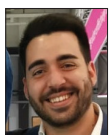
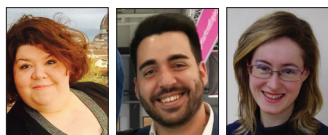


Identifying and treating necrotising fasciitis: a clinical challenge



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Necrotising fasciitis is a life-threatening infection that requires early diagnosis followed by prompt surgical and antibiotic treatment. If not treated rapidly, it quickly progresses, resulting in death. It is an insidious condition that is often underdiagnosed. The authors report the case of a man who presented with necrotising fasciitis in whom prompt management saved both his limb and his life.

Necrotising fasciitis (NF) is a rapidly progressive, life-threatening infection that involves the skin, soft tissue and deep fascia (Miller et al, 2005). It has an overall reported prevalence of 0.40 cases per 100,000 population (Laul et al, 1997). The disease can involve all parts of the body, but the lower extremities are recognised to be the most common sites of infection, with the abdomen, perineum and upper limbs less frequently affected (Espandar et al, 2011).

In the majority of cases, NF occurs after a trauma — generally an external injury. Abdominal NF can be subsequent to hernias, complicated diverticulitis or enteric perforation (Misiakos et al, 2014). Even in the presence of these conditions, predisposing factors are required to develop a NF framework (Martinschek et al, 2012). The most important of these factors is diabetes, due to the diffuse ischaemia and immunopathy associated with this disease (Yeung et al, 2011). Other risk factors include renal failure, heart failure, liver cirrhosis, obesity, immunodeficiency and hypertension (Fontes et al, 2000).

The diagnosis of NF is based on the clinical findings and on dramatic systemic signs developing within hours of onset. Despite this, the classic triad of symptoms — local pain, swelling and erythema — is rarely present in clinical practice. NF encompasses a wide range of severity (Bisno and Stevens, 1996). Often, the disease begins with atypical symptoms and reduced inflammatory reaction. It induces abnormalities in vital signs, such as tachycardia, hypotension, fever and tachypnoea,

only in the later stages. This finding is frequent in immunocompromised subjects, such as people with diabetes. These patients have an increased risk of mortality and undergo more proximal-level amputations than people without diabetes (Bisno et al, 2000). Cutaneous involvement that is not initially well demarcated may progress to blisters and bullae (Majeski and Majeski, 1997).

In the case of equivocal diagnosis, the most important test is the 'finger test', which consists of making small incision in the skin to reach the fascia. This is diagnostic if the finger does not meet tissue resistance or induce bleeding when inserted through the incisions. The purulent material that leaks out in such cases is thinner than expected for the lysis of neutrophils and is caused by lecithinases and other bacterial toxins (Wang and Hung, 2004). Blood abnormalities, when present, are usually limited to leucocytosis and increased inflammatory indexes until the later stages of the disease. Diagnostic imaging and further evaluation can be very useful in equivocal cases but their timing should not delay surgery (Shimizu and Tokuda, 2010).

Prompt and effective therapeutic management can reduce the mortality rate from approximately of 100% in the absence of treatment to about 22% (McHenry et al, 1995). Extensive emergency surgical debridement consisting of fasciotomy, necrosectomy and the removal of all non-viable tissues is the mainstay of treatment and must be performed as soon as possible after diagnosis (Wong and Shih, 1992). This procedure is life-saving

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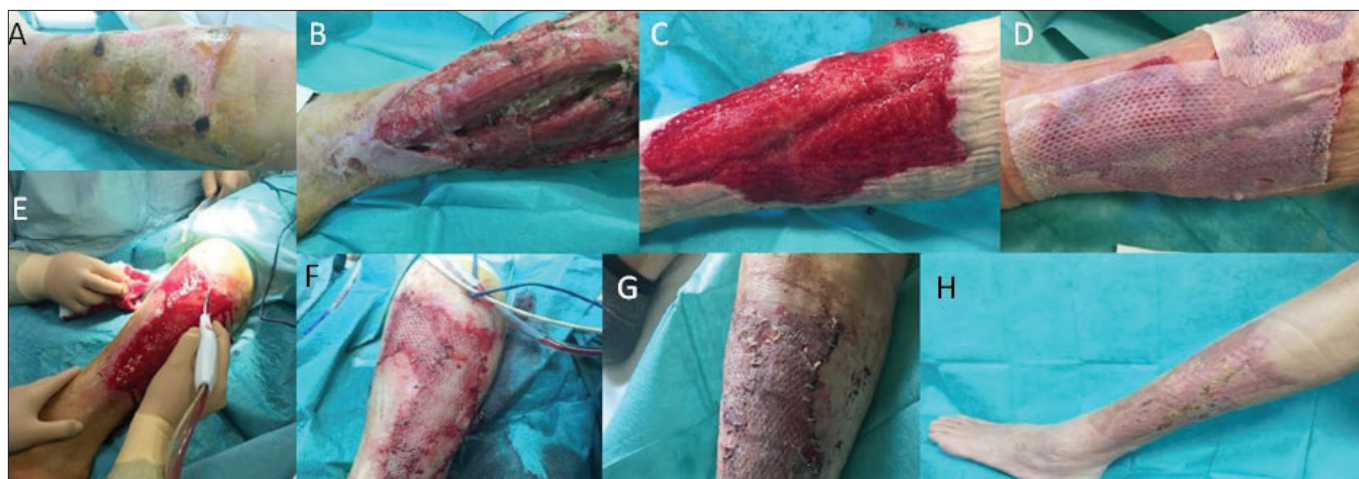


Figure 1. A) The leg at the moment of diagnosis: the presence of oedema, necrosis, paleness and slough are typical of the compartmental syndrome which frequently associates to necrotising fasciitis. B) Two days after surgery, the wound was clean and granulating. C) After 4 weeks of negative pressure wound therapy with instillation, the wound was ready for grafting. D) Porcine skin dermal substitute was applied. E) The remaining devitalised tissues were removed by hydrosurgical debridement. F) and G) The skin graft was successful (1 and 10 days after application); H) The wound fully healed a month later.

and any delay is associated with increases in amputations and mortality (Tang et al, 2011). In addition to surgical treatment, empirical systemic antibiotic therapy should be started immediately and then adapted based on the results of microbiological culture in the laboratory (Naqvi et al, 2009). New therapies, such as negative pressure wound therapy (NPWT), can aid the healing of surgical wounds initially left open for drainage and to prevent compartmental syndrome development (Moues et al, 2007).

Case report

In July 2017, a 52-year-old man with a 10-year history of type 2 diabetes was hospitalised in an internal medicine ward of Pisa University Hospital with left leg and ankle oedema. The oedema had developed following traumatic left ankle sprain that had not resolved with home rest. On admission, his general physical examination, his vital signs were within normal ranges and the patient had no fever. There was a post-traumatic wound on the anterolateral surface of the left leg. The patient's white blood cell count was 23,000/ml, C-reactive protein was 27 ng/ml and procalcitonin was 1.23 µg/L. Plain X-rays of the foot and ankle were negative and duplex scanning excluded the presence of deep vein thrombosis or peripheral arterial disease. Ultrasound soft tissue analysis showed a grade 3 lesion on the long tendon flexor of the first toe and a bulky leg haematoma. Computed tomography and magnetic resonance confirmed the presence of

haematoma at the level of the third distal of the soleus muscle and identified oedema in the lateral head of the gastrocnemius. Both wound and blood culture samples detected methicillin-susceptible *Staphylococcus aureus*. Systemic therapy with piperacillin/tazobactam and daptomycin was promptly started. Despite this, the patient's white blood cell count and C-reactive protein level kept rising.

On day 26 after admission, a consultation with the Diabetic Foot Section was requested. The wide sloughy lesion on the anterolateral surface of the leg had multiple areas of eschar and the surrounding area was macerated. The limb was swollen, red and painful [Figure 1A], with palpatory tenderness. The clinical picture was diagnostic for NF. The patient underwent extensive left leg fasciotomy within 70 minutes of the diagnosis. During the fasciotomy, >1,500 cc of purulent material was collected, the eschar and all non-viable tissue removed, fistulas explored and exposed, and the remaining part of the fascia, not yet involved by infection, revised.

The clinical state of the patient quickly improved after surgical drainage. Forty-eight hours later, his white blood cell count had dropped to 6,100/ml, his C-reactive protein was 3.4 ng/ml and his procalcitonin level was negative for infection. The surgical lesion was clean and granulating, there was no pain or redness and the oedema was decreasing [Figure 1B]. NPWT with polyhexanide solution instillation was applied at this time. After the first week of NPWT, the patient

was discharged and continued to use NPWT at home.

Three weeks later, the depth of the lesion had significantly decreased and most the tissue had granulated [Figure 1C]. At this point, the lesion was ready for dermal grafting. Porcine skin was applied to reduce the depth of the lesion [Figure 1D]. After 4 weeks, hydrosurgical debridement was used to remove the remaining devitalised tissues [Figure 1E] and the wound bed was covered with an autologous meshed skin graft taken from the anterior surface of the ipsilateral thigh. The graft took fully [Figure 1F and G] and complete healing occurred 1 month later [Figure 1H].

Discussion

NF represents a diagnostic challenge due to its heterogeneous clinical presentation. It has a higher prevalence in lower limbs and in people with diabetes. In the case study presented here, the patient had a history of diabetes and NF of the lower limb. Due to the reduced inflammatory reactions evoked in diabetes, the clinical signs of NF are often reduced in the early stages of infection and only become evident when systemic signs of sepsis appear. In these later stages, therapeutic options are less effective and the disease is associated with a very high mortality rate. Clinicians dealing with chronic wounds should consider the possibility of NF and disregard it only after a careful diagnostic workup. In the case study presented, neither ultrasound nor magnetic resonance detected the wide subcutaneous abscess; diagnosis was mainly clinical.

Prompt diagnosis and extensive surgical management form the basis of successful treatment. In this case, swift debridement prevented the infection progressing, enabled the limb to be saved and laid the groundwork for a good clinical outcome. The case highlights the fact that antibiotic therapy alone is insufficient to treat NF. As recommended by international guidelines (Apelqvist et al, 2007), besides the standard approach with prompt surgical drainage with the removal of necrotic or poorly vascularised tissue, revascularisation if needed, and intravenous broad-spectrum antibiotics, new strategies should be considered to reduce healing times and infection rates. After the demolitive phase, a reconstructive one.

In this clinical case, dermal substitute, autologous grafts, hydrosurgical debridement and NPWT were used to support healing and reconstruct lost tissue. At Pisa University Hospital, >80% of such cases result in complete healing (Iacopi et al, 2015).

Conclusion

This case study demonstrates how, in an adequate setting, quick, complete healing can be achieved following the removal of infection through extensive debridement. WINT

Acknowledgements: AP, NR, CG and EI managed the case, acquired and analysed data; SB, LP and LA analysed and reviewed the data; AP and EI wrote and reviewed the manuscript. Written consent to publish this case study was obtained from the patient.

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