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Antibacterial resistance pattern of aerobic bacteria isolates from burn patients in tertiary care hospital

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Abstract

The antibacterial resistant pattern of aerobic bacteria, isolate from burn patients admitted in plastic surgery & general surgery wards of Chhatrapati Shahuji Maharaj Medical University, Lucknow (a tertiary care hospital) were studied.

100 patients were enrolled from plastic surgery & general surgery wards and 200 samples were collected which comprised of 100 burn wound swabs & 100 biopsies of same patients. All samples were cultured on Nutrient agar, Mac conkey agar and Blood agar at 37ºc for 24 hrs. The isolates were identified by culture, staining and biochemical tests including oxidase, lactose and maltose fermentation, catalase and their antibiotic sensitivity determined using Kirby Bauer disc diffusion technique.

The most common isolate was *Pseudomonas aeruginosa*-55.0%, followed by *Staphylococcus aureus*-19.29%, *Klebsiella spp*.-11.43%, *Acinetobacter spps*-7.14%. *Proteus spp* 4.29%, *Escherichia coli*-2.85%. Resistance of *S.aureus* was 40% observed with Oxacillin & 84% to Erythromycin whereas all strains were susceptible to Vancomycin. We analyzed that *pesudomonas* which was the commonest isolate was most resistant to Ceftazidime (70%) followed by Cefotaxime. Ciprofloxacin (55.5%) & Amikacin (54.0%) were found to be most effective antimicrobial agent (7, 11). Other Gram-negative organisms were highly resistant to Cefotaxime (66.0%) followed by Gentamycin (60.0%).). Imipenem was found to be less resistant (26%) against *Pseudomonas*.

Introduction

Burns provide a suitable site for bacterial multiplication and are more persistent richer sources of infection than surgical wounds, mainly because of the larger area involved and longer duration of patient stay in the hospital [1]. Infection is a major cause of morbidity and mortality in hospitalized burn patients [2]. It is now estimated that about 75% of the mortality following burn injuries is related to infections rather than osmotic shock and hypovolemia [3]. The pattern of infection differs from hospital to hospital; the varied bacterial flora of infected wound may change considerably during the healing period [4].

Despite the advances in patient care and the use of a large number of antimicrobial agents, infections which complicate the clinical course of patients who had sustained severe thermal injures continue to be a major unsolved problem .The present study was an ongoing outbreak of multiple drug resistant pathogens in the burn patients admitted in C.S.M.M.U, Lucknow, India.

Material and Methods

This is a study of 280 isolates from 100 patients (40 males and 60 females) admitted in plastic surgery / general sur-

gery wards of C.S.M.M.U, Lucknow, India, between Dec 2006 to July 2007, a total of 200 samples of burn patients were collected and processed. The clinical samples comprised 100 burn wound swabs & 100 biopsies of same patient. All samples were collected from plastic surgery & general surgery wards and immediately transferred under aseptic conditions to Bacteriology laboratory of the department of Microbiology, C. S. M. Medical University, Lucknow where they were processed.

The patient's age, sex, and aetiology of burn was recorded.

Inclusion criteria- The patients with 50% burn were enrolled in this study.

Patients' age ≥ 20 were included in this study.

Exclusion criteria-The patients who were suffering from Immunocompromise, oncogenic disease were excluded.

Samples were cultured on Nutrient agar, Mac conkey agar, Blood agar at 37ºc for 24 hrs. The isolates were identified by culture, staining and biochemical tests including oxidase, lactose and maltose fermentation, catalase, and their antibiotic sensitivity determined using Kirby Bauery disc diffusion technique. Amikacin (30 µg), Gentamycin (10 µg), Ceftazidime (30 µg), Imipenem (10 µg), vancomycin (30 µg), Erythromycin (5 µg), Ciprofloxacin (5 µg), oxacillin (1µg), were used for antibiotic sensitivity test. Sensitivity result was interpreted according to National Committee of Clinical Laboratory Standard (NCCLS) [5].

Results

In the presents study 100 patients were enrolled from surgery ward of CSMMU. 40 patients were male and 60 patients were females. Multiple isolates were found in 37.5% cases, 4% Samples showed absence of bacterial pathogens. The incidence of Gram-positive cocci (GPC) and Gram-negative organisms (GNB) were 19.29% and 80.71%. The most common isolate was *Pseudomonas aeruginosa (P.aeruginosa)*-55.0%, followed by *Staphylococcus aureus (S.aureus)*-19.29%, *Klebsiella spp*.-11.43*%, Acinetobacter spps*-7.14% *Proteus spp* 4.29%, *Escherichia coli*-2.85%. Different antibiotics were tested against the GNB and GPC. Most of the Gram-negative isolates obtained were found to be multidrug resistant. Resistance of *S.aureus* was 40% observed with Oxacillin & 84% to Erythromycin whereas all strains were susceptible to Vancomycin. 40% isolates of Staphylococci from samples were MRSA (Methicillin resistant *Staphylococcus aureus*). List of antibiotics tested and the relative resistant pattern is presented in Table 2.

Table 1: *Incidence of isolates in burn patients*

No.	Isolates	No. of isolates	Percentage
1	*P.aeruginosa*	154	55.00%
2	*S.aureus*	54	19.29%
3	*Klebsiella spp.*	32	11.43%
4	*Acinetobacter spp.*	20	7.14%
5	*Proteus spp.*	12	4.29%
6	*E.coli*	8	2.85%

P.aeruginosa –Pseudomonas aeruginosa,
S.aureus- staphylococcus aureus, E.coli- Escherichia coli.

Table 2: Antibiotic resistant pattern of isolates

S.No	Isolate	Antibiotics	Percentage
1	***P. .aeruginosa***	Amika	30.5%
		Cefo	66%
		Genta	62.5%
		Cip	37.6%
		Imi	26%
		Cefta	70%
2	**GNB**	Amik	46%
		Cefo	69.5%
		Genta	60%
		Cip	44.5%
3	***S.aureus***	Eryt	84%
		Cip	40%
		Co-tri	80%
		Oxa	40%
		Vanco	0%

Amika= amikacin, Cefo=cefotaxime, Genta=gentamycin, Cip=ciprofloxacin, Imi=imipenem, Cefta= ceftazidime, Eryt=erythromycin,Co-tri=Co-trimoxazole , Oxa= Oxacillin, Vanco=vancomycin, GNB- Gram negative bacilli, GPC- Gram positive cocci

Discussion

The burn wound is considered one of the major health problems in the world, and infection is or frequent and severe of complications in patients who have sustained burns [6]. In our study it is noted that single isolates were present in 62.5% of cases and multiple isolates were noted in 37.5% cases. This is in agreement with other reports [7]. In the present study, very high culture positivity 96% was found in the samples from burn patients. It is similar to other study (1). Our finding that *P. aeruginosa* was the most common isolate coincides with many previ-

ous reports [1,7] but is in contrast to some other studies especially from developed countries which report *S.aureus* as predominant organism. Prevalence of *Pseudomonas spp*. in the burn wards may be due to the fact that organism thrives in a moist environment [8]. The second most common isolate was *S.aureus*, again which is similar to other studies [7]. Result of previous studies, which are also, confirmed it. The present study has shown that *P.aeuginosa* and *S.aureus* are the most common isolates in burn injuries, *Klebsiella spp*. was the third most common isolate, followed by *Acinentobacter spp*.

In the present study no isolate of *β-haemolytic Streptococci* was seen which is in agreement with the previous studies [8,9] but contrary to findings in other study [10]. Antibiotic sensitivity patterns served as a useful guideline for choosing the appropriate antibiotic. When we analyzed the resistant pattern of our isolates we found that *pesudomonas* which was the commonest isolate was highly resistant to Ceftazidime (70%) followed by Cefotaxime. This is in contrast, however, to some other study which report *Pseudomonas* was highly sensitive to Ceftazidime [7]. Imipenem was found to be less resistant (26%) against *Pseudomonas*. Gram-negative organism causing invasive burn wound infection in burn patients. Other Gram-negative Organisms were highly resistant to Cefotaxime (66.0%) followed by Gentamycin (60.0%). Ciprofloxacin (55.5%) & Amikacin (54.0%) were found to be most effective antimicrobial agent for GNB [7,11].

The most active drug against commonly encountered Gram-positive organism (especially *S.aureus*) is Vancomycin (100%). *S.aureus* was highly resistant to Erythromycin (84%) & Co-trimoxazole (80%). This was similar to report elsewhere [12]. The subsequent development and use of broad-spectrum antibiotics effective against *Staphylococcus* led to the emergence of gram negative organisms, particularly *P. aeruginosa*, as the predominant organism causing invasive burn wound infections in burn patients [13]. More isolates were recovered from biopsies than from wound swab keeping with the fact that a wound biopsy is a more representative sample of an infected wound as surface contaminants.

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. Another factor adding to the complication is multidrug resistance (MDR)of the organism. 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 reduction overall infection related morbidity and mortality. The over crowding in burns ward is an important cause of cross-infection and must be avoided in order to control a hospital acquired infection.

Conclusion

It was observed that bacteria, which were isolated from burn patients, were multidrug resistant. Furthermore, *P. aeruginosa* was found to be most common (55%) isolate from burn patients where as *Pseudomonas spp*. was highly resistant to ceftazidime (70%). Vancomycin (100%) was found to be susceptible drug for Gram-positive organisms (*S.aureus, co-agulase negative staphylococcus).*

In conclusion, present observations seem to be helpful in providing useful guidelines for choosing effective therapy against isolates from burn patients.

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