Clinico-microbiological Profile Of Necrotizing Fasciitis Secondary To Diabetes Mellitus In A Tertiary Care Hospital

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Abstract

Objectives: Necrotizing fasciitis is a life-threatening soft-tissue infection primarily involving the superficial fascia. The present study describes the clinical presentation and microbiological characteristics of this condition as well as risk factors, management and outcome of the patients.

Materials and Methods: In this prospective study, tissue and/or wound swabs and blood for culture from 50 clinically suspected cases were cultured aerobically and anaerobically and the isolates tested for sensitivity. Clinical correlation and follow-up was done.

Results: The age range was 17-87 years (mean=54 yrs) with a male predominance. The most common site of infection was the calf region (59.5%) and diabetes mellitus was the most common associated comorbidity (44.7%). Majority of the patients presented with symptoms of sepsis, systemic toxicity, or evidence of skin inflammation. Hyperacute cases presented with sepsis and quickly progressed to multiorgan failure (40%). 23 patients (57.5%) had microbiological isolates and in 16% of the cases, there was an anaerobic growth. Staphylococcus aureus and Klebsiella pneumonia were the most common isolates, whereas Pseudomonas aeruginosa was the most common environmental strains, suggestive to be colonizer. Antibiotics were instituted in all patients and all required debridement. Amputation had to be done in 2 patients. 21.3% of the patients were admitted in the ICU. Most of the patients recovered on treatment.

Conclusions: Necrotizing fasciitis is a common condition that results in gross morbidity and mortality if not treated at early stages. A high index of suspicion is important in view of the paucity of the specific cutaneous findings early in the course of the disease.

Introduction

Necrotizing fasciitis (NF) is a progressive, rapidly spreading, inflammatory infection of the deep fascia, with secondary necrosis of the subcutaneous tissues usually associated with trauma and immunodeficiency. [1] A variety of terms are used to describe this condition like Fournier’s gangrene, phagedena, phagedena gangrene, hospital gangrene, progressive bacterial synergistic gangrene (Meleney’s gangrene) and haemolytic streptococcal gangrene and depend on the site of infection. The term NF was first coined by Wilson in 1952, is perhaps most accurate to describe the key features of infectious process. [2] In South East Asian countries it is associated with 30-70% mortality despite advancement in therapy. [3-5] According to the microbiological characteristics, NF is classified as: Type 1 (polymicrobial) and Type 2 (monomicrobial), the former being more common. [6, 7] Type 1 NF commonly occurs in immunocompromised individuals, such as patients with diabetes mellitus or chronic renal failure. The etiologic isolates consist of Gram positive organisms such as Staphylococcus aureus, Staphylococcus pyogenes and Enterococci species. Gram negative aerobes such as Escherichia coli and Pseudomonas species and anaerobic organisms such as Bacteroides and Clostridium species.[8, 9] Classical clinical signs include edema, woody hard texture to subcutaneous tissue, inappropriate pain in relation to affected area with skin vesicles and soft tissue crepitus. The progression of the disease is often fulminant and the prognosis hinges on accurate diagnosis and immediate restitution of appropriate antibiotic treatment. While differentiation from common soft tissue infection such as cellulitis and abscess is critically important due to the paucity of cutaneous findings early in the course of the disease makes the diagnosis challenging. [3] Complications of the disease depend on the causative agent, like Clostridium which can give rise to subcutaneous gas and toxin producing bacteria which lead to toxic shock syndrome. [6] NF is most common in patients with uncontrolled DM, around 25%. [10] Higher blood sugar and low oxygen tension favours microbial growth

Methods

Objectives
The purpose of study was (1) to analyze the clinical
presentation, type of infection and various risk factors, especially association with DM; (2) to determine the bacteriological profile of Type 1 and 2 NF; and (3) to see the resistance pattern of the bacteria isolated.

Materials and Methodology

Medical records of all patients who were diagnosed to have NF at a tertiary care University Hospital were prospectively reviewed for 3 months during the period of May 2010 to July 2010. Fifty patient records were studied and tissue/wound swab was collected after taking informed consent. All patients meeting the clinical and/or histopathology criteria for NF were included. The following criteria were used for establishing the diagnosis.

a) Inclusion Criteria
1. Patient has organisms cultured from tissue or discharge from affected site
2. Patient has purulent drainage at affected site
3. Patient has an abscess or other evidence of infection seen during surgical debridement or histopathological examination.
4. Patient has at least 2 of these signs or symptoms at the affected site with no other recognized cause: localized pain or tenderness, redness, swelling or heat.

b) Collection and processing
Wound swab from all patients diagnosed to have NF was collected after surgical debridement. Blood culture (2 sets preferably) were done if there was any sign of bacteremia. The tissue was homogenized under sterile conditions and was cultured on blood and McConkey agar. The culture plates were incubated overnight at 37°C for aerobic growth. Bacterial growth was identified by the biochemical test and the resistance pattern by disc diffusion method according to CLSI (Clinical and Laboratory Standards Institute) guidelines. The tissue sample or the wound swab was inoculated immediately after collection in RCM (Robertson's Cooked Meat) media for further anaerobic culture and identification. Variables that were examined included age, sex, mode of presentation, site/location of infection, co-morbid illness, etiological factors, admitting diagnosis, investigations, microbiological characteristics, antibiotic sensitivity and the treatment outcome. Statistical Analysis was performed using SPSS statistical software (version16.0).

Results

The minimum age of appearance of NF was 17 years and the maximum being 87 years (mean age=54). There were 46 males (93.6%) and only 4 females (6.4%). 46.8% of the people were agriculturists by profession. Majority of the patients had call region involvement (59.5%). The various sites involved is outlined in Table 1.

Among the risk factors Type 2 DM was present in 21 (44.7%) cases. 12 (25.5%) had hypertension, 3 (6.4%) had liver cirrhosis, 4 (8.5%) had renal failure, 3 (6.4%) had COPD and 2 (4%) had IHD. Hepatitis B, jaundice, seizure disorder, HIV positive status, ear infection and CVA was present in one patient each. In 15 (31.9%) patients, no risk factor could be identified and 12 (25.5%) were aged more than 60 years (Figure 1).

Figure 1. Bar diagram showing various risk factors.

Clinical diagnosis at admission was NF in 23 (48.9%) of the cases, cellulitis in 16 (34%), diabetic ulcer in 4 (8.5%), abscess and others in 2 patients (Figure 2).

Figure 2. Pie chart showing admitting diagnosis.

Etiological factors were soft tissue infection in 20 (42.6%), trauma in 17 (36.2%), thorn prick in 3 (6.4%), snake bite in 2 (4.3%), abscess in 2 (4.3%), RTA, postoperative status, burns in 1 patient each (Figure 3).

Figure 3. Pie chart showing various etiological factors.

Physical findings were varied. Tenderness was the commonest and was seen in 46 patients (97.9%) followed by edema in 43 (91.5%). Erythema, skin vesicles/bulla, soft tissue crepitus, woody hard texture, hypotension, fever, tachycardia, altered mental status, tachypnoea were others and have been summarized in Table 2. All patients responded well to treatment, which was recorded as after 7-10 days and 10-15 days. Investigations were done on admission and repeated as after 7-10 days and 10-15 days and are summarized in Table 3.

Outcome

Mean number of surgical debridements were 1.44. Amputation was done in 3 patients (2 below knee and 1 above knee) and were diabetic. 21.3% underwent ICU care. 2 (4%) patients died, 3 (6%) patients were lost to follow up and 45 (90%) recovered. 40% of the patients had multiple organ failure.

Microbiological characteristics

After culture 20 (42.5%) showed no growth and 27 (57.5%) showed growth (55.6% monomicrobial and 44.4% polymicrobial). Of all the organisms 81.5% were aerobic, 7.4% anaerobic and 11.1% mixed. Out of the 21 diabetic patients, 47% had positive cultures of which 50% were monomicrobial and 50% polymicrobial (Figure 4). Amoxi-clav was the most preferred first line antibiotic for treatment (40.5%) to which 39.5% of the isolates showed resistance and 11.6% were sensitive.

Figure 4. Frequency of organisms isolated.
Discussion

NF is a surgical emergency with a high degree of morbidity and mortality which requires early recognition and aggressive debridement to avoid sepsis. Most of the studies have reported a mortality rate of 30-70%. [10, 11-14] However in our study only two patients died since it may be due to the early diagnosis and debridement of most of the cases or can be attributed to reduced virulence of the microorganism. Although only 2 patients died serious complications like septic shock, renal failure, hypotension, tachypnoea, altered mental status were seen in our patients.

These patients usually have a preexisting disease which increases the susceptibility to infection. Most common ones are DM, age >60 years, hypertension and chronic renal failure. [10] In our study the most common risk factor was DM, which is consistent with other studies. [15, 16] High blood sugar in these patients predispose to an environment of low oxygen tension and a rich substrate for bacterial growth. The most common site of infection was lower limb and this can be explained by the fact that most of our patients were diabetics, who are more prone for lower limb infections. Often it is difficult to make a diagnosis of NF due to paucity of cutaneous findings early in the course of the disease. In our study close to 50% of the cases were diagnosed as NF. However in a study conducted by Wong et al [3] only 14.8% of the cases were diagnosed as NF. Though broad spectrum antibiotics (BSA) were started in these misdiagnosed cases the progression of the disease was not altered which emphasizes the need for accurate diagnosis and emergency surgical debridement. The most common etiological factor was soft tissue infection since most of them merely presented as superficial infection of skin which later on progressed to involve the deeper structures. This would explain the number of cases diagnosed as cellulitis (34%). In our study, edema and tenderness were seen in most of the cases compared to erythema (60%), which may suggest that these to be one of the early signs of the disease. Following debridement and administration of BSA, edema and erythema subsided in majority of the patients. An intermediate stage characterized by the formation of bullae was noted in 50% of the patients. According to Wong it is an important diagnostic clue and should raise the suspicion of NF. [3] Soft tissue crepitus and woody hard texture were inconsistent findings in our patients. Fever and leucocytosis may be considered systemic manifestations of the disease process.

Out of 21 patients who were diabetic 47% had positive cultures, of which 50% were poly microbial and 50% monomicrobial. On the other hand out of 27 cultures which yielded bacterial growth, 55.6% were monomicrobial and 44.4% polymicrobial. Most common organism isolated was Pseudomonas aeruginosa (23%) followed by Klebsiella pneumoniae (16%) and Staphylococcus aureus (16%). Escherichia coli and beta hemolytic Streptococcus is also reported to be an important cause of monomicrobial infection (45.6%) in necrotizing fasciitis. [12] In this study it accounted only for 9% of total growth positive cultures. Bacteriology of NF can be polymicrobial involving combinations of anaerobes and facultative anaerobes. Mixed flora accounts for around 68% of cultures. [12] Anaerobes alone can also be significant pathogens (22%). [14] In this study 7.4% of growth positive cultures had anaerobic organisms and 11.1% had mixed aerobic and anaerobic bacteria.

References

9. Ananya DA, Dellingeni EP. Necrotizing soft tissue infection: diagnosis and management Clin infect Dis
Table 1. Sites of involvement and number of patients affected.

<table>
<thead>
<tr>
<th>Location of infection</th>
<th>No. of patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Limb</td>
<td></td>
</tr>
<tr>
<td>• Calf</td>
<td>28 (59.5)</td>
</tr>
<tr>
<td>• Thigh</td>
<td>1 (2.1)</td>
</tr>
<tr>
<td>• Foot</td>
<td>7 (14.8)</td>
</tr>
<tr>
<td>• Calf+Foot</td>
<td>1 (2.1)</td>
</tr>
<tr>
<td>Upper Limb+Lower Limb</td>
<td>2 (4.2)</td>
</tr>
<tr>
<td>Bilateral Lower Limbs</td>
<td>2 (4.2)</td>
</tr>
<tr>
<td>Neck+Chest</td>
<td>1 (2.1)</td>
</tr>
<tr>
<td>Upper Limb+Trunk</td>
<td>1 (2.1)</td>
</tr>
<tr>
<td>Upper Limb+Trunk+Trunk</td>
<td>1 (2.1)</td>
</tr>
</tbody>
</table>
Table 2. Summary and assessment of physical findings.

<table>
<thead>
<tr>
<th>Physical finding</th>
<th>On admission</th>
<th>After 7-10 days</th>
<th>After 10-15 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eeeema</td>
<td>91.5% (43)</td>
<td>68.9% (31)</td>
<td>18.6% (8)</td>
</tr>
<tr>
<td>Erythema</td>
<td>61.7% (29)</td>
<td>15.6% (7)</td>
<td>2.3% (1)</td>
</tr>
<tr>
<td>Tenderness</td>
<td>97.9% (46)</td>
<td>84.4% (38)</td>
<td>61.4% (27)</td>
</tr>
<tr>
<td>Skin vesicles/bullae</td>
<td>51.1% (24)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Soft tissue crepitis</td>
<td>4.3% (2)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Woody hard texture of skin</td>
<td>10.6% (5)</td>
<td>2.2% (1)</td>
<td>2.3% (1)</td>
</tr>
<tr>
<td>Fever</td>
<td>55.3% (26)</td>
<td>6.4% (3)</td>
<td>0</td>
</tr>
<tr>
<td>Hypotension</td>
<td>12.8% (6)</td>
<td>4.3% (2)</td>
<td>0</td>
</tr>
<tr>
<td>Tachycardia</td>
<td>25.5% (12)</td>
<td>6.4% (3)</td>
<td>2.2% (1)</td>
</tr>
<tr>
<td>Tachypnoea</td>
<td>14.9% (7)</td>
<td>4.3% (2)</td>
<td>2.2% (1)</td>
</tr>
<tr>
<td>Altered mental status</td>
<td>6.4% (3)</td>
<td>6.4% (3)</td>
<td>2.2% (1)</td>
</tr>
</tbody>
</table>
Table 3. Summary of investigations.

<table>
<thead>
<tr>
<th>Investigations</th>
<th>On admission*</th>
<th>After 7-10 days*</th>
<th>After 10-15 days*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Blood Count</td>
<td>17,360 (5200-41200)</td>
<td>13,842 (7200-22400)</td>
<td>10,821 (5300-17100)</td>
</tr>
<tr>
<td>Platelets</td>
<td>2,44,304 (27000-935000)</td>
<td>2,62,350 (31500-643000)</td>
<td>4,03,363 (99000-718000)</td>
</tr>
<tr>
<td>Blood Urea</td>
<td>59.27 (13-221)</td>
<td>44.17 (0-193)</td>
<td>32.33 (12-78)</td>
</tr>
<tr>
<td>ESR</td>
<td>87.96 (6-140)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Random Blood Sugar (RBS)</td>
<td>131.18 (0-475)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sodium</td>
<td>131.82 (117-143)</td>
<td>131.88 (118-144)</td>
<td>131.88 (118-144)</td>
</tr>
<tr>
<td>Potassium</td>
<td>4.32 (2.8-6.4)</td>
<td>4.24 (2.6-11.7)</td>
<td>4.25 (3.5-5.1)</td>
</tr>
</tbody>
</table>

*Mean values
Figure 1. Bar diagram showing various risk factors.

Clinical diagnosis at admission was NF in 23 (48.9%) of the cases, cellulitis in 16 (34%), diabetic ulcer in 4 (8.5%), abscess and others in 2 patients (Figure 2).

Figure 2. Pie chart showing admitting diagnosis.
Figure 3. Pie chart showing various etiological factors.

Figure 4. Frequency of organisms isolated.
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