

Cascade of Surgical Complications: A Case of Necrotizing Fasciitis

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Submitted: 31 Oct 2019; Accepted: 07 Nov 2019; Published: 04 Dec 2019

Summary

A 60 year old female presented with abdominal distension and non-specific abdominal pain and describes herself to have a 'lazy bowel', with a complicated surgery history. Patient subsequently underwent an emergency laparotomy for multiple small bowel perforations, requiring small bowel resection. The patient developed necrotizing fasciitis (NF) due to an increased use of inotropes during surgery which causes excessive vasoconstriction, and she had a major portion of the abdominal flab removed. This followed by a 33 day ITU admission (level 3) due to septic shock and poor pulmonary compliance. During the ITU stay, the patient was taken back into theatre 14 times for vac dressing changes to reduce the pressure from 150 mmHg down to 25 mmHg. Back in the surgery ward, the patient developed a fistula due to the vac dressing eroding the small bowel, leading to a proximal jejunostomy in situ which effectively worked as a high output stoma. The patient later suffered from re-feeding syndrome as the feed was primarily through the jejunostomy. Eventually absorbable mesh was added behind the vac dressing to protect the soft tissue underneath and the final stage was referral to plastic surgeons that would a joint reconstruction of the abdominal wall with the general surgeons at St Marks (tertiary centre for intestinal feeding and the combined reconstruction).

Background-why is this case significant?

Necrotising fasciitis is a rare but life-threatening infectious disease, but public health guidelines fail to address its diagnosis and management [1]. Local trusts fail to yet incorporate guidelines for early recognition and effective management. Therefore, the clinical diagnosis of NF comes down to the experience level of the clinician which can often be difficult to assess or regulate across hospital. More cases of NF need to be addressed, needs to be studied with the hope that a formal framework for guidelines can be constructed as a result.

Case presentation

History

This case study is based on a 60-year-old female who presented to the accident and emergency department with non-specific abdominal pain, gross abdominal distension, vomiting dark blood as well as pyrexia. She was urgently referred by her general practitioner due to the complicated set of presenting complaints. Background included a complicated surgical history of multiple abdominal surgeries that were undertaken abroad and therefore lacked in depth medical records. Past medical history of note included hypertension, complicated hiatus hernia repair, bowel resection for colon cancer which involved a colostomy reversal 20 years ago, also performed abroad. 2 histories of cerebrovascular accidents and hypothyroidism. Social history mentioned she was independent in activities of daily living, being a retired professional. The patient also had allergies noted to ibuprofen, codeine and aspirin all reporting adverse reactions.

Patient journey

The patient was added to the CEPOD list for emergency exploratory laparotomy for query small bowel obstruction. Following the laparotomy, the patient was transferred to an intensive treatment

unit where she went on to develop colicky pain with wounderythema and blister. The working diagnosis at that point was anastomotic leak following multiple small bowel resections at different nodal points. Computerized tomography of the chest, abdomen and pelvis was done which showed post small bowel resection and adhesiolysis with minimal contamination to confirm there were no further leaks. Following inconclusive imaging, it was suspected focal herniation of the SB with distended stomach and proximal small bowel which was the likely cause of the distended abdomen and pulmonary aspiration. This led to very poor pulmonary compliance in ITU. Figure 1 below depicts the following long stay of this patient.

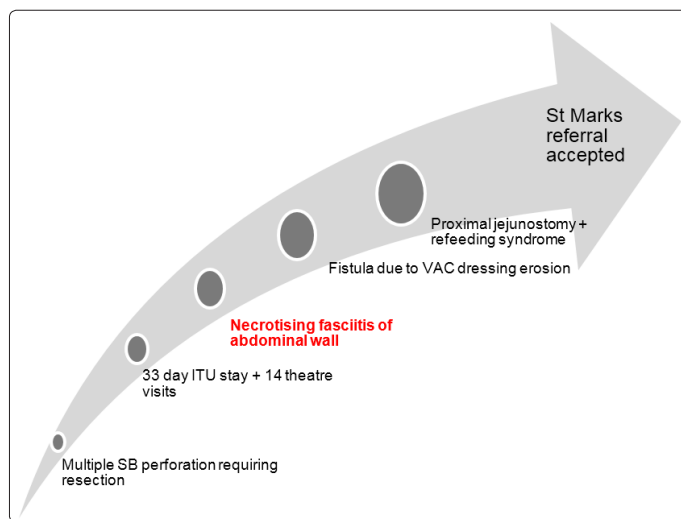


Figure 1: Patient journey post emergency admission

Subsequently it was presumed and confirmed to have developed necrotising fasciitis (NF) around the abdominal wall. It was followed by a 33 day ITU stay where she was taken back to theatre 14 times for a washout, debridement and VAC dressing change (please see figure 2 and 3).



Figure 2: Picture of abdomen post initial surgical debridement



Figure 3: 4 weeks post ITU stay

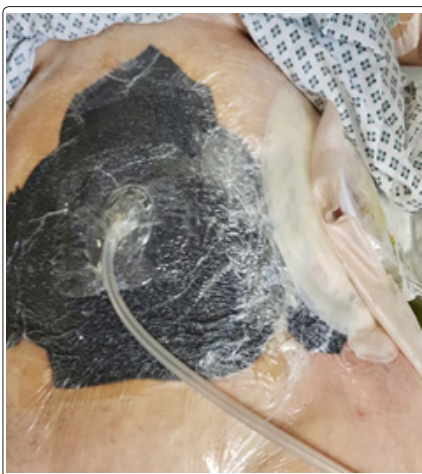


Figure 4: Wound with VAC dressing on

Due to surrounding oedema the pressure of the VAC dressing went up to 150 mmHg and had to be brought down to the normal range of 25mmHg. VAC dressing is a form negative pressure wound therapy where the black foam packs the wound with a drain attached into the airtight wound. The controlled vacuum helps to promote wound healing by continuously draining fluids from the surrounding area

and thereby increasing blood flow. The dressing is changed around 3 times a week. They are widely used for diabetic ulcers.

Later on she developed a fistula of her small bowel due to erosion from the VAC dressing. She went on to have a proximal jejunostomy in situ (please see figure 5). A jejunostomy is a stoma created through the wall of the jejunum due to a bowel leak or perforation.



Figure 5: This is a picture of the jejunostomy

The jejunostomy was later used for feeding as well. A tubogram was done to assess the placement patency of the proximal jejunostomy in place (please see figure 6) as patients had symptoms of refeeding syndrome. Eventually the patient developed re-feeding syndrome. Thyroxine dose had to be increased as well due to the jejunostomy.



Figure 6: Tubogram to Assess Jejunostomy Patency and Position

Final outcome

The ultimate end goal for this patient would be a joint-abdominal wall reconstruction with the plastic surgeons as well as the general surgeons. Therefore she was referred to St Mark's hospital which is a specialist bowel hospital. It is the only hospital in the world to specialise entirely in intestinal and colorectal medicine [2]. It is a national and international referral centre for intestinal and colorectal disorders'

Discussion

Necrotising fasciitis (NF)

Necrotising fasciitis is a rare infection that leads to soft tissue death. While it is quite rare with only 500 cases a year reported in the UK, the outcomes are mostly life-threatening [3]. Onset is sudden, mostly affecting the limbs and the perineum [4]. The microorganisms start by spreading along the fascia planes, both deep and superficial, while the muscles are usually spared. However eventually compartment syndrome develops which often leads to indirect myonecrosis. NF

can be caused by a spectrum of microorganisms and can be therefore classified into four groups according to the causative organism (figure 7).

Type of NF	Causative organism	Details
Type 1 NF	Polymicrobial organism	Type 1 NF is when there is a polymicrobial cause of infectious, usually involving both aerobic and anaerobic bacteria. The most susceptible groups of patients being affected by this subgroup is those with a compromised immune system or chronic diseases [5].
Type 2 NF	Group a streptococcus (GAS)	Type 2 NF involves a group a streptococcus (GAS) infection that can affect health people of any age group. GAS can normally be found in the throat of 1% of all adults and roughly 10% of all children. There is currently no evidence to suggest strep throat increases one's chance of developing NF in the future. While GAS in the throat can cause a strep throat, it can potentially invade into the bloodstream resulting in osteomyelitis and pneumonia, and rarely developing into NF. NF can sometimes occur along with streptococcus shock syndrome which is when the strep bacteria spread its toxin across the body rapidly leading to systemic shock and multi-organ failure [6]. Type 2 NF is deemed to be the most common cause of NF among public health experts.
Type 3 NF	Gram negative monomicrobial organism	Type 3 NF includes infections caused by vibrio spp and aeromonas hydrophila. These are considered to be marine organisms and this infection usually occurs post fish stings or seawater contamination of existing wounds. Patients with a compromised immune system with a background of chronic liver disease can develop type 3 NF following excessive raw seafood consumption. Type 3 has the most rapid development of infection and can often be fatal in within 2 days.
Type 4 NF	Fungal infection	Type 4 NF can be caused in wounds post trauma or burnt skin. Infections can include candida especially in immune-compromised patients and therefore progress rapidly. Type 4 NF is known to be associated with a high rate of mortality.

Figure 7: Type of necrotising fasciitis

Diagnosis

Diagnosis of NF is mostly clinical, with no investigation available as a gold standard. Often clinicians take a tissue sample for biopsy along with extensive blood work to monitor signs of myonecrosis and infection markers [7]. Imaging such as CT or MRI of the wound could indicate the severity of the infection spread.

Risk factors

Patient with a compromised immune system is at a much higher risk of developing NF than their healthy counterpart. Often patients with chronic diseases such as diabetes or liver cirrhosis develop NF due to reduce efficacy of the immune system against the causative organism. In the case of the patient from the case study she was post-surgery which means her immune system would not be fully functioning and therefore would put her at risk of developing NF.

Symptoms

NF typically develops over the course of days with different symptoms presented at different times (please see figure 8). In some extreme cases such as type 3 NF caused by marine organism, it is often fatal with the first 48 hours of infection.

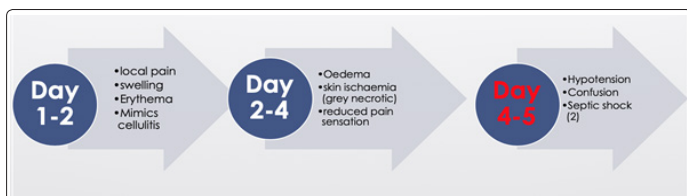


Figure 8: Symptoms of NF over the course of 5 days

Typically it presents with local pain and swelling during the first 48 hours. There will be associated erythema noted around the wound which can mimic cellulitis and this is one of the leading reasons why NF is often misdiagnosed as such. One of the most obvious features at this stage is severe pain, out of proportion to the other symptoms. Figure 9 depicts further differences between NF and cellulitis.

Day 2 to 4 involved tense oedema developing around the wound and often extending beyond the area of erythema. Bullae (often haemorrhagic) are often present which is not present in cellulitis, and it refers to the ongoing ischaemia and discolouration of necrotic skin tissue. Day 5 is usually when the patient becomes septic and the peripheral blood supply shuts down, leading to the patient becoming confused.

NF	Cellulitis
Severe pain out of proportion to other physical symptoms	Relatively less pain noted
Rapid swelling and inflammation noted	Swelling is more gradual noted
Poor margins with tenderness exceeding beyond erythema	Relatively well defined margins of erythema
Typically minimal or no response to antibiotics	Responds well to antibiotics
Lymphangitis is rare	Lymphangitis is relatively more common
Haemorrhagic bullae often seen due to tissue necrosis	Bullae is uncommon

Figure 9: Differences between NF and cellulitis

Treatment

Evidence suggests emergency surgical debridement is the only definitive treatment of NF [8]. It involves removal of infected and dead tissues along with high dose intravenous antibiotics. The most significant factor to determine survival chances is the first initial surgical debridement and it is recommended to have sufficient margins so that no necrotic/infectious tissue is left behind. Wound needs close observation following debridement and repeated daily until infection is adequately controlled. Daily dressings are applied under sedation and often vacuum-assisted closure (VAC) dressings are favourable for this purpose.

High dose antibiotic throughout this process of repeated debridement is essential and the regime will depend on culture sensitivity and patient allergy status. Expert microbiology advice is important to decide on the combination of antibiotics to be used. An example of recommended combinations includes benzyl penicillin, clindamycin and gentamycin. Benzyl penicillin is often swapped for meropenem if patient is penicillin allergic. Antibiotics of choice should be modified once culture results are returned, however culture results should not delay the administration of high dose antibiotics at all. If type 3 NF is suspected where the causative organism is *Vibrio* spp, a tetracycline and third generation cephalosporin should be included in the proposed antibiotic regime [9]. Third generation cephalosporin include doxycycline plus ceftazidime, or ciprofloxacin can be used too.

Significance of early amputation

A retrospective study in Taiwan involving 582 patients concluded patients had significant higher risks of mortality if they received late amputation. Out of the 35 patients who received amputation, 7 had it early and 28 had it late. 16 out of the 28 patients with late amputations later died. The study concluded that NF patients with the following risk factors of haemorrhagic bullae, comorbidity with peripheral vascular disease, presence of bacteraemia, or LRINEC score > 8 should receive early and primary amputation in order to prevent mortality.

Similar case studies

A case study was reported on a 71 year old patient who presented with acute appendicitis but eventually developed a perforated appendicitis resulting in NF of the abdominal flap [10]. It was investigated with CT scans and subsequent emergency laparotomy performed. From the case study the learning point of note was that the unusual presentation of NF with regards to perforated appendicitis makes it quite difficult to diagnose. It is therefore extremely essential to have a low threshold of suspecting NF with patients presenting with abdominal pathologies as early recognition and management is key to prevent mortality.

Learning points

- NF is an uncommon disease which makes it harder to be diagnosed but is associated with high mortality. Therefore any patients presenting with pain, erythema and fever should have NF as one of the differential diagnosis to be ruled out. Clinicians should have a low threshold of suspecting NF in any patient presenting with abdominal pathologies and/or abdominal surgeries
- There are currently no public health guidelines for diagnosis and management of NF in the UK. It is currently treated as a strep infection and that is unsafe and insufficient to manage

an acute life threatening disease. Figure 9 below summarises the proposed steps that junior clinicians should take to identify patients with suspected NF early rather than later. However this needs further expert review and input to hopefully be developed into clinical guidelines.



Figure 9: Proposed algorithm to assess patients with suspected NF

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