High-above-knee open amputation due to necrotising fasciitis

Necrotising fasciitis is a rare but serious bacterial infection of the soft tissues. It usually affects immunocompromised individuals, and people with diabetes are at particular risk. The lesion often starts as a minor wound and rapidly progresses, becoming life-threatening if not recognised early and treated aggressively. The authors present a severe case of necrotising fasciitis of the right lower limb that led to a high-above-knee amputation with faecal diversion to prevent wound contamination. Split skin grafting was used to close the wound once it had granulated. Faecal diversion can be important in cases where there is inadequate skin cover close to the torso, as stumps can be contaminated with faecal organisms, resulting in sepsis and possibly death.

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Diabetes mellitus causes immunosuppression that can lead to life-threatening, rapidly-spreading fulminant soft tissue infections resulting from minor trauma (Martens et al, 2007). Decreased vascularity due to macro- and microangiopathy only adds to the damage, which can range from cellulitis to necrotising fasciitis (Auti et al, 2006). Cellulitis very often resolves with oral antibiotics and proper offloading. Necrotising fasciitis, however, requires high-dose antibiotics with major debridement or limb amputation. The mortality rate for necrotising fasciitis ranges from 6% to 70% (Meyer, 1996; Wong et al, 2003). Delayed diagnosis and consequently delayed operative debridement have been shown to increase mortality (Meyer, 1996).

Necrotising fasciitis can be classified into type 1 (polymicrobial) and type 2 (group A streptococcal) infections (Wong et al, 2003). Aerobic, anaerobic and mixed flora have been found to be responsible. The abdomen, perineum, scrotum and lower extremities are the most common sites of infection (Meyer, 1996; Lunsjo and Abu-Zidan, 2006). Immunocompromised states, such as diabetes, malnutrition and HIV infection, predispose to this condition. In most cases, necrotising fasciitis occurs as a result of invasion by bacteria through some precipitating event like a cut, contusion, burn or operative incision. In certain cases, no known aetiological factor is identifiable (Chadwick and Lewis, 1991; Latanioti et al, 2013).

Postoperatively, hyperglycaemia and non-enzymatic glycation products interfere with fibroblast activity and delay surgical wound healing (Meyer, 1996). The condition is especially grave when the wound is left open near sources of faecal contamination. When necrotising fasciitis has spread to the upper thigh, surgeons are often forced to make high-above-knee amputations with wound debridement, leaving the stump open due to the lack of healthy skin cover (Eakin et al, 1992; Latanioti et al, 2013). Since the open wound is very close to the perianal area, it invariably gets infected with faecal contaminants. Secondary infection with faecal organisms is very dangerous due to the resulting Gram-negative sepsis and has a high mortality rate. Faecal diversions with a reversible sigmoid loop colostomy along with open high-above-knee amputations can keep the raw areas safe from contamination (Smith et al, 2007; Krouse et al, 2009).

Case presentation

A 43-year-old male presented to the emergency room with pain, swelling and dark patches over his right leg and thigh *[Figure 1]*. He was being managed as an inpatient in another hospital near his home following minor trauma to the leg 2 weeks prior to presentation at our emergency room for onward management. He had developed fever with chills and increasing infection of the right lower limb, which had not been offloaded, resulting in spreading of the

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Figure 1. **On presentation, the patient had extensive infection, fever and chills.**

Figure 2. **The leg was amputated high above the knee and the wound debrided as a life-saving measure.**

Figure 3. **The wound granulated. At this point, the wound bed was prepared for grafting.**

infection with onset of blebs and redness that rapidly progressed to the upper part of the thigh.

The patient had been diagnosed with diabetes at the age of 31. His glycaemic control was poor and he did not regularly take his medications, which included insulin. He had no other known comorbidities. He had a family history of diabetes, with his father, mother and sister all having the condition.

On examination, the patient was drowsy and febrile with features consistent with mild dehydration. His peripheral capillary oxygen saturation was 98% on room air, his respiration rate was high, at 22 breaths per minute, and there was good air entry into both lungs. His pulse was 89 beats per minute and his blood pressure was 120/80 mmHg. The patient's abdomen was soft and there was no evidence of organomegaly.

Examination revealed extensive necrotising fasciitis of the right thigh, leg and foot. The skin and ulcers had a dusky discolouration and the lower limb was oedematous with foul-smelling purulent discharge from multiple sites. Peripheral pulsations of the right foot, dorsalis pedis and posterior tibia were low monophasic with hand-held Doppler, denoting poor peripheral arterial circulation.

A number of investigations were carried out. Full blood count revealed a haemoglobin level of 1.02 g/L, packed cell volume of 29% and white blood cell count of 38 cells*10^9L, 85% of which were neutrophils. Blood was present in the patient's urea. His creatinine level was 4.8 mg/dL and his random blood sugar value was 320 mg/dL. The patient's sodium and potassium levels were a little low.

Surgery

Since the patient had sepsis, there was no time for a lower limb angiogram and peripheral angioplasty. After medical stabilisation, including diabetes control, the patient was taken for sigmoid loop colostomy, high-above-knee amputation and debridement as life-saving measures *[Figure 2]*.

During the patient's colostomy surgery, a hole was incised in the loop of sigmoid colon and a rod secured in the aperture with a tube catheter to prevent retraction. The edges of the colostomy were sutured to the edges of the incision.

The patient's limb was cleaned and draped. Anteroposterior flaps were raised at the upper thigh region and the femoral vessels identified, ligated and divided (Vrieling et al, 2008). The femur was cut with a "Giggly saw" and the muscles excised. The infected soft tissue was debrided until clean tissues and wound edges were seen and a sample of deep debrided tissue was sent for bacterial and fungal cultures. After attaining haemostasis, the wound was dressed with gentamicin-soaked dressings as there was no skin cover.

Recovery

Following surgery, the patient was transferred to the intensive care unit. The sepsis resolved completely, his condition steadily improved with fluid supplementation, and he was moved to the ward. The patient's serum creatinine level dropped to 0.07 g/L from 0.48 g/L. The Foley's catheter was removed and a condom catheter placed. Blood transfusions were given to keep the patient's haemoglobin levels above 1g/L. Regular dressing changes with the application of metronidazole and papain ointments on alternate days were applied along with correct colostomy care. The frequency of the dressing changes was changed according to the wound healing status and bedside debridement was done when required (Thiele et al, 1973). Supportive management, including tight blood sugar control, pain management and proper nutrition, was provided.

A number of harmful fungal and bacterial species were initially found to be present. Tissue culture reported the presence of *Escherichia coli* types I and II as well as *Enterococcus* species. Fungal culture revealed the presence of *Candida tropicalis*. Urine culture led to the identification of *Klebsiella pneumoniae* and yeast species sensitive to amphotericin, fluconazole and itraconazole. These organisms were taken into account and the patient was administered with culture-specific antibiotics (intravenous colistin, linezolid and oral fluconazole). There was no aerobic or anaerobic blood culture growth after 7 days of incubation.

The patient was discharged with advice to continue applying Metrogyl Gel and Debridace ointment and to change his dressings on alternate days. Debridace is a papain/urea ointment used on traumatic infected wounds, acute and chronic lesions. Metrogyl Gel, which contains metronidazole, is used to treat anaerobic infections. Oral antibiotics were given as per culture and sensitivity.

The patient was reviewed biweekly in the outpatient department. After 6 weeks, the right above-knee stump wound had granulated well *[Figure 3]* and the patient was prepared for split skin grafting.

Figure 4. **The skin graft over the stump took and the staples were removed.**

Figure 5. **The stump healed well and the patient was mobilised with a prostheis.**

Split skin grafting

Tissue cultures were taken and culture-specific antibiotics administered for 5 days pre- and 2 weeks postoperatively. Under spinal anaesthesia, split skin grafts were harvested from the left thigh using a Humby knife and meshed using a hand mesher (Kinugawa and Shimada, 2014). This increased the surface area of the graft, allowing greater areas to be covered, and also allowed the exudate/blood collecting under the graft to drain. The recipient raw area (wound bed) to be grafted was prepared by superficial scraping to remove the biofilm (a layer of bacteria surrounded by a protective layer of host tissue, making it inaccessible to antibiotics) and thorough irrigation with saline. The meshed graft was anchored with staples to the prepared wound bed (Ploeg et al, 2005). Both the graft harvest site and the recipient site were soaked in gentamicin and dressed with paraffin gauze to prevent any postoperative infection.

The wound was inspected 5 days after surgery as there were no overt signs of ongoing infection or excessive discharge (Ploeg et al, 2005). When the graft was seen to be healthy after a week, the patient was discharged home with oral antibiotics and nadoxine/paraffin gauze dressings. After 4 weeks the grafts had taken well and the sigmoid colostomy was closed *[Figure 4]*. The stump went on to heal well *[Figure 5]* and after another 3 weeks the patient was fitted with an above-knee prosthesis.

Discussion

Important factors in healing and the outcome of amputation include the patient's nutritional status, age, whether or not the patient smokes, and the presence of coexisting diseases such as renal failure, diabetes and anaemia (Canavan et al, 2003). One study concerning lower limb amputation found that the most common stump-related complications were wound infection and poor healing (National Amputee Statistical Database, 2005). Within the population of patients with peripheral vascular disease, major lower extremity amputation results in significant perioperative morbidity and mortality (Vowden and Vowden, 1996). Faecal diversion helps prevent wound contamination, especially in Diabetic patients who may have nuropathy associated poor anal sphinter control (Christian et al, 2005; Niranjan, 2006).

In a high-above-knee amputation with an open stump, the raw surface can easily get infected with faeces and urine, leading to a high incidence of septicaemia and even multiorgan failure and death in immunocompromised patients with diabetes (Henke, 2009; Rajamani et al, 2009). Faecal diversion is important in these patients to help wound healing and reduce morbidity and mortality (Tisi and Callam, 2004; Hunt, 2009). During the past 7 years we have performed six open high-above-knee amputations. The first three cases, which did not have faecal diversions, ended in stump infection and sepsis, and the patients died. The sepsis was caused by organisms from faecal contamination (Hunt, 2009; Rajamani et al, 2009), so we attempted to improve our outcomes by diverting faeces away from the open wound using a colostomy (Richbourg et al, 2007; Adel Mehraban et al, 2008). All three of the patients who underwent this procedure had uneventful postoperative recoveries. They are now ambulant with above-knee prostheses.

Few studies have evaluated faecal diversion with loop colostomies in open high-above-knee amputation stumps. Studies have prospectively evaluated the effectiveness of the defunctioning capacity of the loop stoma through the oral administration of radioactive dye followed by rectal lavage with a Foley catheter to assess the presence of dye (Vowden and Vowden, 1996; Global Lower Extremity Amputation Study Group, 2000). Diverting stomas are employed for various clinical indications and are easier to revert than end stomas (Datta, 2001). General, plastic and colorectal surgeons continue to debate whether a diverting loop stoma adequately diverts stools, preventing spillage into the distal limb. They are also easy to reverse, especially with the advent of bowel staplers (Mayan, 2001; Streubert and Carpenter, 2003). A retrospective study was conducted to determine whether loop ostomies adequately diverted stools without distal limb contamination (Coons et al, 2007; Mitchell et al, 2007). No evidence of wound contamination by intestinal bacteria was found. In the cases where we made the diverting loop colostomy, no wound contamination occurred. Healing was good, with healthy granulation tissue forming in about 6 weeks, and the wound being ready for a split skin graft in reasonably good time. After the split skin graft had taken up, the diverting loop colostomy was closed and patients were fitted with above-knee prostheses and made ambulant.

Conclusion

Our experience has led us to believe that colostomy and faecal diversions are important in improving the outcomes of high-above-knee surgeries. They prevent faecal contamination, especially in patients with poor sphincter control due to diabetic neuropathy and antibiotic-associated diarrhoea, by providing a controlled and hygienic mode of faecal matter disposal. DFJME

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