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BURN PATIENTS;
EFFECTIVENESS OF β LACTAM ANTIMICROBIAL DRUGS AGAINST GRAM NEGATIVE BACTERIA

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ABSTRACT... Objectives: To study the micro flora in wounds of the burn patients from three tertiary care medical hospitals in Karachi. **Introduction:** In burn patient infections arise from multiple sources and infect burn wounds by a variety of micro-organisms. Gram negative bacterial infection results from translocation from colon, further more burn patients are infected by Hospital acquired bacteria by various invasive and non invasive procedures. **Period:** July 2002 to December 2002. **Setting:** This study was conducted at the Department of Microbiology, Basic Medical Sciences Institute, Jinnah Postgraduate Medical Centre, Karachi. **Study Design:** Observational study. **Material & Methods:** A retrospective study of fifty five patients with burn wound infection was carried out at burn units of Civil Hospital Karachi, National Institute of Child health Karachi and Abbasi Shaheed Hospital, Karachi. Patients who received burn injuries with clinical signs and symptoms of infection were included in this study. **Results:** In the present study 46(29%) isolates of P. aeruginosa were recovered, in which most strains were MDR and their sensitivity against Imipenem was 38 (78%). The over all prevalence of the Oxidase negative Gram negative coli form bacteria was more than 70%, in which the most prevalent organism belongs to Proteus Spp;(27%) follows the Enterobacter Spp;.(15.5%). **Conclusions:** Bacteria belongs with family Enterobacteriacae were more prevalent i.e. >70% while P. aeruginosa was individually more prevalent than any member of family Enterobacteriacae and was most resistant to multiple antibiotics than any other bacteria. Imipenem was the most effective drug against all gram negative bacteria follows the 4th. generation Cephalosporin Cefepime.

Key words: Burn, wound, infection, sensitivity.

INTRODUCTION

Burn is one of the most common and devastating forms of trauma. Patients with serious thermal injury require immediate specialized care in order to minimize morbidity and mortality. Significant thermal injuries induce a state of Immuno-suppression, which predisposes infectious complications in burn patients[1].

The devitalized tissue and moist burn is favorable for colonization and proliferation of micro-organisms and subsequent infection, therefore the potential risk of burn wound sepsis persists until complete wound healing[2].

In burn patients infections are independently associated with adverse outcome and mortality. These infections arise from multiple sources and infect burn wounds by a variety of micro-organisms, in which Gram positive bacteria rapidly infect the wound , later on Gram negative bacterial infection results from translocation from colon, further more burn patients are infected by Hospital acquired bacteria by various invasive and non invasive procedures[3].

Pseudomonas aeruginosa is highly pathogenic in the injured immunosuppressive patients, thrives on the moist burn wound surfaces and gain to access through cross contamination, and account as most resistant and dangerous pathogen in burn infection. The Gram negative Enteric bacteria cause trouble in different ways, they produce large quantity of pus containing toxins that kill the surviving skin cells and convert partial thickness into full thickness burn as well as absorption of toxins may cause general illness and difficulty in graft taking but most serious situation occurs when these invasive bacteria cause septicemia that could be fatal[2,4-7].

One of the most presenting problem faced by the health care services is the increasing prevalence of antimicrobial resistance. In medical practice there are concerns that some common infections are being increasingly difficult to treat and the illness due to antibiotic resistant bacteria may take longer to resolve[8].

There is need to assess the pattern of bacterial

pathogens responsible for the burn wound infection. Diagnosis can be made from wound swabs[9].

MATERIAL AND METHODS

Aim and Objects: The present study is undertaken. This study will help to access the burden of infections at the centre and antimicrobial susceptibility testing will help to formulate antibiotic policy for better management of these patients. The present study is undertaken with the following aims and objectives:

(1) To find out the bacterial profile for post burn infection.

(2) To evaluate the antibiotic sensitivity of organisms cultured and isolated.

A total of 55 patients with infected burn wound with irrespective of age, sex, degree and percentage of burn and stay in hospital, were registered for this study.

A total of 170 burn wound swabs were collected following a thorough inspection and examination of an infected area of each patient. These swabs were immersed in Stuart's transport medium, transported to laboratory, cultured on Blood agar, MacConkey's agar and Nutrient agar. Cultured media were incubated at 37˚C for overnight.

Following incubation isolates were identified by their colonial morphology on media and Gram's staining of the isolated colonies. All Gram negative bacteria were divided into two groups on the basis of Oxidase test and were confirmed by certain biochemical tests accordingly.

According to National Committee for Clinical Laboratory Standards Guidelines, susceptibility test of all isolates were performed by Kirby Bauer method[10,11].

RESULTS

In 55 patients and 170 culturing procedures 160 Gram negative bacteria were isolated. All Gram negative bacteria were divided into two groups on result of Oxidase test result. Oxidase positive Gram negative isolates were 46 while Oxidase negative Gram negative bacteria were 114.

Table-I. Summary of total gram negative bacteria isolated in burn patients

No. of pts.	No. of culture procedure	Total gram negative bacteria	Total oxidase positive bacteria	Total oxidase negative bacteria
55	170	160	46 (29%)	114 (71%)

Table-II. Prevalence of Gram negative bacteria (n=160) in burn patients

Name of isolate	Nos: of isolates	%age
Pseudomonas aeruginosa	46	29
Proteus Sps:	43	27
Enterobacter Sps:	25	15.60
Klebsiella Sps:	12	07.50
E.coli	11	07
Serratia Sps:	11	07
Citrobacter Sps:	10	06.00
Providencia Sps:	02	01.25

Result shows that individually P.aeruginosa was most prevalent (46%) organism in gram negative bacteria in burn patients, while the majority of infections were found by various members of the family Enterobacteriacae.

Result shows that Imipenem was the drug that was only effective against P.aeruginosa and was most effective drug against all members of family Enterobacteriacae. 4th generation Cephalosporin was the second most effective drug against all members of family Enterobacteriacae but was effective only 52% strains of P. aeruginosa.

Table-III. Sensitivity pattern of all isolated Gram negative bacteria.

Name of drug	PSEUD SP; (46)	PROT SP; (43)	ENTER SP; (25)	KLEB SP; (12)	E.Coli SP; (11)	SERRA SP; (11)	CITRO SP; (10)	PROV SP; (02)	Overall activity of a single drug on all isolates
IMP	36 (78%)	41 (95%)	24 (96%)	12 (100%)	07 (64%)	09 (82%)	09 (90%)	02 (100%)	90%
CEF	24 (52%)	20 (46.5%)	16 (64%)	06 (50%)	10 (91%)	09 (82%)	08 (80%)	02 (100%)	73%
PIP	10 (22%)	23 (53.5%)	03 (12%)	08 (67%)	06 (54.5%)	06 (54.5%)	05 (50%)	02 (100%)	56%
CFU	04 (9%)	18 (42%)	07 (28%)	01 (08%)	05 (45.5%)	05 (45.5%)	07 (70%)	02 (100%)	48.5%
CFT	04 (9%)	19 (44%)	12 (48%)	03 (25%)	04 (36%)	03 (27%)	05 (50%)	02 (100%)	47%
CFR	02 (4.5%)	13 (30%)	07 (28%)	02 (16%)	04 (36%)	03 (27%)	04 (40%)	02 (100%)	43.5%
AZT	06 (13%)	12 (28%)	07 (28%)	01 (08%)	04 (36%)	04 (36%)	04 (40%)	02 (100%)	39%
AUG	01 (02%)	09 (21%)	05 (20%)	02 (16%)	02 (18%)	02 (18%)	02 (20%)	01 (50%)	27%
AMX	-	05 (11.5%)	02 (08%)	01 (08%)	01 (09%)	01 (09%)	01 (10%)	01 (50%)	10%

IMP Imipenem, CEF Cefepime, PIP Piperacillin, CFU Cefutaxime, CFT Ceftizoxime CFR Cefuroxime, AZT Aztreonam, AUG Augmentin, AMX Amoxicillin. PSEUD P.aeruginosa, PROT Proteus sp;, ENTER Enterobacter sp;, kleb Klebsiella sp; SERRA Serratia sp;, CITRO Citrobacter sp;, PROV Providencia sp;

DISCUSSION

P. aeruginosa remain the leading pathogen causing burn wound infection[12].

P aeruginosa survives well in the hospital environment. Once it was established, it can persist for months with in a unit, posing as multi drug resistant nosocomial infection risk for patients being treated there[13,14].

In the present study 46(29%) isolates of P. aeruginosa were recovered from burn patients. This finding is similar to several other studies[15-17].

Immuno-compromised burn patients, who receive multiple antibiotics, are essentially incubator for antibiotic resistant strains. The development of resistance is progressive, evolving from low level through intermediate to high level which can result in immediate high resistance. There is no antimicrobial drug to which resistance has not eventually appeared. The bacterial resistance to antimicrobial agents is an important public health problem in both the developing and the developed countries, in which many of these organisms are multi drug resistant[18-20].

High frequency and nature of antibiotic resistance may be due to over usage of antibiotics as well as non availability and high cost of preferred antibiotics of choice[21].

Beta lactam antibiotics have been shown to cause Gram negative problem with high number of courses of empirical treatment[22].

Carbepenemes are useful in treatment of some cases of multi-drug resistant strains of P. aeruginosa[5]. In present

study most of the P. aeruginosa strains are MDR and their sensitivity against Imipenem, though not ideal but is comparatively better than other drugs i.e. 78% and also correlate with the studies of Neely and Holder 1999, Xu and Sun 1998 and Mokaddas and Mustafa 1996[13,18,23].

Aztreonam is a Monobactam beta lactam drug. It has excellent activity against P aeruginosa but has a limited treatment option against MDR strains of P.aeruginosa[5]. In present study Aztreonam shows very limited activity against P aeruginosa i.e. 6% and most strains were MDR.

Piperacillin similar to Carbenecillin shows greater activity against P aeruginosa,[23,24] this statement not correlate with present study where Piperacillin shows limited (i.e. 22%) activity against P.aeruginosa.

The "Third generation" Cephalosporins may be defined as having high stability to β-lactamases, particularly those produced by Coliform[14].

In present study only 4.5% strains of P aeruginosa were sensitive to Cefutaxime and 50% strains were sensitive to 4th generation Cefepime. According to Ronald1998, Cefutaxime was effective against only 18% strains of non enteric Gram negative bacilli while in another study in 2003 in New Delhi by Singh et al, 66% strains of P. aeruginosa were resistant to Cefutaxime[26,27].

For many years, the third-generation Cephalosporins have been utilized in the treatment of a broad range of infections. The reduction in the efficacy of these antimicrobials in hospitals seen in recent years as a result of the development of resistance to these compounds. This resistance, caused in part by the production of β-lactamases which can spread from species to species, has intensified the search for alternative agents. Compared with third-generation Cephalosporins, Fourth-generation Cephalosporins possess excellent penetration into Gram-negative bacilli, and are more stable against the activity of some β-lactamases. Fourth-generation Cephalosporins are attractive candidates to replace third generation Cephalosporins for the treatment of many nosocomial infections[25].

The over all prevalence of the Oxidase negative Gram negative coli form bacteria was more than 70%, in which the most prevalent organism belongs to Proteus Spp; follows the Enterobacter Spp;. Unfortunately the poor socio-economic condition of the patients, poor resources of the hospital, lack of knowledge about infection control measures in hospital workers, irregular microbiological analysis, over crowding of patients as well as visitors in burn unit, poor isolation between patients, un hygienic conditions of the patients as well as burn unit and misuse of the broad spectrum antibiotics in hospital may the major causes of these infections.

Imipenem is more effective (90%) drug against all isolates of Oxidase negative coliform bacteria, follows the Cefepime (73%). Enterobacter spp; were highly resistant to Piperacillin. Klebsiella spp; were moderate to highly resistant to Cephalosporin. All isolates of P. aeruginosa were resistant on Amoxicillin and only one strain was sensitive to Augmentin, while 10% and 27% strains of Enterobacteria were sensitive to Amoxicillin and Augmentin respectively.

The infection of burn wounds with multiple organisms, with super added problem of drug resistance, illustrates the need for a drug policy by the hospitals for burn patients. The isolated bacteria exhibited multiple resistances to antibiotics. Therefore antibiotics should always be administered rationally in burn wards guided by infection control unit of hospital[9].

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"Keep your fears to yourself, but share your courage with others."

(Robert Louis Stevenson)