Bacterial infections in burn patients at a burn hospital in Iran

Alireza Ekrami & Enayat Kalantar*

Department of Laboratory Medical Sciences, School of Paramedical Sciences, Ahvaz Jundi-Shapour University of Medical Sciences, Ahvaz & *Department of Microbiology, School of Medicine, Kurdestan University of Medical Sciences, Sanandaj, Iran

Received January 24, 2007

**Background & objectives:** The major challenge for a burn team is nosocomial infection in burn patients, which is known to cause over 50% of burn deaths. Most studies on infection in burn patients focus on burn wound infection, whereas other nosocomial infections in these patients are not well described. We undertook this study to determine three types of nosocomial infections viz., burn wound infection, urinary tract infection, and blood stream infection in burn patients in a burn hospital in Iran.

**Methods:** During the one year period (May 2003 to April 2004), 182 patients were included in this study. Blood, urine and wound biopsy samples were taken 7 and 14 days after admission to Taleghani Burn hospital. Isolation and identification of microorganisms was done using the standard procedure. Disk diffusion test were performed for all the isolates for antimicrobial susceptibility.

**Results:** Of the 182 patients, 140 (76.9%) acquired at least one type of infection of the 140, 116 patients (82.8%) were culture positive on day 7 while 24 (17.2%) on 14 days after admission. Primary wound infection was most common (72.5%), followed by blood stream (18.6%) and urinary tract infections (8.9%).

The microorganisms causing infections were *Pseudomonas aeruginosa* (37.5%), *Staphylococcus aureus* (20.2%), and *Acinetobacter baumannii* (10.4%). Among these isolates *P. aeruginosa* was found to be 100 per cent resistant to amikacin, gentamicin, carbenicillin, ciprofloxacin, tobramycin and ceftazidime; 58 per cent of *S. aureus* and 60 per cent of coagulase negative *Staphylococcus* were methicillin resistant.

**Interpretation & conclusions:** High prevalence of nosocomial infections and the presence of multidrug resistant bacteria, and methicillin resistant *S. aureus* in patients at Taleghani Burn Hospital suggest continuous surveillance of burn infections and develop strategies for antimicrobial resistance control and treatment of infectious complications.

**Key words** Antimicrobial resistance - burn wounds - nosocomial infection
infection was burn wound infection (60%) followed by blood stream infection (20%), urinary tract infection (20%), and pneumonia (10%). This distribution of infections is strikingly different from the study by Wurtz et al\(^3\) in which over 50 per cent of infections were pneumonia followed by urinary tract infection, blood stream infection, and wound infection.

The common pathogens isolated from burn patients include \textit{Pseudomonas aeruginosa}, \textit{Staphylococcus aureus}, \textit{Klebsiella} spp, and various coliform bacilli. Fungi (\textit{Candida albicans}, \textit{Aspergillus fumigatus}) can also cause infection\(^4\). Multidrug-resistant bacteria have frequently been reported as the cause of nosocomial outbreaks of infection in burn units or as colonizers of the wounds of burn patients\(^8\). Similarly, antimicrobial resistance in some of the most frequent bacterial species isolated from burn patients in Iran such as \textit{S. aureus} or \textit{P. aeruginosa}, and other Gram negative bacilli has reached to a worrying level\(^11,12\). 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\(^13\). This study was carried out to determine three types of nosocomial infections viz., burn wound infection, urinary tract infection, and blood stream infection caused by bacterial pathogens isolated from burned patients at Taleghani Burn Hospital in Khuzestan province, Ahvaz, Iran as also the susceptibility of these isolates to various antibiotics.

**Material & Methods**

A total of 182 patients were admitted to the Taleghani Burn Hospital which is an academic educational hospital affiliated to Ahvaz Jundishapour University of Medical Sciences during the one year period (from May 2003 to April 2004). This hospital is the only referral centre for Khuzestan province, Iran.

None of the patients included in the study had any sign and symptoms of urinary tract infection (UTI), blood stream infection (BSI), and wound infection (WI) based on NNIS system criteria\(^13\) within the first 48 h after the admission.

Blood, urine and wound biopsy samples were taken on day 7 and 14 after admission, and then cultured on blood agar and MacConkey agar. Isolation and identification of microorganisms was done according to standard procedure\(^14\).

Disk diffusion test were performed for all the isolates by the method recommended by Clinical and Laboratory Standard Institute (CLST)\(^15\). A suspension of each isolate was made so that the turbidity was equal to 0.5 McFarland standard and then plated onto Muller-Hinton agar (Difcos) plate. Antibiotic disk (Oxoid) was applied to each plate (Table). After incubation at 35°C for 24 h, zone size was measured. Reference strains included were ATCC 25923 (\textit{S. aureus}) and ATCC 35218 (\textit{Escherichia coli}), obtained from Jundishapour University of Medical Sciences, Ahvaz, Iran. The analysis of the data was performed with the SPSS 10 (SPSS inc, Chicago, IL). This work was approved by the Ethical Committee of the Ahvaz Jundishapour University of Medical Sciences, Ahvaz, Iran.

**Results**

The mean age of patients was 19.3 ± 17.05 yr (< 1-70 yr). There were 108 males (59.3 %) and 74 females (40.6 %) with a male to female ratio 1.45:1.

Culture positivity on 7 and 14 days after admission was seen in 116 (82.8%) and 24 (17.2%) patients, respectively. Of the 182 patients, 140 (77.3 %) suffered at least one type of nosocomial infection (UTI, BSI and WI). The wound infection was the most frequent (76.9%), followed by blood infection (18.6%) and urinary tract infection (8.9%).

A total of 173 bacterial isolates were obtained. The most predominant bacterial isolate was \textit{Pseudomonas aeruginosa} 65 (37.5%) followed by \textit{Staphylococcus aureus} 35 (20.2%), \textit{Acinetobacter baumannii} 18 (10.4%), \textit{Escherichia coli} 10 (5.7%), \textit{Proteus mirabilis} 9 (5.2%), coagulase negative \textit{Staphylococcus} 9 (5.2%), \textit{Citrobacter freundii} 9 (5.2%), \textit{Pseudomonas aeruginosa} 6 (3.4%), \textit{Enterococcus} spp. 4 (2.3%), \textit{Citrobacter freundii} 3 (1.7%), \textit{Serratia marcescens} 2 (1.1%), \textit{Alcaligenes} spp. 2 (1.1%), \textit{β} haemolytic group \textit{A Streptococcus} 1 (0.5%).

It is worth to note that 58 per cent of \textit{S. aureus} and 60 per cent of coagulase negative \textit{Staphylococcus} were methicillin resistant. However, these isolates were susceptible to vancomycin and teicoplanin. \textit{P. aeruginosa} was resistant to gentamicin, cephalothin,
ciprofloxacin, amikacin, carbenicilin, ceftazidime, tobramycin (100%) and cephalexin (98) respectively (Table).

**Table.** Antibiotic susceptibility pattern (%) of isolates in burn patients

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Concentration/ Organism (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>S. aureus</em></td>
</tr>
<tr>
<td>Gentamicin</td>
<td>10</td>
</tr>
<tr>
<td>Cephalothin</td>
<td>30</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>05</td>
</tr>
<tr>
<td>Cephalexin</td>
<td>30</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>02</td>
</tr>
<tr>
<td>Oxacillin</td>
<td>01</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>30</td>
</tr>
<tr>
<td>Amikacin</td>
<td>30</td>
</tr>
<tr>
<td>Ampicillin</td>
<td>10</td>
</tr>
<tr>
<td>Carbenicillin</td>
<td>100</td>
</tr>
<tr>
<td>Cotrimoxazol</td>
<td>1.25/23.75</td>
</tr>
<tr>
<td>Ceftazidine</td>
<td>30</td>
</tr>
<tr>
<td>Tobramycin</td>
<td>10</td>
</tr>
<tr>
<td>ND: not done</td>
<td></td>
</tr>
</tbody>
</table>

To conclude, burn patients were most commonly infected with *P. aeruginosa* and *S. aureus* and they were resistant of most of the antibiotics tested. A nosocomial infection surveillance system may be introduced to reduce the rate of nosocomial infections among burn patients, and for better therapeutic options.

**Discussion**

Despite significant improvement in the survival of burn patients, infectious complications continue to be the major cause of morbidity and mortality. Though control of invasive bacterial burn wound infection, strict isolation techniques and infection control policies have significantly minimized the occurrence of burn wound infection, our study showed high prevalence of bacterial infections among burn patients as compared to another study from Iran.

Our study indicated that the wound infection was the most common cause of nosocomial infection. Rastegar *et al* at Tohid Burn Center in Tehran, Iran, reported the same. Askarian *et al* also reported the wound infection as the most common cause of nosocomial infection was followed by BSI and UTI.

Our study showed *P. aeruginosa* as a common cause of nosocomial infection, similar to our earlier study. Other studies also showed that nosocomial infection caused by *P. aeruginosa* was the major danger in burn patients in Iran.

In our study 58 per cent of *S. aureus* MRSA were methicillin resistant. This pathogen has been reported as a major cause of nosocomial infection in Europe.

**References**


**Acknowledgment**

Authors acknowledge Ahvaz Jundi-Shapour University of Medical Sciences, Ahvaz, Iran, for financial support.


*Reprint requests:* Dr Kalantar E, Department of Microbiology, School of Medicine, Kurdestan University of Medical Sciences Kurdestan, Iran

e-mail: kalantar_enayat@yahoo.com; ekalantar@hotmail.com