BACTERIOLOGICAL PROFILE AND ANTIBIOTIC SUSCEPTIBILITY PATTERN OF BLOOD CULTURE ISOLATES FROM BURN PATIENTS

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ABSTRACT

BACKGROUND

Infection in a burn patient is a leading cause of morbidity and mortality and remains one of the most challenging concerns for doctors.

The aim of this study is to determine the bacteriological profile of blood stream infections and their antibiotic sensitivity pattern.

MATERIALS AND METHODS

One hundred sixteen blood samples were collected from acutely burnt patients, being treated in the Rajendra Surgical Ward of the Patna Medical College and Hospital, Patna. This descriptive study was conducted from July 2004 to August 2005.

RESULTS

In the present series of study, it is observed that out of a total of 17 isolates (5.84%) of *Staphylococcus aureus*, 14 isolates (i.e. 82.35%) were sensitive to Cloxacillin. Antibiotics resistant to *Staphylococcus aureus* were Gentamicin, Amikacin, Cotrimoxazole, Lomefloxacin, out of a total of 27 (i.e. 9.28%) isolates of *Pseudomonas aeruginosa*, 11 isolates (i.e. 40.74%) were sensitive to Gentamicin and 13 isolates (i.e. 48.15%) were sensitive to Imipenem. Isolates were resistant to Cloxacillin, Ampicillin, Cefazolin and Cotrimoxazole. Out of a total of 7 isolates (i.e. 2.41 %) of *Proteus* spp., 6 isolates (i.e. 85.71%) were sensitive to Imipenem. Isolates were resistant to Cloxacillin, Cefazolin, Cefoperazone. Out of a total of 6 isolates (i.e. 2.06 %) of *Klebsiella* spp., 3 isolates i.e. 50% were sensitive to Imipenem and 2 isolates (i.e. 33.3 %) were sensitive to Imipenem. Isolates were resistant to Ampicillin, Cloxacillin, Cefazolin. Out of total of 4 isolates (1.37%) of *E. coli*, 3 isolates (i.e. 75%) were sensitive to Imipenem. Isolates were resistant to Ampicillin, Lomefloxacin and Cloxacillin. *Proteus* spp. are becoming difficult because of the development of resistance to newer antibiotics. So, inadvertent use of antibiotics must be discouraged.

CONCLUSION

In spite of use of effective antimicrobial agents, the problem of control of infection in burn patients still persists. *Pseudomonas aeruginosa* is still the major pathogen responsible for bacteraemia in burn wound infection. Other important bacteria are *Staphylococcus aureus* and *Proteus* spp. *Pseudomonas aeruginosa* is sensitive to Imipenem and ciprofloxacin; *Proteus* spp. to Ceftriaxone; *Staphylococcus aureus* to cloxacillin; *E. coli* to ciprofloxacin and Cefotaxime; *Klebsiella* spp. to ciprofloxacin and gentamicin; *Streptococcus pyogenes* to cefotaxime and cefoperazone; and *Staphylococcus epidermidis* to cloxacillin.

KEYWORDS

Burn Wound, Blood Culture, Antibiotic Sensitivity Pattern.

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BACKGROUND

Burn patients are ideal hosts for opportunistic infections (Cochran et al, 2002). The burn site remains relatively sterile during the first 24 hours; thereafter, colonisation of the wound by Gram-negative bacteria is common (Pruitt et al, 1998). *Pseudomonas aeruginosa* has emerged as a predominant member of the burn wound flora and in the

absence of topical therapy is cultured from the burn injuries of 70% patients by the third week (Church et al, 2006). Microorganisms routinely isolated from burn wounds include aerobic organisms like *Staphylococcus aureus*, *Streptococcus pyogenes*, *E. coli*, *Klebsiella* spp., *Proteus*, etc., anaerobic organisms like *Bacteroides fragilis*, *Peptostreptococcus*, *Propionibacterium* spp., *Fusobacterium* spp. and fungi like *Aspergillus niger*, *Candida* spp. and *Zygomycetes* (Revathi et al, 1998). Infection in the burn patient is a leading cause of morbidity and mortality and remains one of the most challenging concerns for doctors.¹ The importance of preventing infection has been recognised in organised burn care since its inception and has followed recurring themes through the years. In spite of use of effective antimicrobial agents, the problem of control of infection in burn cases has not been entirely solved.² The measures taken for infection control in burn patients are strict aseptic technique, use of

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sterile gloves and dressing materials, wearing masks for dressing changes and special separation of patients, either using private rooms or cubicles.³ There are three conditions which lead to the development of infection in burn patients: source of organisms, mode of transmission, and the susceptibility of the patient. Exogenous organisms from the hospital environment are generally more resistant to antimicrobial agents than endogenous organisms.⁴ All burn wounds become colonised by 72 hours after injury with the patient's own flora or with endemic organisms from the treatment facility. Bacteria colonise the surface of the wound and may penetrate the vascular eschar. Even with firm clinical evidence of sepsis, a definitive microbiological diagnosis of infection can sometimes be difficult to obtain.⁵ Blood cultures have a relatively low yield in the "burn" population and other anatomic sites of potential infection (e.g. wounds, respiratory tract and urine). Organisms may also reach the damaged area from the surrounding skin, clothing and systemic routes.⁶

When the burn wound starts to heal, granulation tissue appears, and when the surface is clearing up, microclimate changes and Gram-positive flora, predominantly *Staphylococcus* comes back. Previously, β -haemolytic *Streptococci* was identified as the most serious threat and almost all burn patients become infected with this organism at some stage of their stay in hospital, and they often proceeded to a rapidly fatal course.⁷ In recent years, MRSA has become a particularly significant problem in Indian hospitals. The Burn Unit is a particularly fertile environment for MRSA, because of open wounds, frequent dressing changes, requiring handling by multiple healthcare workers, use of intraluminal devices and the inherent immunocompromised state of burn patients.⁸ Ultimately, the Gram-negative organisms emerge as the major cause of death in thermally injured patients. Among these, *Pseudomonas aeruginosa* was the worst offender.⁹ Majority of the victims of domestic burn are women and children. Patients in the burn ward are prone to cross contamination by airborne spread of the bacteria.¹⁰ Microorganisms carrying burn wound infection must be identified earlier and their sensitivity pattern should be done cautiously by selecting the proper and adequate antibiotics.

MATERIALS AND METHODS

Blood samples were collected from acutely burnt patients, being treated in the Rajendra Surgical Ward of the Patna Medical College, Hospital, Patna. This descriptive study was conducted from July 2004 to August 2005. The burn patients and their attendants were explained about the nature of the test done and information collected from them, in a scheduled proforma – as 1. Serial No., 2. Registration No., 3. Name, 4. Age, 5. Sex, 6. Religion, 7. Occupation, 8. Type of burn, 9. Percent of burn, 10. Interval between burn and admission. A total of 116 blood samples were processed during the study period. Five mL blood sample was collected from each adult, 2-5 mL from each child and 0.5-2 mL from infant's aseptically using 70% alcohol and 2% tincture of iodine and inoculated immediately into 50 mL Brain-Heart

Infusion (BHI) Broth with 0.025% of sodium polyanethol sulfonate as anticoagulant. In paediatrics cases, 1-2 mL of blood was inoculated in 5-10 mL of BHI broth. Negative result was followed by examining the broth daily for the sign of bacterial growth (turbidity, haemolysis, clot formation) and by doing final subculture at the end of seventh day. Bottles that showed sign of growth were further processed by Gram stain, followed by subculture on Blood agar, MacConkey agar, Mannitol salt agar and examined after 18-24 hours of incubation. Bacterial isolates were identified by colony morphology, Gram staining, catalase test, coagulase test, oxidase test, methyl red/Voges-Proskauer test (MR-VP), Triple sugar iron agar test, citrate utilisation test, Urease test and Sulfur Indole Motility (SIM) test using standard procedure for bacterial identification. Antibiotic Sensitivity Test was performed on Muller-Hinton Agar, blood agar and MacConkey Agar plates by Kirby-Bauer disc diffusion methods.

Statistical Analysis

The data collected was entered in the Microsoft excel computer programming and checked for any inconsistency. The results are presented in proportion/percentage.

RESULT

One hundred sixteen blood samples were collected from acutely burnt patients, being treated in the Rajendra Surgical Ward of the Patna Medical College and Hospital, Patna. This descriptive study was conducted from July 2004 to August 2005. In the present series of study, it is observed that out of a total of 17 isolates (5.84%) of *Staphylococcus aureus*, 14 isolates (i.e. 82.35%) were sensitive to Cloxacillin. Antibiotics resistant to *Staphylococcus aureus* were Gentamicin, Amikacin, Cotrimoxazole, Lomefloxacin. Out of a total of 27 (i.e. 9.28%) isolates of *Pseudomonas aeruginosa*, 11 isolates (i.e. 40.74%) were sensitive to Gentamicin and 13 isolates (i.e. 48.15%) were sensitive to Imipenem. Isolates were resistant to Cloxacillin, Ampicillin, Cefazolin and Cotrimoxazole. Out of a total of 7 isolates (i.e. 2.41 %) of *Proteus* spp.; 6 isolates (i.e. 85.71%) were sensitive to Imipenem. Isolates were resistant to Cloxacillin, Cefazolin, Cefoperazone. Out of a total of 6 isolates (i.e. 2.06 %) of *Klebsiella* spp., 3 isolates i.e. 50% were sensitive to Imipenem and 2 isolates (i.e. 33.3%) were sensitive to Imipenem. Isolates were resistant to Ampicillin, Cloxacillin, Cefazolin. Out of total of 4 isolates (1.37%) of *E. coli*, 3 isolates (i.e. 75%) were sensitive to Imipenem. Isolates were resistant to Ampicillin, Lomefloxacin and Cloxacillin. *Proteus* spp. are becoming difficult because of the development of resistance to newer antibiotics. So, inadvertent use of antibiotics must be discouraged. Antibiotic sensitivity pattern are given in Table 4 in 100% sensitive and 100% resistant form of both Gram-positive and Gram-negative organism. We excluded those antibiotics that are in the form of intermediate. [Table 1, 2, 3, 4, 5].

Samples taken at	Total no. of samples Taken	No. of samples Showing Positive Blood Culture	Percentage of Samples showing Positive Blood Culture	No. of samples Showing Negative Blood Culture	Percentage of samples showing Negative Blood Culture
Within first 24 hrs. of admission	116 (100%)	0	0	116	100
At the end of first week	98 (100%)	51	52	47	48
At the end of second week	77 (100%)	10	12.98	67	87
Table 1 Showing the Total Number and Percentage of Positive and Negative Cases of Blood Culture of Samples taken within 24 hours of Admission, at the end of First Week and at the End of Second Week					

Organism Isolated	No. of isolates in blood culture of samples taken within 24 hrs of admission	No. of isolates in blood culture of samples taken at the end of first week	No. of isolates in blood culture of samples taken at the end of second week.
Pseudomonas aeruginosa	Nil	25	2
Proteus spp.	Nil	6	1
Staphylococcus Aureus	Nil	13	4
E. coli	Nil	2	2
Klebsiella spp.	Nil	5	1
Total	Nil	51	10
Table 2 Showing Number of Isolates in Blood Culture of Samples taken Within 24 hrs., at the end of First Week and at the end of Second Week of Admission			

Organism Isolated	Percentage of isolates in blood culture of sample taken within 24 hrs.	Percentage of isolates in blood culture of samples taken at the end of first week of admission (n = 98)	Percentage of isolates in blood culture of samples taken at the end of second week (n=77)
Pseudomonas aeruginosa	Nil	25.58	2.59
Proteus. Spp.	Nil	6.12	1.29
Staphylococcus aureus	Nil	13.26	5.19
E. coli	Nil	2.04	2.59
Klebsiella spp.	Nil	5.10	1.29
Table 3 Showing Type and Percentage of Isolates in Blood Culture of Samples taken Within 24 hrs. of Admission, and at the End of First Week, and at the end of Second Week of Admission			

Organism Isolated	Total No. of Isolates	Percentage
Pseudomonas aeruginosa	27	9.28
Proteus spp.	7	2.41
Staphylococcus aureus	17	5.84
E.coli	4	1.37
Klebsiella spp.	6	2.06
Total	61	20.96
Table 4 Showing Frequency of Total Isolates of Blood Culture, Recorded from Samples taken Within 24 hrs. of Admission, at the end of First Week and at the end of Second Week		

Sensitivity Pattern of the Isolates in Blood Culture to different Antibiotics

In the present series of study, it is observed that out of a total of 17 isolates (5.84%) of Staphylococcus aureus, 14 isolates (i.e. 82.35%) were sensitive to Cloxacillin. Antibiotics resistant to Staphylococcus aureus were Gentamicin, Amikacin, Cotrimoxazole, Lomefloxacin,

Out of a total of 27 (i.e. 9.28%) isolates of Pseudomonas aeruginosa, 11 isolates (i.e. 40.74%) were sensitive to Gentamicin and 13 isolates (i.e. 48.15%) were sensitive to Imipenem. Isolates were resistant to Cloxacillin, Ampicillin, Cefazolin and Cotrimoxazole.

Out of a total of 7 isolates (i.e. 2.41 %) of Proteus spp., 6 isolates (i.e. 85.71%) were sensitive to Imipenem. Isolates were resistant to Cloxacillin, Cefazolin, Cefoperazone.

Out of a total of 6 isolates (i.e. 2.06%) of Klebsiella spp., 3 isolates i.e. 50% were sensitive to Imipenem and 2 isolates (i.e. 33.3%) were sensitive to Gentamicin. Isolates were resistant to Ampicillin, Cloxacillin, Cefazolin.

Out of a total of 4 isolates (1.37%) of E. coli, 3 isolates (i.e. 75%) were sensitive to Imipenem. Isolates were resistant to Ampicillin, Lomefloxacin and Cloxacillin.

Organism Isolated	Sensitive (100%)	Resistant (100%)
Pseudomonas aeruginosa	Gentamicin, Imipenem	Cloxacillin, Ampicillin, Cotrimoxazole, Cefazolin
Proteus spp.	Imipenem	Cloxacillin, Cefazolin, Cefoperazone
Staphylococcus aureus	Cloxacillin	Gentamicin, Amikacin, Cotrimoxazole, Lomefloxacin]
Klebsiella spp.	Imipenem, Gentamicin	Ampicillin, Cloxacillin, Cefazolin
E. coli	Imipenem	Ampicillin, Cloxacillin, Lomefloxacin
Table 5 Showing Antibiotic Sensitivity Pattern of Isolates in Blood Culture to Different Antibiotics		

DISCUSSION

Samples of blood taken within 24 hours of admission shows no growth of bacteria because the organism did not pass into

the blood, although the wound got heavily contaminated. Around one week after burn injury, the organism started entering the blood from the surfaces causing bacteraemia and septicaemia. In the present series, it has been observed that *Pseudomonas aeruginosa* is mostly sensitive to Amikacin and Imipenem. 38.46% isolates are sensitive to Amikacin and 42.3% isolates are sensitive to Imipenem. 75.5% isolates of *Staphylococcus aureus* are sensitive to Cloxacillin. 98% isolates of *Proteus* spp. are sensitive to Imipenem. 44.4% isolates of *E. coli* are sensitive to Ciprofloxacin and 55.5% isolates are sensitive to Imipenem. 50% isolates of *Klebsiella* spp. are sensitive to Imipenem and 50% isolates to Gentamicin. 75% isolates of *Streptococcus pyogenes* are sensitive to Cefotaxime and 12.5% are sensitive to Cefoperazone. 83.3% isolates are sensitive to Cloxacillin and 8.3% isolates are sensitive to Cefazolin. It has also been observed that most of the isolates show resistance to some antibiotics. In this study, it has been seen that *Pseudomonas aeruginosa* is resistant to Cloxacillin, Lomefloxacin, Cotrimoxazole, Ampicillin and Cotrimoxazole. *Staphylococcus aureus* is resistant to Gentamicin, Cotrimoxazole, and Lomefloxacin. *E. coli* is resistant to Amikacin, Cloxacillin, Lomefloxacin, Cefotaxime and Cotrimoxazole. *Klebsiella* spp. is resistant to Ampicillin, Cloxacillin, Ciprofloxacin and Lomefloxacin. *Streptococcus pyogenes* is resistant to Cotrimoxazole, Ciprofloxacin, Amikacin, Gentamicin and *Staphylococcus epidermidis* is resistant to Ceftriaxone, Cotrimoxazole, Ampicillin, Amikacin and Gentamicin. This increasing tendency to bacterial resistance is because of inadvertent use of antibiotics in burn cases. Here lies the importance of bacteriological isolation and its proper antibiotic selection to avoid use of unnecessary antibiotic administration to the patient. Above facts are also accepted by Joan Weber, R.N., Albert McManus, 1990. They stated that systemic antimicrobial treatment must be thoughtfully considered in the care of burn patients to prevent the emergence of resistant organisms. Organism isolated in blood, culture also shows the same sensitivity pattern as that of isolates of wound swab culture. The above findings are also shown by Jackson, Lowbury & Topley, 1951, who stated that incidence of *Pseudomonas* infection in burns is rising and is likely to cause fatal septicaemia. Blach, 1965, stated that septicaemia is more common in severely burnt patients and microorganisms isolated from the blood stream are usually found in the burn wound.

CONCLUSION

In spite of use of effective antimicrobial agents, the problem of control of infection in burn patients still persists. In cases of burn wounds, it is important to do an immediate infection workup and administer the appropriate antibiotics. Patients in the burn ward are more prone to cross contamination by airborne spread of the bacteria. Beddings, pillows, blankets and mattresses are proved to be the reservoir of microorganisms. Thermal burn is the most common type of burn. Next is the scald burn which is more common among children. Young females, mostly those involved in domestic works are the major victims of burn injury. Most common

isolates from upper extremity are Gram-positive cocci, whereas most common isolates from lower extremity, back, perineum, buttocks, and thigh are Gram-negative bacilli. *Pseudomonas aeruginosa* is still the major pathogen responsible for bacteraemia in burn wound infection. Other important bacteria are *Staph. aureus* and *Proteus* spp. Specific isolates of wound swab culture and blood cultures are sensitive to same antibiotics. *Pseudomonas aeruginosa* is sensitive to Imipenem and ciprofloxacin; *Proteus* spp. to Ceftriaxone; *Staphylococcus aureus* to cloxacillin; *E. coli* to ciprofloxacin and Cefotaxime; *Klebsiella* spp. to ciprofloxacin and gentamicin; *Streptococcus pyogenes* to cefotaxime and cefoperazone; and *Staphylococcus epidermidis* to cloxacillin. *Staphylococcus aureus* and *Proteus* spp. is becoming difficult because of the development of resistance to newer antibiotics. So, inadvertent use of antibiotics must be discouraged. On correlating the burn wound swab culture and blood culture, it is seen that most of the isolates of blood culture and their corresponding wound swab culture are identical. If antimicrobial therapy is indicated to treat specific infection, it should be tailored to the specific susceptibility pattern of the organisms, as soon as this information is available. Most of the cases of late arrival in hospital shows growth of microorganisms in wound swab culture.

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