

Necrotizing fasciitis: The role of early wide surgical debridement and diversion colostomy

Najeeb S. Jabbo, FRCS*; **Haqqi I. Razzouki, CABS****; **Sattar J. Kadhum, CABS, MRCS****

* Department of surgery, Al-Mustansiriya Medical College, Baghdad, Iraq.

** Department of surgery, Al-Yarmouk Teaching Hospital, Baghdad, Iraq.

Abstract

Background: Necrotizing fasciitis is a rare, progressive serious bacterial infection of skin, subcutaneous tissue and fascia. It frequently affects the perineum and genital areas in which local redness and edema progress rapidly to necrosis and hemorrhagic bullae. Because of this rapid progression, it is important to diagnose and treat necrotizing fasciitis quickly.

Aims: To evaluate the role of early wide surgical debridement and diversion colostomy in improving the prognosis.

Methods: A case series study was done at Al-Yarmouk teaching hospital, involving all patients diagnosed with NF and treated by the authors for a three-year period. Those patients were assessed clinically on admission and followed closely. All relevant demographic, clinical, biochemical and radiological data were documented. The methods of treatment with special emphasis on surgical debridement were recorded. The clinical outcome, morbidity and mortality were recorded.

Results: Seventeen cases were included, 11(64.7%) male and 6(35.3 %) female. The mean age was 51[±]7 years and 64.7% were diabetics. The primary sites affected were the perineum and scrotum, seen in 7 cases (41.1%). The main presentation was excessive local pain, seen in 15 cases (88.2%) and 15 patients had initial constitutional symptoms (88.2%). Blood cultures and culture of debrided material revealed mainly group A streptococci and proteus. Early wide debridement was done in 9 cases (52.9%) and those patients had earlier healing and shorter stay in hospital (mean stay 20 days). Initial local debridement was done in 6 cases (35.2%) and the mean duration of stay in hospital was 40 days. Diversion colostomy was done for 3 patients (29.4%) and all had early healing without mortality. There were 3 deaths (17.7%), two of them had initial local debridement.

Conclusions: Early wide surgical debridement is essential and improves healing, shortens hospital stay and decreases mortality. Diversion colostomy is helpful in some cases but needs further evaluation.

Keywords: Necrotizing fasciitis, debridement, colostomy

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Address for Correspondence:

Prof. Dr. Najeeb S. Jabbo

Department of surgery,
Al-Mustansiriya Medical College,
Baghdad, Iraq

INTRODUCTION

Necrotizing fasciitis (NF) is a progressive, fulminant bacterial infection of the skin and subcutaneous tissues, that spreads rapidly through the fascial planes causing extensive tissue destruction.

The condition was described first in 1871 by an army surgeon named Joseph Jones during the American Civil War ⁽¹⁾. It was named "necrotizing fasciitis" in 1952. During the last two centuries, sporadic cases were described and usually remained restricted to military

hospitals during wartime with some civilian population outbreaks.

The incidence worldwide varies from 3.8 new cases per 100000 each year in Australia to 4.3 cases per 100000 in the USA. ⁽²⁾ If untreated, it is invariably fatal. The overall mortality reported in the published literatures ranges from 25% - 73%. ^(3,4)

Most cases of NF presents with a known etiology, and are classified as secondary NF. Primary or idiopathic NF occurs in the absence of a known etiology. The underlying pathogenesis is still unknown. It is important to consider that idiopathic NF exists, and that it is a distinct clinical entity. ⁽⁵⁾

NF is classified according to the microbial source of infection into 4 types;

Type I (80%) infections are polymicrobial and causative bacteria include a combination of Gram positive cocci, gram negative bacilli and anaerobes. ⁽⁶⁾ They frequently occur in the perineal and trunk regions in immunocompromised patients, particularly diabetics and patients with peripheral vascular disease. Other risk factors include obesity, chronic renal failure, HIV, alcohol abuse, abscess, I.V. drug use, blunt or penetrating trauma, insect bites, surgical incisions, indwelling catheters, and rarely perforation of the gastrointestinal tract (e.g. carcinoma or diverticulitis). ⁽⁶⁾

Type II (18%) is far less common. It is caused by the group A streptococcus either alone or in combination with staphylococcus aureus, classically located on the extremities.

Type III (1%) is a Gram- negative mono-microbial infection. Infection caused by *Vibrio* spp. is a variant form.

Type IV (Fungal) (1%) is very rare and is caused by candida spp.

Microbial invasion of the subcutaneous tissues occurs either through external trauma or direct spread from a perforated viscus or urogenital organ. Bacterial growth within the superficial fascia releases a mixture of enzymes and endo- and exotoxins causing the spread of the infection through this fascia. This process results in poor microcirculation, ischemia in affected tissues, and, ultimately cell death and necrosis. Thrombosis of small veins and arteries passing through the fascia causes profound skin ischemia. ⁽⁷⁾

Many patients with NF are first diagnosed as cellulitis, delaying appropriate management and increasing the

incidence of morbidity and mortality. The most critical early distinctive symptom of NF is a disproportionate level of pain compared with physical findings. Blisters or bullae formation is an important but late feature of NF. Lymphangitis is rare in NF. ⁽⁷⁾ The rate of progression of NF can varies from several days from presentation to, in contrast, a rapid deterioration and death within hours from presentation. Patients with NF in the later stages of the disease often develop multiorgan failure. Therefore, a high index of suspicion in patients with features suggestive of NF should prompt immediate management.

Diagnosis of NF is essentially clinical. The golden standard is surgical exploration and tissue biopsy.

Laboratory tests include a complete blood count (CBC), which may reveal leucocytosis, coagulopathy and thrombocytopenia. Anemia can be dilutional from hemolysis. Raised serum creatinine kinase indicates myonecrosis, and is due to the effects of circulating toxins or ischemia. ⁽⁸⁾ Hypocalcaemia is a sign of fat necrosis. Inflammation and necrosis cause raised C- reactive protein (CRP). Abnormal renal and hepatic function, with metabolic acidosis, and high serum lactate concentrations may occur. Blood cultures are positive in 11 patients (60%) for group A streptococci. Percutaneous needle aspiration is useful but tissue biopsy is the investigation of choice. A scoring system was designed to distinguish NF from other soft tissue infections. The most reliable indicators were CRP, creatinin, haemoglobin, WBC count, sodium, and serum glucose. ⁽⁹⁾ However, the results of these blood tests cannot be solely relied upon to make an immediate diagnosis.

CT-scan, ultrasound and MRI have all been used to image NF, but imaging is not a diagnostic procedure and should not delay surgery.

Early diagnosis, aggressive resuscitation, surgical debridement, antibiotic therapy, and supportive intensive care are necessary for managing patients with NF. Initial management includes patient stabilization, including supplemental oxygen, cardiac monitoring, and intravenous fluid administration. Broad-spectrum antibiotics should be started immediately as well as aggressive surgical debridement. Several studies have shown that the most important factor affecting mortality is timing and adequacy of initial surgical debridement. ⁽¹⁰⁾ The infection is rarely eradicated after a single debridement and serial debridement are almost always needed.

Newer modalities of therapy include I.V Immunoglobulin therapy and hyperbaric oxygen. There is very limited evidence which suggests a decreased mortality from using immunoglobulin in group A streptococcal NF. ⁽¹¹⁾

Fecal diversion has been suggested in the management of NF. ^{(12) (13)}.

The aim of this study is to determine the role of early radical surgical debridement and diversion colostomy in improving the outcome of NF.

PATIENTS AND METHODS

This is a case series study of patients with NF, managed by the authors at Al- Yarmouk Teaching hospital from Jan. 2010 - Dec. 2013. All patients are clinically assessed on presentation, admitted and followed closely. Demographic and clinical data were collected. All patients were resuscitated with I.V. fluids and systemic antibiotics were started immediately after taking a swab for culture and sensitivity. Investigations including CBC, renal and liver function tests were requested for all patients. Blood culture and other tests such as calcium and CRP were done in selected cases. Imaging investigations (plain x-rays, ultrasound, CT-scan and MRI) were done patients with uncertain diagnosis. Details of medical management, the types of antibiotics used and the surgical management in detail were also recorded. Local or limited debridement comprised removing all clearly gangrenous or necrotic skin and subcutaneous tissues. In wide or extensive debridement, tissues with doubtful viability or compromised vascular supply were also excised down to a level where visible active bleeding could be observed. Patients with diversion colostomy were studied in regards to the indication for colostomy, operative details, post-operative course and complications. The clinical outcome after management with colostomy and without colostomy was compared..

RESULTS

There were 17 diagnosed cases of NF, 11 (64.7%) males and 6(35.3%) females. Nine patients were in the sixth decade of life (52.9 %). The mean age was 51±7 years (Table 1). Eleven patients were diabetic (64.7%), 9 of them with type II diabetes and 2 with type I. Other comorbid conditions encountered were: hypertension (3 patients), chronic steroid usage (3 patients), ischemic heart disease (2 patients) and one patient with obstructive airway disease. There was recent history of trauma in 3patients (17.7 %), one due to shell injury to the thigh with arterial damage and the other due to perineal laceration.

There was recent history of surgical operation or therapeutic procedure in 4 patients (23.5%): explorative laparotomy for bladder injury, elective inguinal hernia repair, suprapubic cystostomy and difficult urethral catheterization. Two patients has perianal abscess and one has infection at intravenous injection site.

The primary site of the infection was in the perineum in 4 patients (23.5%). , scrotum in 3, thigh in 2, abdominal wall in 2, genitalia in 2, and one case in the gluteal region, inguinal region, the leg and the forearm for each. All the patients had systemic symptoms mainly fever in 15 patients (88.2%), rigors in 7(41.1%), nausea and/or vomiting in 5(29.4%), tachypnea and/or dyspnea in 4 (23.5%), initial jaundice in 3(17.6%), oliguria in 2 and initial disturbed level of consciousness in 2. In most patients, the vital signs were initially within normal. However, with the progression of the disease, 4 patients (23.5%) developed features of shock. The main local symptom was severe pain which was present in 15 patients (88.2%). There was initial erythema and/ or discoloration in 14 (82.3%). All patients had initial superficial necrosis and/ or ulceration which progressed within 1-5 days to deep necrosis or frank gangrene.

Biochemical investigations were done for all patients and repeated accordingly. During their stay in hospital, 16(94.1%) patients had anemia, 14(82.3%) had leukocytosis, 13(76.4%) had raised ESR. There was hyperglycemia in 11(64.7%), hypoglycemia in 2(11.7 %), elevated urea and/ or creatinin in 5(29.4 %) and elevated bilirubin in 3 patients(17.6 %).

Culture and sensitivity was done for all patients. It revealed a mixed growth of anaerobic bacteria and streptococci. Blood culture was done for all patients and was positive for group A streptococci in 7 patients (41.1%).

Systemic antibiotics were started immediately after taking a swab for culture and sensitivity. They were changed according to the results of the culture. The main antibiotics used were: Cefotaxime, Ceftriaxone and Meronim . Metronidazole was usedfor all cases..

Regarding surgical management, 9 patients (52.9%) had early wide and extensive surgical debridement. In 6 patients (35.2%), the initial debridement was limited or local but in all of them it was necessary to proceed to extensive debridement later. In one patient, the initial procedure was fasciotomy only but local debridement was done later. In one patient, a foreign body (missed gauze pack) was removed first, but local debridement was

needed later. All patients had multiple admissions to theater with an average of three times. Additional procedures were: orchiectomy in 3(17.6%) patients and delayed skin graft in 2(11.8%).

Diversion colostomy was done for 5 patients (29.4%). The indication for the colostomy was the presence of severe and wide necrosis with initial wide excision and debridement. In those patients, a long period of treatment was anticipated with a high chance of soiling of the exposed raw area. The colostomy in the form of proximal transverse loop colostomy was done in 3 patients and sigmoid colostomy in 2 patients. In other patients with perineal and scrotal injuries, the soiling was minimal, and was managed with frequent change of dressings and the use of diapers.

Regarding the clinical outcome, there was full recovery in 14 patients but with variable period of time. The time needed for complete healing of the necrosis was 20-55 days with a mean of 33 days. The patients were followed for a period of 3 months.

The mean hospital stay was less in the group treated by initial wide debridement (20 days), compared with the group who were treated initially more conservatively (40 days).

There were 3 deaths in this study (17.6%). They had an extensive affected area at presentation and all were diabetic. Two had initial local debridement and one had initial wide debridement. None of those patients had a diversion colostomy.

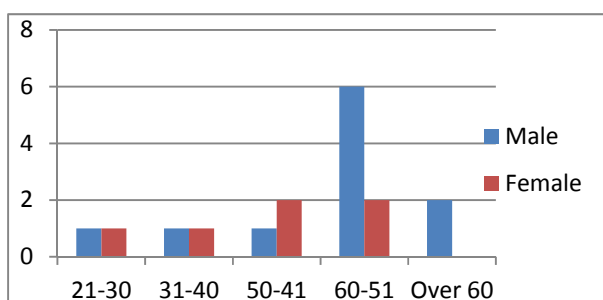


Figure 1. Age and gender incidence.

DISCUSSION

Necrotizing fasciitis is a life-threatening, invasive soft-tissue infection that is characterized by widespread, rapidly developing necrosis of the subcutaneous tissue and fascia. In this study, the number of male patients with the diagnosis of NF was higher than the number of female

patients (11:6). In the study by Fazeli ⁽¹⁴⁾, the male to female ratio was 2.6:1. This can be explained by relatively higher prevalence of perineal and genital involvement in males. The average age of patients in this study was 51.7 years. In the study by Fazeli, the average age was 45.4 years ⁽¹⁴⁾ and was 53.8 years in another study by Mazzaferri ⁽¹⁵⁾.

The most common predisposing disease was diabetes mellitus (64.7%). The incidence in other studies was 50%. ⁽¹⁴⁾ Diabetes is associated with an immunocompromised state and increased susceptibility to infection. In this study, 4(23.5%) patients had a recent abdominal surgical operation complicated by infection and 2(11.7%) patients had a recent history of penetrating trauma. These risk factors and others are mentioned in the literature. The use of NSADs has been associated with development of NF. ⁽¹⁶⁾

Four patients had perineal involvement (23.5%). In 3 the scrotum was involved, thigh, abdominal wall and genitalia in 2, and lower and upper limb in 1. In other studies, 50% had perineal involvement and 50% had limb involvement. ⁽¹⁴⁾ Another study by Parenti ⁽¹⁶⁾, showed a higher limb involvement (81%).

As a result of infectious and inflammatory nature of this disease, leukocytosis and increased ESR are expected. In this study, this was noticed in 82.3% and 76.4% respectively. Similar results were seen in other studies. ⁽¹⁴⁾

Researchers have attempted to identify laboratory markers that may help with early diagnosis of NF. Age older than 50 years, hemoglobin < 11 g/dL, serum creatinin > 1.5 mg/dL, WBC count > 40,000 cells/mm, temperature > 36 C, a heart rate > 110 beats/minute, glucose > 180 mg/dL, serum sodium > 135 mmol /L and an elevated CRP have been found to correlate with development of NF. ⁽⁹⁾

The diagnosis in this study was mainly clinical. In NF, diagnosis is complicated by the non-specific findings of infection and the infrequent incidence of the disease. Signs that the infection has spread into the deep fascia include: failure of initial antibiotics therapy, hardening of the superficial fascia, bullous lesions, necrosis, and systemic signs of toxicity. ⁽¹⁷⁾

In this series the initial symptoms were severe pain (88.2 %) and local erythema (82.3%). This was followed shortly in all patients by necrosis and ulceration. Other series also mentioned pain out of proportion to the visual appearance. ⁽¹⁸⁾ There were also erythema, edema, and tenderness at the site.

In this series there was history of trauma in 2 patients. The patient may recall trauma to the skin within the past 48 hours; however this is not reliable during diagnosis. ⁽¹⁸⁾

In this series there were three deaths (17.7%). Mortality rates vary among reports, averaging 34%, depending on time to diagnosis. ⁽¹⁹⁾ So high suspicion of this serious pathology with a prompt surgical management can be factors reducing mortality. This is recommended by many studies which report a lower mortality rate with the early diagnosis and immediate surgical procedures. ⁽²⁰⁾

Treatment should primarily involve surgical debridement and ancillary measures such as antibiotics and supportive care such as hyperbaric oxygen therapy or intra-venous immune gamma-globulin. In this series, this was done to all patients; extensively in 52.95 % and locally in 35.2%. These patients may require several wound debridement to ensure eradication of all infected tissue. In this series, the average admission to theater was three times. Vacuum-assisted closure devices may be advantageous over traditional wound dressings to promote wound healing. ⁽²⁰⁾

In our study, all patients received antibiotics covering gram positive, gram negative and anerobic bacteria, until the results of culture and sensitivity were available. Although surgical debridement remains the mainstay of overall care, antibiotics should be used to treat the secondary bacteremia and underlying infected tissue. Gram stain and cultures should be performed on the surgically removed tissue and blood to guide therapy. Antibiotics should empirically cover the most likely causative agents, while taking into consideration drug-resistant bacteria and local resistance rates ⁽¹⁷⁾

In this study, patients who were treated by initial wide debridement had better clinical outcome compared to those treated by initial local debridement. The mean duration of healing (20 days) and the stay in hospital was less in the first group. Also, the mortality was relatively less.

A study by Bilton showed that aggressive surgical treatment of NF serves to decrease mortality ⁽¹⁰⁾ They assigned the patients to 2 groups: Group A (31%) who had delay in therapy or inadequate preliminary therapy and Group B (69%), who underwent surgical aggressive treatment from the outset. Mortality in group A was 38% and in group B was 4.2%. The difference in mortality was found to be statistically significant ($P= 0.0007$). ⁽¹⁰⁾ Another study by Aasen ²¹ stressed the importance of radical surgical excision. The overall mortality rate in their study was 11%. They showed that the incidence of

amputations and other complications increased if aggressive surgical treatment is delayed for 4-8 days. They used hyperbaric oxygen on most of their patients. Majeski showed that there was no mortality in cases treated with immediate wide surgical excision. ⁽¹⁹⁾ They used frozen section tissue biopsy for early accurate diagnosis of NF.

Controversy exists regarding how much tissue should be initially excised because the skin may often appear normal. Andreasen ²² examined the normal –appearing tissues microscopically and reported that the tissues had extensive early vascular thrombosis as well as vasculitis. Their findings indicate that these tissues, though they have a normal appearance, have a high potential for full-thickness loss.

In this study, diversion colostomy was used in 4 patients (23.5%). There was full recovery in this group with no mortality. In the study by Jeffery, a colostomy was done for 7 patients out of 30. ⁽²³⁾ They advised the very selective use of diversion colostomy. Diversion procedures were reported in the study by Khan ²⁴ including a colostomy (5.3%) and a cystostomy (15.8%) and contributed to better prognosis. In another study from Korea ²⁵, there were 12 episodes of fecal diversion and 5 of urinary diversion and those patients had lower mortality.

Palmer ²⁶ recommends fecal diversion in cases of severe necrotizing perineal infection, especially where the source of infection is from the colon-rectum. Some authors have recommended diversion only when the sphincter is infected, there is demonstrable rectal perforation, if the rectal wound is large or if the patient is immunocompromised. ⁽²⁷⁾ Other authors ²⁸ suggest that a colostomy is virtually never needed, even if massive necrosis is present. In the study by Moorthy ⁽¹³⁾, 4 colostomies were performed. One patient died because of bronchopneumonia. The indication for colostomy in these cases was the persistence of systemic sepsis in spite of optimal radical debridement.

Conclusions:

Early recognition is important in the management of NF and the main diagnostic modality is clinical. Early wide surgical debridement is essential to early healing, shorter stay in hospital and improved survival. Diversion colostomy is helpful in selected cases but its role needs further studies.

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