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Necrotizing Fasciitis in Diabetes

Introduction

Diabetic foot complications remain the leading cause of hospitalization among people with diabetes due to foot ulcerations, cellulitis or other soft tissue infections. Among soft tissue infections, necrotizing fasciitis (NF) is a fulminant and rapidly progressive infection primarily involving the fascia and the subcutaneous tissue. Since diabetic patients are more prone to neuropathic ulcers and have peripheral vascular disease (PVD), they are more susceptible to this condition. Some studies have identified that patients with diabetes contribute upto 70% of patients with NF. However, it is often diagnosed at late stages leading to morbidity and mortality. In this paper, we report a series of 12 diabetic patients with clinical features of NF and try to assess the prognostic features of this condition.

Necrotizing fasciitis is a fulminant and rapidly progressive infection primarily involving the fascia and the subcutaneous tissue. It is of utmost importance to diagnose necrotizing fasciitis at an early stage.

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Clinical material

We did a retrospective analysis of 247 patients who were admitted as inpatients at Dr. Mohan's Diabetes Specialities Centre from August 2005 to January 2006, for soft tissue infections requiring surgical intervention. The reason we chose this specific time period is that during this time, Chennai and surrounding areas in Tamil Nadu state, received unprecedented rains and hence the number of patients admitted with severe soft tissue infections suddenly increased. Among these 247 patients of soft tissue infection, 12 patients (5%) were clinically suspected as cases of necrotizing soft tissue infection and were included in this analysis. Outcome of these patients was measured in terms of morbidity and mortality. Morbidity was measured as, patients requiring amputation either minor or major amputations or extensive loss of soft tissue requiring skin graft. The average duration of hospital stay with requirement of a high-dependency unit (HDU) or intensive care unit (ICU) was also studied.

Figure 1a: Intraoperative picture with extensive skin and subcutaneous tissue necrosis.

Figure 1c. Healthy granulation tissue (6 weeks later).

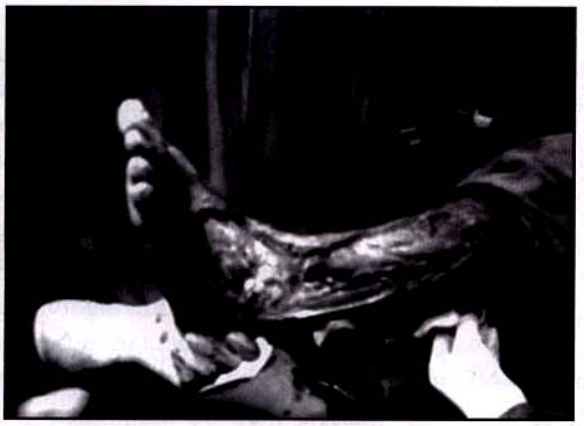

Figure 1b. Exposed muscle and involvement of fascia between muscle layers.

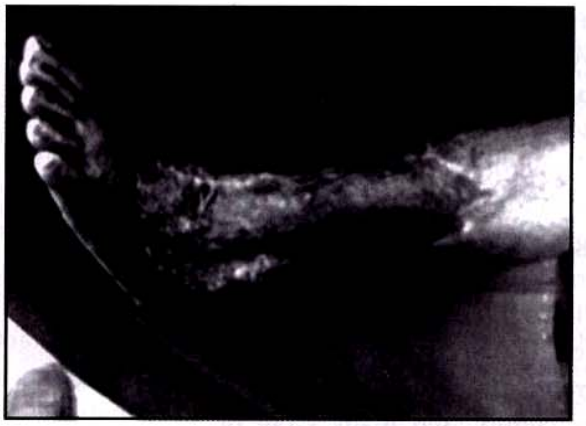

Figure 1d. After split skin graft (after 10 weeks).

Figure 1a-1d shows the clinical course of a 55-year-old male patient who presented with cellulitis with extensive skin involvement and wound healing and after grafting showing complete healing.

Intervention

All patients were managed by controlling diabetes and infection control with broad-spectrum antibiotics along with metronidazole. Wound debridement with fasciotomy and extensive resection was done within 24 hours of hospitalization. Topical wound care in the form of bedside debridement with regular dressing followed by split skin graft for extensive raw area was done and whenever required HDU or ICU care was given to the patient.

Results

A total of 12 patients of the 247 patients (5%) with foot infections were clinically suspected to have NF. These 12 patients were in the age group of 45-70 years with diabetes duration ranging from 5-30 years. Ten patients (83%) had HbA_{1C} of 9% or greater indicating poor control of diabetes. Bilateral sensory neuropathy was assessed clinically by biothesiometry and was present in all patients. Six of these patients (50%) presented without any prior history of foot infection, while the remaining six had a past history of neuropathic ulcer or wound or a surgery in the foot. The average duration of the complaints, until referral to hospital ranged from 1 to 2 weeks for 10 patients while the other two patients were referred after 2 weeks.

All patients presented with

pyrexia, swelling, severe pain with extensive tenderness over leg or foot. Presence of crepitus with blackening of the skin was the predominant feature and clinical clue to the presence of NF.

On laboratory analysis, all patients had leucocytosis >13,000/mm^3 with increased polymorphs, severe hyperglycemia, hyponatremia and hypoalbuminemia of variable severity. One patient had repeated episodes of hypoglycemia due to septicemia. Anemia (Hb < 10 g%) was noticed in two patients. Five patients had mild elevated blood urea and serum creatinine levels. Pus culture showed polymicrobial nature of infection predominantly gram-negative organisms and *Pseudomonas aeruginosa* was the most common, followed by gram-positive aerobic bacteria (e.g., *Staphylococcus aureus*). One patient had negative pus culture. On plain X-ray of affected lesions, gas shadow was present in eight patients (66.6%). Three patients (25%) had peripheral vascular disease with ankle - brachial index ranging from 0.6 to 0.8 (normal >0.9).

All patients underwent aggressive surgical debridement in the form of fasciotomy with wide resection of necrotic skin, with or without prior bedside debridement, within 24 hours of hospitalization. Eight patients required either HDU or ICU stay during postoperative period. One patient underwent Ray's amputation while three patients required a below knee amputation. Two patients who presented late in the course of disease with severe metabolic derangement and septic encephalopathy expired on the fifth day of admission. The average duration of hospital stay was 2 weeks.

Discussion

Though NF is relatively uncommon it is very important to diagnose this condition because of the high mortality and morbidity. Diabetic patients are more susceptible to NF. Advanced age, poor glycemic control, long duration of diabetes, sensory neuropathy and delayed referral are poor prognostic factors. Polymorpho nuclear leukocyte dysfunction with altered chemotaxis, phagocytosis, antibacterial activity due to poor glycemic control, contribute to impaired defense against infection. Limb ischemia could be an additional factor. Predisposing and triggering factors for NF are summarized in Table 1.

Inadequate response to antibiotics for cellulitis and presence of bullae and severity of pain should raise suspicion of NF clinically. In long standing wounds, the pain is possibly associated with an increase in exudate levels and may indicate change in bioburden of wound. The pain which is disproportionate to the extent of skin involvement, is an important feature of NF. This "iceberg" effect represents the course of infection through the underlying tissue planes without a corresponding devitalization of overlying skin until much later in the disease. The extent of lesion is finally recognized when the vascularity of the skin is compromised through septic thrombosis and the subsequent skin infarction leading to gangrenous necrotic skin[6]. The other classical signs of NF are systolic blood pressure <90 mm of Hg, bullae, necrotic skin, crepitus and gas on X-ray. However, not all features need to be present in all patients. On biopsy, the following findings may be seen: Subcutaneous tissue necrosis with thrombosis of blood vessels may be associated with myonecrosis. Clinical features of early and later stages of NF along with laboratory investigations and factors associated with favorable prognosis in NF are summarized in Tables 2, 3 and 4.

Table 1
Triggering and predisposing factors for NF

Triggering factors	Predisposing factors
• Chronic wounds	• Age >50 years
• Previous surgery	• Longer duration of diabetes
• Soft tissue infections	• Poor control of glycemia
• Blunt/penetrating trauma	• Peripheral vascular disease
• Muscle injuries	• Obesity
• Change in bioburden of wounds	• Sensory neuropathy
	• Microangiopathy

Table 2

Clinical findings of NF

Early features	Late features
• Pain	• Severe pain and tenderness disproportionate to skin changes
• Cellulitis	• Skin discoloration (purple/black)
• Pyrexia	• Blisters or bullae
• Tachycardia	• Crepitus
• Swelling	• Severe sepsis
• Induration	• Multiorgan failure
• Impaired sensations	

Table 3

Laboratory features of NF

Laboratory investigations
- Leucocytosis
- Hypoalbuminemia
- Altered coagulation profile
- Abnormal renal function
- Acidosis

Plain radiography
- Soft tissue gas

Incisional exploration/ biopsy

Confirmation of diagnosis

Table 4

Factors associated with favorable prognosis in NF

- Early suspicion of NF
- Prompt diagnosis
- Immediate resuscitation
- Early surgical radical debridement
- Good glycemic control
- Reconstructive surgery
- Psychological support

It is of utmost importance to diagnose NF at an early stage. The leucocytosis and hyponatremia have been proposed as a two-factor model for early suspicion of NF, which is classically seen in all these cases[2]. With help of larger studies, it is possible to develop risk scoring system for early suspicion and diagnosis of NF, based on risk factors, clinical signs, laboratory and radiological investigations. This can be confirmed by tissue biopsy or frozen section biopsy. Once diagnosed, the treatment of choice for NF is fasciotomy with wide resection. Time between hospital admission and first surgical debridement is a crucial factor in minimizing both morbidity and mortality due to NF.

Suggested readings

1. Hasham S, Matteucci P, Stanley PR and Hart NB. Necrotizing fasciitis. *Br. Med. J.* 2005;330: 830-833.
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3. Bagdade JD, Root JK and Bulder RJ. Impaired leukocyte function in-patient with poorly controlled diabetes. *Diabetes* 1974;23: 9-15.
4. Elliot D, Kufera JA and Myer RA. The microbiology of necrotising soft tissue infections. *Am. J. Sur.* 2000;179:361-366.
5. Headley A. Necrotising soft tissue infections; A primary care review. *Am. Fam. Physician* 2003;68:323-328.
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Inhalable Insulin Approved

An inhaled form of insulin, the first new way to get the hormone into the body has received the US FDA approval. Its introduction marks the biggest change in diabetes treatment in decades, although there are still some long-term safety questions, and it's not clear yet whether it will be more expensive than standard insulin.

The product is likely to be to become available by June or July.