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CHARACTERISATION OF CARBAPENEM RESISTANT GRAM NEGATIVE MICROBES IN A BURN UNIT OF TERTIARY HEALTH CARE CENTRE

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ABSTRACT

Back ground: Burn wounds are major challenge for clinicians in a burn unit, because these are responsible for more than 50% nosocomial infection and fatality in burn patients. Recently a change in prevalent microbial flora has been noticed in burn patients and therefore this study has been done to know the prevalent micro organism and multi drug resistance in burn ward. Aims and objective: To know the changing bacterial profile and multi drug resistance in burn patiens. Material and Methods: This study was conducted on 1074 pus swabs from burn patients received in laboratory during a period of one year from Jan to Dec 2013. The micro organisms were identified as per standard protocol and their antibiotic susceptibility was performed as per CLSI guidelines. Study design: This was a retrospective study done in department of Microbiology of Pt. B.D.Sharma PGIMS, Rohtak. Results: Infection rate of 88.4% was found in burn unit with an increase in isolation rate of Klebsiella spp.and Acinetobacter spp. However Pseudomonas spp. was most common followed by Staphylococcus aureus. In parallel an increase prevalence of multi drug resistant strains was noticed. Conclusion: As these nosocomial strains can be source for infection outbreaks in other units as well, therefore strict hand hygiene practices is required among hospital staff members to inhibit the cross transmission of microbes.

KEYWORDS: Burns, carbapenem, multi drug resistance, Pseudomonas spp.

INTRODUCTION

Hospital-acquired infections in burn patients are a cause of morbidity, and death.[1] The rate of infection is higher among burn patients due to immunocompromised state and prolonged

stay in hospital, secondly cross infection also further aggravate the situation, these bacterial infections are difficult to control and can lead to sepsis having mortality in 75% cases.[2]

Burn patients are ideal hosts for opportunistic infections.[3] Use of invasive devices for surgery and antimicrobial agents lead to selective drug pressure, facilitates colonization, transmission and resistance of infective microbes.[4]

The burn site remains relatively sterile during the first 24 hour; thereafter, colonization of the wound by gram negative bacteria is common.[2] Pseudomonas aeruginosa is most common organism in burn patients followed by Staphylococcus aureus, Klebsiella etc.[5]

Infections in burns patients are caused by multiple organisms having multiple drug resistance, which can act as a risk factor for further dissemination of these multi drugresistant (MDR) strains in hospital due to the presence of the drug resistance gene on plasmid.

Based on National Nosocomial Infection Surveillance System (NNIS) criteria, all the burn patients are required to follow the distribution of bacterial species among burn isolates, and the antimicrobial susceptibility of the pathogens in order to adapt empirical antibiotic strategies.[6]

In burns sepsis can lead to mortality in 75% cases, which can be managed appreciably with medical aseptic precautions and tools. The present study was done to know the wound infection rate, the identification of isolates and the presence of multi drug resistance in burn patients.

MATERIAL AND METHODS

This retrospective study was conducted on the pus or swab samples from burn patients, during a period of one year from January – December 2013. All the patients admitted in the Burns care Unit of the hospital with total burns surface area more than 20%, irrespective of the age and gender differences were included in the study. The burn wound infections were diagnosed by quantitative cultures, in presence of pathognomic clinical appearance of the wound and pus. Samples were processed immediately and were cultured on blood agar and Mac Conkey agar, incubated at 37ºC for 18-24 hours. Their identification was done on colony morphology and biochemical properties as per standard protocols.[7] Antibiotic susceptibility testing was done by Kirby bauer disc diffusion method according to Clinical laboratory Standard Institute guidelines.[8]

Following antibiotic discs were used.

Ofloxacin (5 µg), amikacin (30 µg), ceftazidime (30µg), ceftizoxime (30µg), netilmicin (300µg), meropenem (10µg), imepenem (10µg), doxycycline (30 µg), cotrimoxazole (25µg), amoxyclavulanic acid (), piperacillin+tazobatam () ATCC Escherichia coli 252922 and Staphylococcus aureus ATCC 25923 and Pseudomonas aeruginosa ATCC 27853 were used as controls.

RESULTS

Out of total 1074 pus samples received from burn and plastic surgery, 950 samples were positive for bacterial growth, 119 samples were sterile and five samples were contaminated. (Table 1)

Among these organisms, P. aeruginosa was commonest 238(25%) isolate, followed by S.aureus 202(21%) and Escherichia coli 181(19%). (Table 2)

Among gram negative organisms, Klebsiella spp. (91.5%) was found to be the most common multi drug resistant organism followed by Citrobacter spp. (89%) and E.coli (79.5%). Over all the antimicrobial carbapenem was most effective agent followed by piperacllin +tazobactam and fluroquinolones. (Table 3,4)

S. aureus was one of the most common causative infection organism in burns followed by coagulase negative staphylococcus and Enterococcus spp. and these isolates were effectively treatable by Linezolid followed by amoxyclavulanic acid. Out of these 85.2% isolates were methicillin resistant Staphylococcus aureus. (Table 5)

Table 1: Distribution of total samples

Total samples	No. of isolates
Samples from Burn and Plastic surgery	1074
Total positive samples	950(88.4%)
Total sterile	119
Contaminated samples	5

Table 2: Distribution of different organisms in infected burn wound

Organism	No. of isolates (%)
Pseudomonas aeruginosa	238(25%)
Staphylococcus aureus	202(21%)
Escherichia coli	181(19%)
Enterobacter spp.	91(9.6%)
Klebsiella spp.	59(6.2%)

Citrobacter spp.	36(3.8%)
Acinetobacter spp.	60(6.3%)
Enterococcus spp	16(1.7%)
Coagulase negative Staphylococcus	45(4.7%)
Proteus spp.	22(2.3%)
Total	**950**

Table 3: Antibiotic susceptibility pattern of Gram negative isolates

Organism	Ofloxacin	Amikacin	Ceftzidime	Ceftizoxime	Neti	Mr	Ime	Cot	Do	Ac	Pit
Pseudomonas aeruginosa	10%	42.4%	3.2%	5.1%	13%	33.7 %	96.4 %	-	-	-	60.64 %
Escherichia coli	59%	16.6%	-	-	-	80%	87%	31.5	4.5 %	-	40.1 %
Enterobacter spp.	46.7%	11.23%	-	-	-	80%		20.7 %	4.2 %	2.7 %	42.5 %
Acinetbacter spp.	Cp=31.6 %	25.4%	6%	-	-	76.3 %	48.33 %	9.3%	58. 3%	10 %	58.3 %
Klebsiella spp.	-	8.4%	1.7%	-	-	67.8 %	81.5 %	23.7 %	0	3.4 %	29.8 %
Citrobacter spp.	Cp=57%	5.5%	4.3%	-	-	71.4 %	56%	14.3 %	57 %	9.1 %	50%
Proteus spp.	Cp=77.3 %	4.5%	11.11%	-	-	57%	**78.6 %**	21%	-	11. 7%	91%

Table 4: Prevalence of MDR in Gram negative isolates

Organism	MDR	PDR
Pseudomonas spp.(238)	76%(182)	5.8%(14)
Escherichia coli(181)	79.5%(144)	0.5%(1)
Klebsiella spp.(59)	91.5%(54)	1.7%(1)
Enterobacter spp.(91)	78%(71)	3.2%(3)
Citrobacter spp.(36)	89%(32)	-
Proteus ssp.(22)	91%(20)	-
Acinetobacter spp.(60)	88%(53)	-

Table 5: Antibiotic susceptibility pattern of Gram positive isolates

Organism	Cf	E	Do	Lz	Cx	Ac	Cdr	Va	G
Staphylococcus aureus	-	21.3%	14%	97%	14.8%	67%	17.6%	-	-
CONS	6.6%	22.2%	8.5%	96%	11.1%	82.6%	7.4%	-	-

DISCUSSION

Control of nosocomial infection has a major role in health care and regular surveillance is often needed to keep a check on the frequency and spreading of the multi drug resistant

hospital strain. Surgical site infections are a problem in all fields of surgery.[9] The situation becomes more complex, when the burn wound get infected with multi drug resistant hospital strain.

In the present study the infection rate in burn unit was 88.4%, which was inconcordance with other studies which reported the infection rate of 84.9%, 80.6%,94%.[10,11,12] A study has also reported a lower rate(10%) of infection, which attributed to precise and aseptic application of advanced surgical techniques and instruments in procedures.[13]

This study demonstrated Pseudomonas aeruginosa and E.coli (44%) accounts for majority of isolates followed by S.aureus (21%) from burn exudates. An increase in the isolation of Klebsiella spp. and Acinetobacter spp. was noticed incomparison to previous studies.[14] Similar results were reported in other studies.[15,16]

The change in the pattern of bacterial resistance of nosocomial infections is important both clinically and epidemiologically. In this study, a high percentage of drug resistance was observed among gram negative isolates to third generation cephalosporin, aminoglycosides, flouroquinolones. Many previous studies has shown similar outcomes. There was a high rate of prevalence of multidrug resistant in Enterobacteriacae and non fermenters. Among Enterobacteriacae Klebsiella spp. and Proteus spp. were most common MDR isolates (91%).

Acinetobacter species are emerging as an important cause of nosocomial infection in burn units and an increase in the MDR Acinetobacter spp. was documented (88%) in the present study, which was more than Pseudomonas spp. (79%). Similar results has reported in previous studies.[1,2] There are a number of factors which may contribute to this increase like its presence as a normal skin commensal and its easy spread due to multi drug resistance in a hospital setting.[17] In the same , a group of gram negative isolates was observed which was found to be resistant to all available treatment options and were named as Pan drug resistant (PDR). The ratio of PDR was most common in Pseudomonas ssp. followed by Enterobacter spp.

However, imipenem and combination drugs like piperacillin +tazobacam were found to be effective. This could be due to the reason that these are reserve drugs and used as last available options for treatment of multi drug resistant bacteria.

Among gram positive cocci, a significant high resistance was seen to cephalosporins, doxycycline, erythromycin. Here 85.2% isolates were Methcillin resistant Staphylcoccus aureus, However, new drugs like linezolid and vancomycin were found to be very effective for therapeutics of the micro flora.

CONCLUSION

Such high antimicrobial resistance even to the high end antimicrobial is probably promoted due to selective pressure exerted on bacteria due to non adherence to hospital antibiotic policy. These multi drug resistant and pan drug resistant strains establish themselves in the hospital environment in areas like in toilets, mattresses and are transmissible from one patient to another. This highlights the need for strengthening the infection control practices and regular surveillance activities to control the evolution of resistant microbes. Strict enforcement of infection control practices and antimicrobial rotation programmes can go a long way in reducing the burden of multi-drug resistant organisms.

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