Microbiological surveillance of burn unit of EPM/UNIFESP in São Paulo, Brazil

Perfil microbiológico da unidade de queimaduras da EPM/UNIFESP, São Paulo, Brasil

ABSTRACT

Introduction: Despite great advances in treatment, burned skin infection remains a major challenge. The aim of this study is to evaluate the microbiological aspects of the first year's operation of a Burn Unit in a University Hospital. Methods: Retrospective study. Microbiological data were collected and analyzed from patients admitted to the Burn Unit of São Paulo Hospital, a University Hospital of the Paulista Medical School (EPM) of the Federal University of São Paulo (UNIFESP) from June 2009 to July 2010. Results: The average length of stay was 13.8 days with a mortality rate of 5.9%, and median of TBSA was 10.3%. Evaluated 159 cultures from 101 patients. Blood cultures were the most requested (41%). It was also accessed 245 surveillance cultures collected from 75 patients. The microbiological analysis revealed a total positivity rate of 34.5%. The most prevalent agents were Coagulase-negative Staphylococcus – CoNS – (33%), Pseudomonas aeruginosa (24%), Acinetobacter spp. (22%) and Klebsiella pneumoniae (5%). Conclusion: The microbiological evaluation of the first year's activity of EPM/UNIFESP Burn Care Unit revealed that, although the most prevalent agent was CoNS, Gram-negative bacilli are still very prevalent, such as Pseudomonas aeruginosa and Acinetobacter baumannii. Despite the short time of operation, was observed large number of multiresistant microorganisms which can be explained by long exposure to antimicrobials and high transfer rate from other hospitals.

Keywords: Burn Units; Epidemiology; Staphylococcus; Pseudomonas aeruginosa; Acinetobacter baumannii.

RESUMO

Introdução: Apesar dos grandes avanços em seu tratamento, infecção de pele com queimadura continua a ser um grande desafio. O objetivo deste estudo é avaliar os aspectos microbiológicos do primeiro ano de funcionamento de uma unidade de queimadura em um Hospital Universitário. Métodos: Estudo retrospectivo. Dados...
INTRODUCTION

Infections are major causes of mortality in severely burned patients. The United States has the highest mortality rates in patient’s victims of burns among industrialized countries. In Brazil, burns are responsible for over 100,000 hospital admissions and 2,500 deaths per year. Burn treatment is funded by the government and needs of epidemiological data for the correct management and publishing for prevention.

This patients are most susceptible to developing infection, as changes occur in the immune system due to dysfunction of granulocytes, reduced numbers of circulating lymphocytes and reduction of substances such as IL-2 and IgG. The largest burn extension, the higher probability of the patient developing infection.

Studies evaluating the frequency of infections in these patients show that bloodstream infections, respiratory tract infections, urinary tract infections and skin infections are most prevalent.

Despite great advances in treatment, burned skin infection remains a major challenge. The disruption in skin barrier, vascular changes in the tissue and immune system dysfunction contribute to infection. In addition, the wound environment is propitious to microorganism’s development.

The aim of this study is to evaluate the microbiological aspects of the first year’s operation of a burn unit in a University Hospital.

METHODS

This is a prospective epidemiological study where we evaluated the microbiological data from patients admitted to the burn unit of São Paulo Hospital, a University Hospital of the Paulista Medical School (EPM) of the Federal University of São Paulo (UNIFESP) from June 2009 to July 2010. This study was approved by the Research Ethics Committee of EPM/UNIFESP under number 1272/10.

Opened in June 2009, the Burn Unit of São Paulo Hospital is a high complexity center with four intensive care and six ward beds and operative room in the Burn Unit. São Paulo Hospital is a University Hospital that belongs to the Paulista Medical School of the Federal University of São Paulo.

Evaluated 159 cultures from 101 patients admitted to the Burn Unit from July 2009 to June 2010.

The microbiological protocol of patient care in the burn unit is started by collecting samples from the wound, oropharyns and rectum at the patient’s arrival in the burn unit. During the clinical outcome when the patient has systemic symptoms such as fever, abnormal white blood cell count, increase of PCR and other inflammatory markers, or local changes, such as discoloration of the wound, the presence of cellulitis or vasculitis, is collected culture of the wound and blood culture. When there are specific signs such as changes in the urinary, digestive, pulmonary systems, most common sources of infection, among several, specific cultures are required for diagnosis.

Microbiological data were analyzed considering the culture requested, prevalent agents and antimicrobial susceptibility. All cultures were processed at Microbiology Central Laboratory from São Paulo Hospital. The microorganism identification and susceptibility tests for antimicrobial drugs were processed by automated system (Phoenix – BD®). The interpretative criteria’s for break points definition to the susceptibility followed the CLSI standards (Clinical Laboratory Standards Institute) document M100-S19.

Patient and burn’s characteristics such sex, age, total body surface area (TBSA), surgical procedures, injury severity were also evaluated by epidemiologic form filled out during patient’s hospitalization.
Clinical features assessed considered average hospital stay between admission and surgery, burn infection and graft loss.

Burn infection is defined by the invasion of microorganisms in the area of the burn injury with the presence of signs such as discoloration, from points of vasculitis, points or plaques blackened in the subcutaneous tissue, presence of cellulitis around the lesion, secretion on the lesions and systemic repercussions with abnormal laboratory tests. Graft skin loss is when the skin does not take by the presence of exudate or other serious solution between the graft and the recipient site. This can occur by local conditions of the recipient site or the systemic conditions of the patient, more often as a septic shock.

Statistical analysis of results was obtained by SPSS software.

RESULTS

From June 2009 to July 2010, 101 patients were admitted at the Burn Unit. During this period an epidemiological study was performed and revealed that the average age of patients admitted was 33.7 years and they were male in 66.7% of admissions.

The average length of stay was 13.8 days with a mortality rate of 5.9%. The median of TBSA was 10.3% and 64.3% were regarded as small burns (Table 1). The mean time to surgery (debridement or grafting) was 4.4 days.

During the studied period, the average of surgeries per month was 9.1. Debridement and skin grafting, in distinct surgical moments, were the most common procedures, respectively 39 (35.4%) and 37 (33.6%) (Table 2).

<table>
<thead>
<tr>
<th>BSAB</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 10%</td>
<td>61</td>
<td>60.4</td>
</tr>
<tr>
<td>11–25%</td>
<td>30</td>
<td>29.7</td>
</tr>
<tr>
<td>26–50%</td>
<td>8</td>
<td>7.9</td>
</tr>
<tr>
<td>51–75%</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>76–100%</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>101</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 1. Patient body surface area burned (BSAB), number (n) and percentage (%) – EPM/UNIFESP Burn Unit.

From June 2009 to July 2010, 159 cultures were requested when infection was suspected. Blood cultures were the most requested (41%), followed by urine culture (18%), quantitative skin biopsy (14%w) and catheter tip (11%), as shown in Figure 1.

It was also accessed 245 surveillance cultures collected from 75 patients with distribution of site collection and isolated microorganisms (Figures 2 and 3).

When it was evaluated the surveillance cultures, it was found a prevalence of Coagulase Negative Staphylococcus, Escherichia coli and Staphylococcus aureus.

Table 2. Surgical procedures realized in the period, number (n) and percentage (%) – EPM/UNIFESP Burn Unit.

<table>
<thead>
<tr>
<th>Procedures</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debridement</td>
<td>39</td>
<td>35.45</td>
</tr>
<tr>
<td>Skin graft</td>
<td>37</td>
<td>33.64</td>
</tr>
<tr>
<td>Sequel</td>
<td>2</td>
<td>1.82</td>
</tr>
<tr>
<td>Debridement and Skin Graft</td>
<td>27</td>
<td>24.54</td>
</tr>
<tr>
<td>Others</td>
<td>5</td>
<td>4.55</td>
</tr>
<tr>
<td>Total</td>
<td>110</td>
<td>100</td>
</tr>
</tbody>
</table>

Only one (0.45%) E. coli isolate presented extended lactamase production (ESBL) with resistance to cephalosporins and one (0.45%) isolate of Pseudomonas aeruginosa presented multi-resistant susceptibility profile.

Among Gram positives, was founded 26% and 5% of resistance to oxacillin in CoNS and S. aureus respectively.

Figure 1. Type of cultures requested when infection was suspected at EPM/UNIFESP Burn Unit.

Figure 2. Distribution of site collection in surveillance cultures at EPM/UNIFESP Burn Unit.
The microbiological analysis revealed a total positivity rate of 34.5%. Figure 4 shows the positivity rate according the culture requested. The most prevalent agents were Coagulase-negative Staphylococcus – CoNS (33%), Pseudomonas aeruginosa (24%), Acinetobacter spp. (22%) and Klebsiella pneumoniae (5%), according figure 5.

The analysis of antimicrobial susceptibility tests demonstrated that 83% of CoNS were resistant to oxacillin. Regarding Pseudomonas aeruginosa and Acinetobacter spp., 85% and 50% respectively were multi-resistant. It was found one Klebsiella pneumoniae isolate resistant to carbapenem and positive to Modified Hodge Test (possible carbapenemase producing strain).

DISCUSSION

Our epidemiological data revealed a male prevalence (66.7%) and median age of 33.7 years. Similar results were found in several studies in different countries. Studies show that males are exposed to work activities with higher risk for accidents such as handling equipments or chemicals, fuel, labor and electricity networks.

Regarding total body surface area (TBSA), the average percentage was 11.3%, a value close to the study conducted in Lithuania from 1991 to 2004, which averaged found was 9.6%. Most of the burn extension was considered small, between 0 and 10% of BSA in 62 (61.4%) patients, coinciding with other studies with rates of 60.0% and 57.0% respectively.

Inhalation injury was associated with six deaths, and the one-year mortality rate was 5.9%, higher than the study conducted by Onarheim et al. (2.1%), and Brussels et al. (14.7%). However, similar result was found at Macedo and Rosa's Brazilian study, with 6.2% mortality rate.

In severely burned patients, the diagnostic of infection is extremely difficult, once inflammatory response can either cause symptoms like fever and hypotension, with increase in white blood cell account and in C-Reactive Protein (CRP). Therefore, cultures are important tools for the diagnosis of infection.

The most request culture in our service was blood culture (41%) with a positivity rate of 26.5%, followed by urine culture (18%) with positivity rate of 38% and quantitative skin biopsy (14%) with a positivity rate of 0%. Catheter tip was the fourth culture most requested, positive in 63.6%. In one study conducted in Turkey, among 169 burned patients, 127 acquired and 166 nosocomial infection (15.7% pneumonia, 56.0% BWI, 8.4% UTI and 19.9% BSI for an overall NI rate of 18.2 per 1000 patient-days).

A total of 55 microorganisms were isolated from 159 cultures. The most prevalent agents were Coagulase-negative Staphylococcus – CoNS (33%), Pseudomonas aeruginosa (24%), Acinetobacter spp. (22%) and Klebsiella pneumoniae.
ae (5%). Except for the CoNS, a similar result was found at ONCUL's study. GUGGENHEIM et al. (2009) conclude dinamo-microbiological study with burned patients, from 1986 to 2005, that Staphylococcus aureus was isolated mostoften, 20.8%, followed by Escherichia coli with 11.8% with Pseudomonas aeruginosa, coagulase-negative (SCN) with 10.9%, Enterococcus spp, with 9.7%, 8.6% Enterobacter cloacae, Klebsiella pneumoniae 5%, Acinetobacter spp. 3.2%, Proteus mirabilis with 2% and Stenotrophomonas maltophilia 1.4%.11

Our analysis showed that CoNS was the most prevalent agent, mainly from blood cultures. However, it is difficult to assess the clinical importance of these pathogens as responsible for causing infection once they are also associated to skin colonization.

Although the low prevalence of Acinetobacter baumannii in burned patients according some authors, at São Paulo Hospital it was the most isolated. The Brazilian Scope Project evaluated the blood stream infection agent's prevalence and revealed a high incidence by this agent.

Pseudomonas aeruginosa is an important causative agent of infection in burns, especially skin infections. The presence of this agent is associated with high mortality rates. In this study, it was the second most prevalent agent although it has not been associated with skin infection in the sample assessed.

MEN'SHIKOV et al. (2009) in a specialized center for burn treatment, studied 3,179 samples of exudates from wounds and 6,501 strains of microorganisms that affect the wounds and noted that the most prevalent was Staphylococcus aureus.14

At EPM/UNIFESP Burn Unit, wound secretion culture's is not recommended for routine diagnosis of infection, since it may represent colonization. The quantitative culture of a skin biopsy is the better choice to evaluate the suspecting infection.

Among 101 patients, 9 quantitative burn skin biopsy was request. None had growth of microorganisms in a significant account (> 105 UFC) and none of patients evaluated with burn skin infections. Maybe this could be attributed for the early debridement and skin graft (mean time to surgery 4.4 days).

Studies show that early surgical treatment of burned patients with debridement and application of skin grafts, prevents biofilm formation, colonization, skin infection and sepsis. It has been demonstrated, effective essin reducing complications, reducing mortality rates, length of stay and number of surgeries.16-19

At EPM/UNIFESP Burn Care Unit, stringent measures area doptedin the care of burn with daily dressing changes, wound cleaning, disinfection and use of topical antimicrobials. GRAGNANI et al. (2005) have reported that adoption of these measure secourages a moist environment conducive to wound healing, mainly superficial.20

The susceptibility tests to antimicrobials showed a high frequency of multidrug-resistant microorganisms in our unit, represented mainly by Acinetobacter baumannii and Pseudomonas aeruginosa are sistantes to carbapenems (85% and 50% respectively). From the analysed samples only one isolate of Klebsiella pneumoniae was resistant to carbapenem swith-Hodge test positive suggesting a possible carbapenemase production.

Despite the short time drive activity of the EPM/UNIFESP Burn Care Unit, the patients studied are exposed to long periods of antibiotic therapy, which increases the selective pressure for resistant organisms (average length of stay of 13.8 days). Moreover, it is are ferral service that receive patients from other services (30.6%).

There ate of wound infection in burns was 0%, disagreeing with the literature. The surgical procedures (early debridement and grafting) associated with wound care such as daily dressings and topical antimicrobials, may explain the results founded.

CONCLUSIONS

The most prevalent agent was Coagulase-negative Staphylococcus in the microbiological evaluation of the first ear’s activity of EPM/UNIFESP Burn Care Unit. Although this agent responsible for a third of the analysed cases, Gram negative bacilli, such as Pseudomonas aeruginosa and Acinetobacter baumannii, are still very prevalent, being identified in approximately half of the cultures. The long exposure to antimicrobials and high transferrate from other hospitals can explain the large number of multi resistant microorganisms in the sudy.

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Author Disclosure Statement

None of the authors has competing financial interests to disclose.

REFERENCES


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