had poly-microbial pathogens reported and the combination of *Pseudomonas aeruginosa* and *Proteus spp* dominated with 43.48% (10/23) (Figure 3)

Figure 3: Polymicrobial pathogens isolated from burn wound cases studied

When the antibiotic resistane pattern of the pathogens were studied, it was observed that among Gram positive cocci, all the isolates of *Staphylococcus aureus* were resistant to amikacin while high level of resistance was observed against all the antibiotics tested. Among the staph aures reported 33.3% were found to be VRSA. All isolates of *Enterococcus faecalis* were found to be sensitive to amikacin, teicoplanin, ciprofloxacin and co-trimoxazole while 50% of them were Vancomycin resistant Enterococci (VRE). (Figure 4)

Figure 4: Resistance pattern of Gram positive isolates (in percentage)



Most of the Gram negative isolates obtained were found to be multidrug resistant with high level resistance exhibited towards amoxycillin-clavulanate and cephalosporins. (Table 1)

Table 1: Resistance pattern of Gram negative isolates (in percentage)

Gram Negative bacilli	Amoxy-clav	Pip-taz	Ceftaz idime	Cefi pime	Imep enem	Ciprofl oxacin	Co-trimoxazo le	Colist in
Esch coli (5)	100	80	100	100	97	60	100	80
Acineto baumanii(11)	100	100	100	100	94	90.9	90.9	90.9
Klebs pneumoniae (12)	100	83.3	91.7	100	100	91.7	91.7	91.7
Proteus mirabilis(30)	90	85.2	86.7	96.7	67.8	53.3	46.7	100
Pseudomonas aeruginosa (45)	100	91.1	95.5	93.3	100	64.4	100	100

DISCUSSION

Infection causes 50% to 60% of deaths in burn patients in spite of intensive therapy with antibiotics both topically as well as intravenous.[5] The pattern of infection differs from hospital to hospital and the varied bacterial flora of infected wound may change considerably during the healing period.[6] Despite the advances in patient care and the use of a large number of antimicrobial agents, infections which complicate the clinical course of severe thermal injures continue to be a major unsolved problem.[3]

Male preponderance in this study matches the findings of various workers. [13, 14, 15, 16,17] However female dominance has also been reported by several workers. [18, 19] In our study the maximum subjects (76.84%) belonged to 11-40 years of age group.This age group is universally known to have increased psychological stress for earning and settlement which can lead to both suicidal and occupational burns. Our study was in concordance with the findings reported by Kwong and Chung et al.[20] In our study the psychological aspect was not covered.

Among the pathogens isolated *Pseudomonas aeruginosa* was found to be the main culprit. Similar findings have been reported by other workers also. [16, 21,22,23,24, 25] While *Proteus mirabilis* as another common pathogen (20%) has also been observed by Rajput et al. [19]

Most of the pathogens reported were found to be multidrug resistant due to their indiscriminate use on empirical basis for prolonged duration of time. Over the last several decades, Gram-negative organisms have emerged as the most common etiologic agents of invasive infection by virtue of their large repertoire of virulence factors and antimicrobial resistance traits. The breached skin barrier is the hallmark of thermal injury. Although burn wound surfaces are sterile, immediately following thermal injury, these wounds eventually become colonized with microorganisms. Significant thermal injuries induce a state of immunosuppression that predisposes burn patients to infectious complications like blood stream infections and pneumonia. Gram-positive bacteria that survive the thermal insult, such as Staphylococci located deep within sweat glands and hair follicles, heavily colonize the wound surface.[26]

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 threating illness, secondly, in burn wound, because of the mixed infection, the potential virulence of one organism may affect another organism growing alongside. 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 reduce 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.[27]

Burn units should routinely determine and track the specific pattern of burn wound microbial colonization, time-related changes in the predominant microbial flora of the burn wound in individual patients and the antimicrobial susceptibility profiles of microorganisms implicated in burn wound infections in a given time. The infection control program for burn centers requires strict compliance with a number of environmental control measures that include strictly enforced hand washing and the universal use of personal protective equipment (i.e., gowns, gloves, and masks).

CONCLUSION

It is quite clear that infections are serious problem among burns patients. To keep a check on burn wound infections it is important for every hospital to have a data on prevalent organisms and their antibiotic susceptibility pattern. Such studies will help to assess the burden of infections at the centre and antimicrobial susceptibility testing will help to formulate antibiotic policy for better management of these patients.

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