Fungal Infection in Burns – A Prospective Study in Rural India

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Introduction
The risk of developing fungal infections in burn patients are high compared with other patients. This is due to the destruction of dermal layer of skin, which is a protective barrier and associated depression of cellular and humoral immune responses. In low to middle income countries, the rate of infections was higher compared to high income group of countries because of lack of resources. Burn wound infection is the most devastating trauma and a serious public health issue. As a result of effective and easy availability of antibiotics, the incidence of bacterial infections in burns patients were reduced and the rise of fungal infections have been witnessed.

The main risk factors for fungal infections in burns patients are burned total body surface area and perturbed immunity. The use of wide spectrum of antibiotics will cause eradication of natural bacterial flora and promotes the fungal infections. Other predisposing risk factors are old age, uncontrolled diabetes, central venous catheters and Foley’s catheters.

Fungal infections are difficult to diagnose because of their similarity to bacterial infections and also due to shortage of mycology laboratories. The incidence of fungal infection is around 6% to 44% in various burn centres around the world. The mortality rate due to fungal infection was 5.3% in a study conducted by Clinton Murray. The most common fungal species found in burns patients were Candida species, with the prevalence rate of 13 to 31.8%. Now there is a changing pattern of fungal infection with the isolation of Non-albicans Candida species, Fusarium spp, Aspergillus, and Zygomycetes which are more difficult to treat.

Aim
To assess the fungal infections frequency in thermal burn patients in relate to total body surface, degree of burns, age of wounds, to assess common fungal pathogens and mortality.
Materials and Methods

We conducted a prospective study on 100 patients admitted with 20-60% thermal burn wounds in surgical department during period of August 2016 to July 2017. We have taken consent from each patient. Ages of the patients are from 18yrs to 60yrs. We have excluded pregnant women, lactating mothers, patients with pre-existing immune disorders.

In thermal burn patients, the wound is cleaned with normal saline and betadine, followed by dressing. We give broad spectrum antibiotics and high protein diet. Under local anaesthesia pus swab and scrapings were taken at the first week, second week and third week and sent to microbiology department. The scrapings and pus for fungal culture were taken under the eschar, from multiple sites (at least 3 sites) and multiple times (at least three times per week). In the microbiology department scrapings were examined by direct microscopy and culture studies are done on Sabouraud’s dextrose agar medium with and without chloramphenicol. Chi square test was used for statistical analysis.

Results

In our study the incidence of fungal infection in thermal burn patients is about 24%. Out of 100 patients 24 people were positive for fungal infection. 14 patients were identified by direct microscopy and 24 patients were positive on fungal culture. So fungal culture is better than direct microscopy, but it took at least 6 weeks of time to get report.

Table-1: Relation of percentage of burns with direct microscopy and fungal culture

<table>
<thead>
<tr>
<th>% of Burns</th>
<th>NO. of patients</th>
<th>Positive on direct microscopy</th>
<th>Positive on fungal culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-30</td>
<td>34</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>31-40</td>
<td>22</td>
<td>1(4.54%)</td>
<td>3(13.63%)</td>
</tr>
<tr>
<td>41-50</td>
<td>20</td>
<td>5(25%)</td>
<td>9(45%)</td>
</tr>
<tr>
<td>51-60</td>
<td>24</td>
<td>8(33.33%)</td>
<td>12(50%)</td>
</tr>
</tbody>
</table>

The above table shows the increase incidence of fungal infection with the percentage of burns. In the patients with 51-60% of burns, the incidence is 50%. In patients with 20-30% burns, the incidence of infection is zero. So it shows that total body surface area, is the risk factor for fungal infection.

Table-2: Relation of degree of burns with direct microscopy and fungal culture

<table>
<thead>
<tr>
<th>Degree of burn</th>
<th>NO. of patients</th>
<th>Positive on direct microscopy</th>
<th>Positive on fungal culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>First degree</td>
<td>32</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Second degree</td>
<td>38</td>
<td>4(10.5%)</td>
<td>7(18.42%)</td>
</tr>
<tr>
<td>Third degree</td>
<td>30</td>
<td>10(33.33%)</td>
<td>17(56.67%)</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>14(14%)</td>
<td>24(24%)</td>
</tr>
</tbody>
</table>

The above table shows that, the chances of fungal infection were more with third degree burns than first degree burns. The fungal infection in first degree burns patients is zero. So it proves that the degree of burns is the risk factor for fungal infection.

Table - 3: Relation of post burn time and fungal infection

<table>
<thead>
<tr>
<th>Post Burn Week</th>
<th>NO. of fungal positive cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>First week</td>
<td>0</td>
</tr>
<tr>
<td>Second week</td>
<td>10(41.66%)</td>
</tr>
<tr>
<td>Third week</td>
<td>14(58.33%)</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
</tr>
</tbody>
</table>

The above table clearly shows that increase in the post burn time, increases the incidence of fungal infection.

The most common fungal organism identified in culture medium is Candida albicans. The incidence of aspergillus flavus, non-albicans

Fig-1 Pie chart showing fungal organisms identified in culture

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candida and zygomycetes are 20.83%, 25% and 8.33% respectively.

**Table-4: Relation of fungal organism and mortality of patient**

<table>
<thead>
<tr>
<th>Fungal organism</th>
<th>NO.of cases</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candida albicans</td>
<td>12</td>
<td>2 (16.67%)</td>
</tr>
<tr>
<td>Aspergillus flavus</td>
<td>5</td>
<td>1 (20%)</td>
</tr>
<tr>
<td>Non-albicans Candida</td>
<td>6</td>
<td>1 (16.67%)</td>
</tr>
<tr>
<td>Zygomycetes</td>
<td>1</td>
<td>1 (100%)</td>
</tr>
</tbody>
</table>

The highest percentage of mortality (100%) is seen in patient infected with zygomycetes infection. Zygomycetes fungal infection is rare and dreadful infection. The mortality in candida albicans, aspergillus flavus and non-albicans candida are 16.67%, 20% and 16.67% respectively.

**Discussion**

Emerging fungal infections in burn injuries represent a major challenge in the management of burns. Injudicious use of antibiotics in burns patients causing the emergence of fungal infections.

In our study the incidence of fungal infection is 24%. In the study conducted by Mousa et al., the incidence of fungal infection is 20%\(^\text{11}\). In a multi-centre review, conducted by Ballard et al., the incidence of fungal infection is 6.3%\(^\text{5}\). In a study conducted by Sharma et al., the incidence of fungal infection is 26%\(^\text{13}\). Burn wounds provide good nourishment and colonization of fungi, which leads to higher incidence of fungal infection around 20%\(^\text{14}\).

This study shows the increase of incidence of fungal infection with increase in total body surface area with fungal infection in 50% of the burn patients having 51-60% TBSA involvement. There are no fungal infections in patients with 20-30% burns. In the review study done by Ballard et al., 435 patients out of 6918 patients developed fungal infection had burns of 34.8+ \_22.7% TBSA\(^\text{5}\). Our study incidence rates were similar to the study done by Bruck et al., who had incidence of 46.9% in patients with 30-59% TBSA\(^\text{15}\). With this interpretation we can conclude that it is better to do fungal culture studies in 40-60% burns and can start fungal treatment empirically.

This study shows that maximum fungal infections were observed in third degree burns with the incidence of 56.67%. the incidence in second degree burns is 18.42%. In the study conducted by Bruck et al., the incidence in second and third degree burns is 16.7% and 58.8% respectively\(^\text{15}\). In our study the, the incidence of fungal infection is 58.33% in third week of post burn period and 41.66% in second week of post burn period. In the study conducted by Bruck et al., the fungal colonization increases after first week and maximize around third and fourth week\(^\text{15}\). In the study conducted by Ibrahim et al., the incidence of fungal infection is 36% by the end of fourth week of admission\(^\text{16}\).

The most common fungal organism identified in our study is candida albicans. In the studies conducted by Ibrahim et al., Branski et al., Mundhada et al., the candida albicans is the most common fungal infection. In our study, the mortality rate in fungal infection patients is 20.83%. In the study conducted by chamania et al., the mortality rate in all burns patients due to sepsis is 19.6%\(^\text{2}\). In our study, we encountered a rare fungal organism zygomycetes, the mortality rate is 100% in this organism as the patient had 55% burns and third degree burns.

**Conclusion**

The emergence of fungal infections and difficult to diagnose them clinically pose a major threat in the management of burn patients. Precautions to be taken in the management of burns are do culture tests in burns above 40% and third degree burns, judicious use of antibiotics, maintain immune competence and earliest closure of burn wound if possible. The antifungal should be used appropriately and it should be targeted therapy. Further studies should be done to make guidelines for identifying fungal infections and its management.
References