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ORIGINAL ARTICLE

Recent trends in antibiotic sensitivity and resistance patterns in infected wounds of burns patients presented to a tertiary care hospital.

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ABSTRACT… Objective: To study the recent trends and patterns of antibiotic sensitivity and resistance in infected wounds of burns patients. **Study Design:** Cross sectional study. **Setting:** Burns and Plastic Surgery Canter, Peshawar, Pakistan. **Period:** July 30th to January 30th, 2023. **Methods:** In this cross sectional study we adopted convenience sampling technique. A total of 75 samples collected from patients fitted to our infected patients criteria and culture and sensitivity tests were performed using standard microbiological techniques. **Results:** Among the positive infected wound samples, Klebsiella Species were found in 23 (30.7%), Pseudomonas Aeruginosa in 16 (21.3%), Acinetobacter Species in 14(18.7%), Proteus Species in 8(10.7%), Citrobacter species in 5(6.6%), Staph. Aureus in 5(6.6%), Enterobacter species in 3(4%) and E.coli in 1(1.4%) of the positive cultures. Each pathogen showed varying degree of sensitivity and resistance patterns to different antibiotics tested. **Conclusion:** Klebsiella Species was the most common pathogen in patients with infected burns wounds. Meropenem, imipenem, Doripenem, Piperacillin/Tazobactum, Colistin, and Tigecyclin were found to be effective against the majority of the bacteria. Conversely, most of the bacterial strains exhibited resistance to commonly prescribed antibiotics such as co-amoxiclave, ampicillin, ceftriaxone, ciprofloxacin, cefotaxime and co-trimoxazole.

Key words: Antibiotic Sensitivity, Burns Infection, Pathogens, Resistance Patterns.

INTRODUCTION

Burn injury is a type of which is often overlooked, it potentially impact individuals of any demographic, occurs unexpectedly in any setting. Burns can be caused by flames, hot liquids, friction, cold, exposure to radiation, certain chemicals or electric sources, but major cause of burns is by thermal injury from hot fluids, solids or directly from fire.[1] Burn injury produces a massive release of the humoral factors in human body, which includes different types of cytokines, prostaglandins, leukotrienes, and other vasoactive substances.[2] This release of different types of factors at burn injury sites causes accumulation of these factors in systemic circulation leading to immunosuppression. All components related to immune system are directly or indirectly involved in this immunosuppression. End result of immunosuppression is decrease in chemotaxis of neutrophils along with decrease in phagocytic and bactericidal activity of white blood cells.[3] Burn injury causes decrease in phagocytic activity and leads to decline in lymphokine production by macrophages. Microbial colonization is caused by disruption of the natural cutaneous barrier to infection, loss of vascularity, coagulated proteins and other microbial nutrients at the burn wound site. Colonization may be followed by invasion of microorganisms in some patients, leading to burn wound infection. After initial treatment and effective management of fluid and electrolytes abnormalities in burn victim patient, the main cause of mortality is infection and septicaemia.[4] That's why effective strategies for prevention and management of burn wound infections are very necessary for the patient's survival with burn wounds. Many studies done regarding burns patients strongly suggest correlation of wound infection to mortality.[5]

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The possibility of burn wound infection by certain antibiotic-resistant bacteria like Pseudomonas aeruginosa, Klebsiella and Acinetobacter should be acknowledged as a potential hazard for burn patients, and it necessitate the identification of their sensitivity patterns. Additionally, it is very crucial to characterize presence of the hospital-acquired microorganisms and multi-drug resistant strains (MDRs) within burn units.[6]

The antibacterial susceptibility profiles of pathogens isolated from hospitalized patients with wound infections are constantly changing and adapting over the time.[7] identifying the sensitivity patterns of bacteria to antibiotics may help treating surgeons to use appropriate antibiotics and thus improve in survival and decrease in morbidity and mortality. In cases where a suitable alternative antibiotic is not available it can pose a life-threatening risk for some individuals.[8]

Wound infections in burns patients may be life-threatening if infection is not diagnosed and treated properly. This study is conducted to determine the microbial profile of infected wounds in burn patients, recent trends in antibiotic sensitivity and resistance patterns of the cultured microbes. It will help treating surgeons in formulation of effective treatment strategies to cope with infections in burns patients.

METHODS

This cross-sectional research was undertaken at Burns and Plastic Surgery Centre Peshawar, from July 30th to January 30th, 2023. In this study we included patients of both gender and all ages admitted with deep burns and undergone wound debridement/excisions, and skin grafting. All the patients with negative culture reports were excluded from the study. Patient was assessed initially by taking complete history, examining the patient physically and by performing certain necessary investigations. Initial resuscitation and optimization of patients was done on standard management outlines.

Presence of wound infection was decided by the presence of one or more of the signs of inflammation at the surrounding uninjured skin, such as oedema, erythema, warmth, or tenderness; and presence of one or more systemic signs of infection, such as hypothermia, tachypnea, hypotension, oliguria, hyperthermia (temperature, 138.4 C) , hyperglycaemia or leucocytosis (WBC count, 110,000 cells/mm3).[9]

Convenience sampling technique was adopted for culture and sensitivity and all the specimens were collected at the time of dressing of burn wounds. After approval from the hospital ethical review board, ethical committee letter No: 04/REB/B&PSC/23, specimens for culture and sensitivity were collected by accomplishment of standard samples collection techniques and analysis was done at microbiological laboratory for culture and sensitivity. After inoculation on the appropriate culture media, all the specimens were incubated at 37□C for 24 hours to obtain growth of aerobic and anaerobic organisms. Antibiotic susceptibility was determined by employing disc diffusion method with use of standard antibiotic discs. The data were analysed through Statistical package for social sciences software, SPSS version 20. Different descriptive statistics were used to calculate frequencies, percentages, and means for the causative organisms and pathogen sensitivity and resistance patterns.

RESULTS

The study included 75 samples, 64 % (n=48) patients were male and 36% (n=27) were female. The mean patient age was 30.44 and ranged from 7 year to 72 year. Among total 75 patients with infected wounds, 23 tested positive for Klebsiella Species making 30 % of the total cases. 16 samples reported Pseudomonas Species which were 21.3 % of the total samples. Acinetobacter were 14 (18.7%), Proteus were 8(10.7%), Citrobacter were 5(6.6%), Staphylococcus Aureus were 5 (6.6%) out of which 3 (4 % of total samples) were methicillin resistant. Enterobacter was reported in 3 cases (4%) and E.coli in 1 patient (1.4%). The number and percentages are shown below in Table-I. While the culture sensitivity to antibiotics is shown in Table-II.

Pathogens	Frequency (n)	Percentage (%)
Klebsiella Species	23	30.7
Pseudomonas Aeruginosa	16	21.3
Acinetobacter Species	14	18.7
Proteus Species	8	10.7
Citrobacter Species	5	6.6
Methicillin Resistant Staphlococcus Aureus(MRSA)	3	4
Enterobacter Species	3	4
Methicillin Sensitive Staphylococcus Aureus(MSSA)	2	2.6
Escherichia Coli	1	1.4
Total	75	100.0

Table-I. Results of culture report:

DISCUSSION

Due to loss of skin barrier and decrease in tissue vasculature in burn wound, susceptibility to infections increases to many folds. Size and depth of wound also increases chances and severity of infection, Moreover pathogen involved also increases frequency and severity of infection in burn wounds.[10,11]

In our study Klebsiella species were found in 23 (30.7%), Pseudomonas aeruginosa in 16 (21.3%), Acinetobacter Species in 14(18.7%), Proteus species in 8(10.7%), Citroacter species in 5(6.6%), Staph. Aureus in 5(6.6%), Enterobacter species in 3(4%) and E.coli in 1(1.4%) of the positive cultures, thus most common pathogen involved in wound infection was Klebsiella Species, this finding vary from different studies done at other study papulation where Pseudomonas Aeruginosa was the most common pathogen found in infection of burn wounds.[12,13,14,15] However in conforming to our study, some previously done studies also shows Klebsiella as the commonest pathogen causing infection in burns wounds.[16,17]

Antibiotics Tested	Klebsiella Species(n=23)	Pseudomonas Species(n=16)	Acinetobacter species(n=14)	Proteus species (n=8)	Citrobacter species (n=5)	Enterobacter species (n=3)	MRSA (n=3)	MSSA (n=2)	E.coli (n=1)
Meropenem	65.2%	50%	57.1%	87.5%	60%	100%	-	-	100%
Colistin	70%	93.8%	28.6%	0%	20%	100%	-	-	100%
Polymyxin-B	65.2%	87.5%	28.6%	0%	20%	100%	-	-	100%
Pipercillin / Tazobactum	43.5%	31.2%	71.4%	50%	40%	33.3%	0%	100%	100%
Cefoperazone / sulbactum	26%	31.2%	21.4%	37.5%	20%	0%	0%	100%	100%
Ceftazedime	8.7%	25%	35.7%	12.5%	0%	0%	-	-	100%
Gentamycin	13%	31.2%	14.2%	755	20%	0%	0%	50%	0%
Co-trimoxazole	8.7%	-	21.4%	12.5%	0%	0%	0%	0%	100%
Ampicillin	0%	-	0%	-	0%	0%	0%	0%	0%
Ciprofloxacin	34.8%	31.2%	35.7%	5%0	0%	0%	0%	-	100%
Tobramycin	17.4%	31.2%	7.1%	25%	0%	05	-	-	0%
Amoxicillin / clavulanic acid	0%	-	0%	25%	0%	-	0%	0%	-
Cefotaxime	4.3%	-	0%	0%	0%	0%	0%	0%	0%
Imipenem	39.1%	43.8%	71.4%	75%	40%	66.6%	0%	100%	100%
Tigecycline	74%	-	78.6%	0%	40%	66.6%	100%	100%	100%
Amikacin	30.43%	37.5%	28.6%	50%	40%	0%	0%	100%	100%
Ceftriaxone	4.3%	-	7.1%	0%	0%	0%	-	-	0%
Tetracyclin	13%	-	28.6%	0%	0%	0%	33.3%	50%	0%
Doripenem	56.5%	43.8%	71.4%	87.5%	60%	66.6%	-	-	100%
Ticarcillin	_	18.8%	-	-	-	-	-	-	-
Levofloxacin	_	25%	-	-	-	-	-	-	-
Linezolid	_	-	-	-	-	-	100%	100%	-
Vancomycin	_	-	-	-	-	-	100%	100%	-
Oxacillin	_	-	-	-	-	-	0%	100%	-

Table-*II*. Antibiotics sensitivity patterns shown in the form of percentage of pathogens sensitive to tested antibiotic:

In a study previously done by saaiq et. al the isolates were Pseudomonas aeruginosa, Klebsiella pneumoniae, Staphylococcus aureus, Proteus, E. Coli, Acinetobacter and Candida, moreover most of (70 % to 80%) Klebsiella, Pseudomonas and Protues species were sensitive to Piperacillin/ Tazobactum.[18] These same pathogens except candida were also isolated in our study samples but our studies shows decrease sensitivity (31.2 % to 50 %) of Pseudomonas, Klebsiella and Proteus to Piperacillin/Tazobactum and these pathogens shows maximum sensitivity (50% to 87.5 %) to Meropenem in our study.

After Meropenem, Colistin and Polymyxin-B were the two antibiotics that were most effective against most of isolates excluding Proteus species. Both Colistin and Polymixin-B were very effective against the two most commonly involved pathogens Klebsiella and Pseudomonas. Keeping in mind Pseudomonas Aeruginosa sensitivity (87.5%) to Polymyxin-B and its availability in topical form, Polymyxin-B can be used as drug of choice in Pseudomonas infected burn cases.

There is decrease in percentage of staph aureus infection in burn wound in our study as compare to previously done studies.[18,19,20] This seems to be because of use of broad spectrum empirical antibiotics covering mostly gram positive organisms moreover antibiotics like Linezolid, Vancomycin and Fucidic Acid are being effectively used to treat methicillin resistant Staph. Aureus thus decreasing its incidence as well as spread from patient to patient.

The research was conducted at a single center, potentially limiting the generalizability of the results. Nonetheless, the cross-sectional approach employed in the study provides a momentary snapshot that could unveil trends and patterns.

CONCLUSION

Klebsiella species was the most common pathogen in patients with infected burns wounds followed by Pseudomonas aeruginosa, Acinetobacter Species, Proteus species, Citrobacter species, Staph. Aureus, Enterobacter species and E.coli. Meropenem, Imipenem, Doripenem, Piperacillin/ tazobactum, Colistin, Polymyxin-B and Tigecyclin were found to be effective against the majority of the bacteria. Conversely, most of the bacterial strains exhibited resistance to commonly prescribed antibiotics such as co-amoxiclave, ampicillin, ceftriaxone, ciprofloxacin, cefotaxime and co-trimoxazole. All the antibiotics showed varying patterns of sensitivity and resistance. Therefore, it is highly recommended to diagnose burn wound infection early, identify the bacteria causing this infection and find effective antibiotic treatment which may prove life saving for the burn victims.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

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2	Qazi Amjad Ali	Data collection, Complication result, correspondence.	
3	Hamid Salman	Data collection & complication of result.	
4	Junaid Ul Hassan	Data collection & Data reivew.	
5	Walid Khan	Data analysis.	