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Microbiology

BACTERIOLOGICAL PROFILE AND ANTIMICROBIAL SUSCEPTIBILITY PATTERN OF BURN WOUND ISOLATES: A STUDY FROM TERTIARY CARE CENTRE OF THE SUB-HIMALAYAN REGION OF INDIA.

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ABSTRACT

Background: Burn injuries to the skin and other tissues are caused by heat, radiation, electricity, friction, or contact with chemicals, leading to loss of skin integrity and dysbiosis of the immune system. This makes the burn wound the most common site for the origin of sepsis in these patients. Therefore, it is important to determine the causative organism and its antimicrobial susceptibility pattern. **Material and Method:** This study is a retrospective analysis of the bacteriological profile and antimicrobial susceptibility of the organisms isolated from burn wounds over a period of 3 years i.e. from January 2020 to December 2022. All samples were processed as per standard Microbiological guidelines. Antimicrobial susceptibility was done by the Kirby Bauer disk diffusion method as per CLSI guidelines. **Results:** Out of 66 samples received, bacterial culture positivity was 61(92.42%). Male to female ratio was 1.4:1. Gram-negative bacteria were more predominant 90(93.75%), than Gram-positive bacteria 6(6.25%). Among gram-negative bacteria maximum susceptibility was seen to Imipenem (72.2%) followed by Gentamicin (57.7%) and the least susceptibility was seen for Ceftazidime (31.1%). Among gram-positive isolates maximum susceptibility was seen to Vancomycin (100%) followed by Clindamycin (83.4%) and the least susceptibility was seen for Penicillin (16.7%). **Discussion & Conclusion:** This study highlights drug resistance patterns in burn wound patients in this region of North India. This pattern will be instrumental in the formation of hospital antibiotic policy and the initiation of appropriate empirical therapy for better outcomes of burn patients.

KEYWORDS : CLSI-Clinical laboratory standard institute, MSSA-Methicillin sensitive Staphylococcus aureus, MRSA-Methicillin resistant Staphylococcus aureus.

INTRODUCTION

Burn injuries to the skin and other tissue caused by Heat, Electricity, Friction or contact with chemicals[1] Human skin is the largest anatomical organ of our body which meets the environment most directly. The skin protects us from microbes and the elements, helps regulate body temperature and permits the sensations of touch, heat, and cold. Conditions leading to loss of skin integrity, particularly burns cause serious complications. [2]

Burn is an immense immunocompromised state leading to disruption of the epidermal barrier and down-regulation of both local and systemic immune response which increases the susceptibility of burn patients to infections and may lead to sepsis.[3] Many factors also lead to infections in burn patients, such as exposed body surfaces, invasive procedures carried out in the health care facility, and prolonged hospital stays. Factors related to a patient, such as age, total body surface area (TBSA), depth of burn wound, and factors related to microbiological organisms, such as type and number, enzyme/toxin production, and motility of organisms, both determine invasive infection. [4-6]

The burn wound has three characteristic areas. The first one is the zone of coagulation nearest to the source of heat which forms an eschar. Adjacent to this area is the zone of stasis which is at increased risk for ischemia due to loss of perfusion. The outermost zone, the zone of hyperaemia, consists of relatively normal skin with increased blood flow and vasodilation and minimal area of cellular injury. The most important is the area containing moist protein-rich eschar, which supports microbial growth due to its avascular nature and hinders the delivery of immune cells and antibiotics [7]

Initially, the burnt area is considered free of microbial contamination. But microorganisms in the depth of sweat glands and hair follicles heavily colonize the wounds within 48 hours of injury. These are derived from the patient's gastrointestinal and upper respiratory tract and the hospital environment. Following colonization, these organisms start penetrating the viable tissue depending on their invasive capacity, local wound factors and the degree of the patient's immunosuppression. If sub-eschar tissue is invaded disseminated infection is likely to occur.[8]

Infection in the burn patient is an important cause of morbidity and mortality and presents a challenge for the burn team. It has been estimated that 75% of mortality following burn injury is related to infection rather than osmotic shock and hypovolemia.[9] Therefore knowledge of the bacterial flora of the burn wound, its prevalence, resistance or susceptibility pattern is vital to plan effective strategies for reducing morbidity and mortality due to burn wound infections.

MATERIAL AND METHOD

This study is a retrospective analysis of isolates from the burn unit performed at the Department of Microbiology at Dr. R.P. Govt. Medical College Kangra at Tanda over a period of three years i.e. from January 2020 to December 2022. Aseptically collected wound swabs from burn patients were received in the laboratory and inoculated on 5% Blood agar plates and MacConkey agar plates and incubated aerobically at 37°C for 24 hours. Culture plates with bacterial growth were considered for gram staining and identification is carried out by biochemical reactions. [10]

Antimicrobial susceptibility testing was done according to the standard operational procedures, in vitro antimicrobial susceptibility testing was done on Mueller-Hinton agar (Hi-Media Lab Ltd, India) using the Kirby-Bauer disc diffusion method. The test organisms were suspended in sterile normal saline and turbidity was adjusted to 0.5 McFarland standards. The test organism was uniformly seeded over the surface of Mueller Hinton agar plates. The plates were allowed to dry for 15 minutes before the application of antibiotic discs. The plates were incubated at 37°C for 16-18 hours. After incubation, clear zones around the antibiotic discs were measured with a ruler and recorded in millimeters. Susceptibility and resistance data were interpreted according to Clinical Laboratory Standards Institute guidelines and antimicrobial susceptibility was performed according to CLSI guidelines.[11]

RESULT

A total of 66 samples were received, out of these 61(92%) samples showed microbial growth and 5(8%) samples were sterile. Out of these samples 39(59%) were male and 27(41%) were females. Male to female ratio was 1.4:1

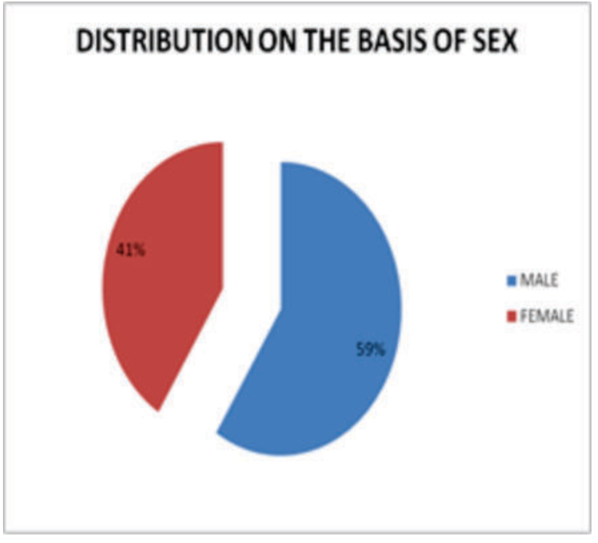

Fig. 1: Distribution On The Basis Of Sex

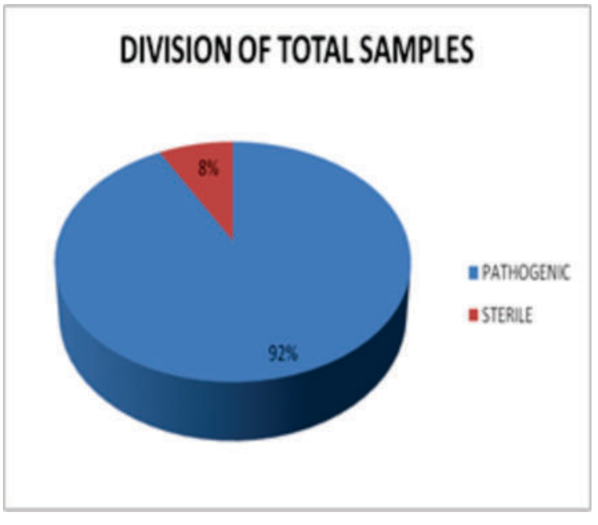

Fig. 2: Division Of Total Samples

Bacterial isolates were further classified on the basis of gram staining as gram-negative bacteria 90(94%)and gram-positive bacteria 6(6%).

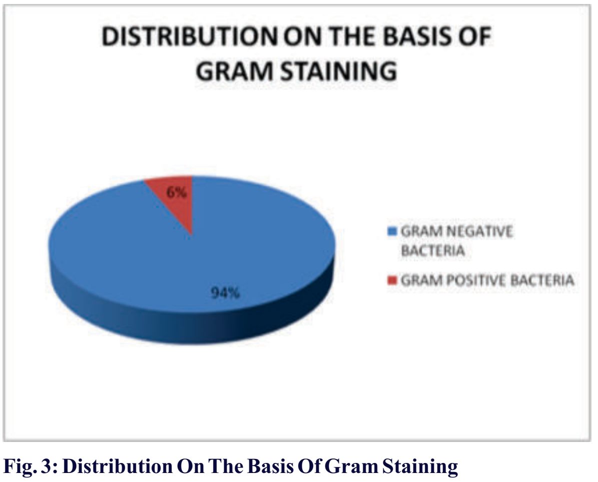

Fig. 3: Distribution On The Basis Of Gram Staining

In Gram-negative bacterial isolates, Pseudomonas aeruginosa 33(34.30%)was the most common isolate followed by Acinetobacter baumannii 23(24%), Klebsiella pneumoniae 16(17%), and least were Enterobacter spp. 4 (4.4%).

And in Gram-positive bacterial isolates Staphylococcus aureus 6(6.20%) were the most common isolates which were further divided into Methicillin-sensitive Staphylococcus aureus 4(66.6%) and Methicillin-resistant Staphylococcus aureus (33.3%).

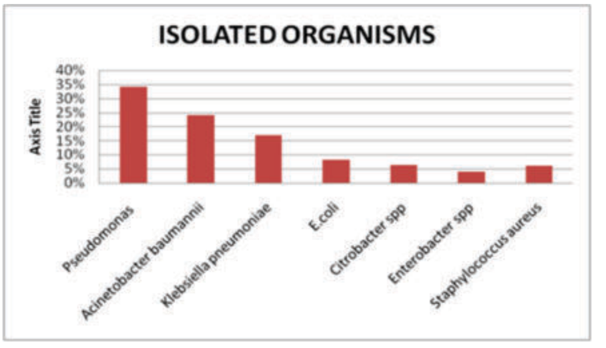

Fig. 4: Isolated Organisms

Among gram negative bacteria maximum susceptibility was seen to Imipenem (72.2%) followed by Gentamicin (57.7%) and the least susceptibility was seen for Ceftazidime (31.1%).

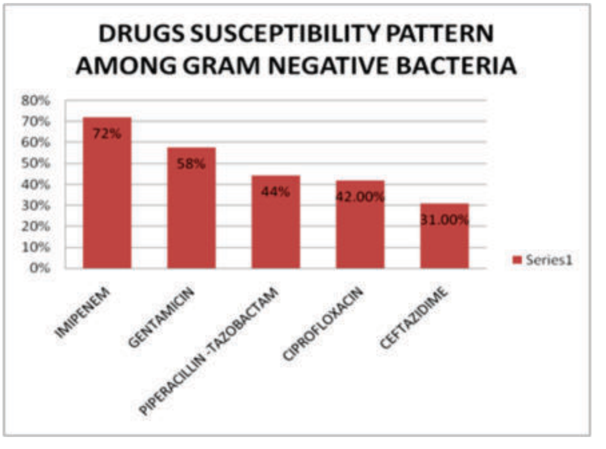

Fig. 5: Drugs Susceptibility Pattern Among Gram Negative Bacteria

Among gram positive isolates maximum susceptibility was seen to Vancomycin (100%) followed by Clindamycin (83.4%) and the least susceptibility was seen for Penicillin (16.7%).

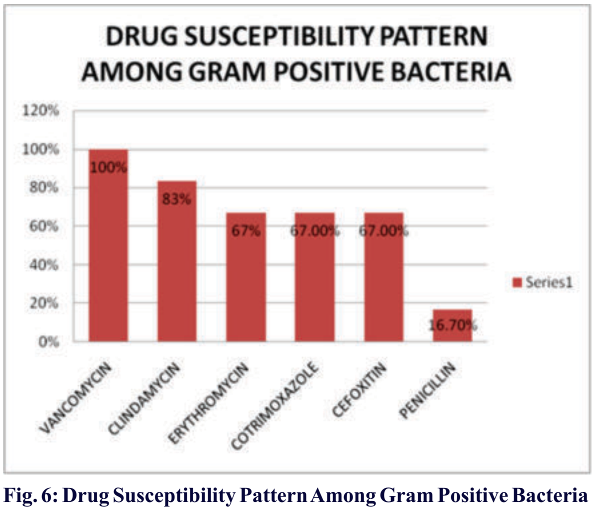

Fig. 6: Drug Susceptibility Pattern Among Gram Positive Bacteria

DISCUSSION

In our study, more males (55%) were predominant than females(45%)

.This is in accordance with the study conducted in the burn unit of a tertiary care hospital by Chaudhary N A et al. where 55% were males, while 45% were females. The reason for this can be that males are exposed to occupational hazards and are thus at a greater risk of encountering burn injuries than females.[12]

In our study out of 66 samples, 61(92%) samples showed bacterial growth, out of these positive samples the majority of the isolates were gram-negative bacterial isolates, than the gram-positive bacteria. A similar result was seen in the study by Shankar Srinivasan et al, in their study.[8]

In gram-negative isolates, P. aeruginosa was the most common pathogen isolated from burn injuries. This was inconsistent with many studies [13-15], including studies conducted by Mehta et al. and Laham et al. [16-17]. In contrast, another study by Hegde et al. showed that Acinetobacter was the most common organism infecting burn wounds [18], whereas S. aureus was the most common organism according to other studies by Altoparlak et al. and Erol et al.[19-20]

In gram-positive isolates the majority were Staphylococcus aureus. Similar results have been seen in another study by Muhammad Saaiq et al.[9] In our study, the majority of gram-positive bacterial isolates were completely sensitive to vancomycin. This is similar to the study by Saaiq et al and Chaudhary N A et al. [9,12]

Among gram-negative bacteria maximum susceptibility was seen to Imipenem (72.2%) followed by Gentamicin (57.7%) and the least susceptibility was seen for Ceftazidime (31.1%).

CONCLUSION

We have concluded that the composition of bacterial flora in burns is dependent not only on the depth and extent of the burn but also on the site of the burn, the duration of the burn, the age of the patient and his/her co-morbidities. Pseudomonas aeruginosa and Acinetobacter baumannii were the majority in our study causing Burn wound infections. The increasing antibiotic resistance of Pseudomonas aeruginosa against the known antibiotic demands rigorous infection control, discouraging overuse and misuse of antibiotics. Also , an antibiotic policy should be formulated in the hospital. Depending on the antibiotic sensitivity pattern of the isolates, antibiotics should be used to avoid the dangers of indiscriminate use of antibiotics.

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