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, and Cotrimoxazole. 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, Cloxacillin, and Cotrimoxazole. 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.


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...
sterile gloves and dressing materials, wearing masks for
dressing changes and special separation of patients, either
using private rooms or cubicles. 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. All burn
wounds become colonised by examining the broth daily for the sign of
blood samples were collected from
infection must be identified earlier and their sensitivity
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.

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. 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 immuno-
compromised state of burn patients. Ultimately, the Gram-
negative organisms emerge as the major cause of death in
thermally injured patients. Among these, Pseudomonas
aeruginosa was the worst offender. 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. 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
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,
Manitol 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 Müller-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

<table>
<thead>
<tr>
<th>Organism Isolated</th>
<th>No. of isolates in blood culture of samples taken within 24 hrs of admission</th>
<th>No. of isolates in blood culture of samples taken at the end of first week</th>
<th>No. of isolates in blood culture of samples taken at the end of second week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>Nil</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>Proteus spp.</td>
<td>Nil</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Staphylococcus Aureus</td>
<td>Nil</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>E. coli</td>
<td>Nil</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Klebsiella spp.</td>
<td>Nil</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>Nil</td>
<td>51</td>
<td>10</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Organism Isolated</th>
<th>Percentage of isolates in blood culture of sample taken within 24 hrs.</th>
<th>Percentage of isolates in blood culture of samples taken at the end of first week of admission (n = 98)</th>
<th>Percentage of isolates in blood culture of samples taken at the end of second week (n=77)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>Nil</td>
<td>25.58</td>
<td>2.59</td>
</tr>
<tr>
<td>Proteus. Spp.</td>
<td>Nil</td>
<td>6.12</td>
<td>1.29</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>Nil</td>
<td>13.26</td>
<td>5.19</td>
</tr>
<tr>
<td>E. coli</td>
<td>Nil</td>
<td>2.04</td>
<td>2.59</td>
</tr>
<tr>
<td>Klebsiella spp.</td>
<td>Nil</td>
<td>5.10</td>
<td>1.29</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Organism Isolated</th>
<th>Total No. of Isolates</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>27</td>
<td>9.28</td>
</tr>
<tr>
<td>Proteus spp.</td>
<td>7</td>
<td>2.41</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>17</td>
<td>5.84</td>
</tr>
<tr>
<td>Ecoli</td>
<td>4</td>
<td>1.37</td>
</tr>
<tr>
<td>Klebsiella spp.</td>
<td>6</td>
<td>2.06</td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
<td>20.96</td>
</tr>
</tbody>
</table>

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 was 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.

<table>
<thead>
<tr>
<th>Organism Isolated</th>
<th>Sensitive (100%)</th>
<th>Resistant (100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>Gentamicin, Imipenem</td>
<td>Cloxacillin, Ampicillin, Cotrimoxazole, Cefazolin</td>
</tr>
<tr>
<td>Proteus spp.</td>
<td>Imipenem</td>
<td>Cloxacillin, Cefazolin, Cefoperazone</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>Cloxacillin</td>
<td>Gentamicin, Amikacin, Cotrimoxazole, Lomefloxacin</td>
</tr>
<tr>
<td>Klebsiella spp.</td>
<td>Imipenem, Gentamicin</td>
<td>Ampicillin, Cloxacillin, Cefazolin</td>
</tr>
<tr>
<td>E. coli</td>
<td>Imipenem</td>
<td>Ampicillin, Cloxacillin, Lomefloxacin</td>
</tr>
</tbody>
</table>

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 Cloxacillin. 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 83.3% 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 doxycillin; 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.

REFERENCES