



Case Report

Abdominal wall Necrotizing Fasciitis Due to Small Intestine Rupture- Successful Management with Temporary Abdominal Closure Technique

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Citation: Stavrou E, Kornaropoulos M, Evaggelou FM, Politopoulos C, Triantafyllou A, et al. (2023) Abdominal wall Necrotizing Fasciitis Due to Small Intestine Rupture- Successful Management with Temporary Abdominal Closure Technique. J Surg 8: 1744 DOI: 10.29011/2575-9760.001744

Received Date: 21 February, 2023; **Accepted Date:** 24 February, 2023; **Published Date:** 28 February, 2023

Introduction

Necrotizing Fasciitis (NF) is the deadliest and most dreadful form of soft tissue infection, which is characterized by a rapid and fulminant course, as long as a high mortality rate (24-34%) [1]. The disease was first described by Meleney in 1924 as “acute hemolytic streptococcal gangrene”, while the most accurate term was introduced by Wilson in 1952 as “necrotizing fasciitis” which describes the key features of this clinical entity [2]. NF is divided into two subcategories according to the causative agents: Polymicrobial or synergistic gangrene (type 1) which is the most common type (70-85% of all cases), and Streptococcal or monomicrobial (type 2) gangrene [3,4]. The most common risk factors include diabetes mellitus, liver cirrhosis, alcohol abuse, intravenous drug use, immunodeficiency, liver and renal failure and malignancy [5]. The aim of this article is to present an extremely rare case of a patient who came to the emergency room in septic shock due to extended NF of the anterior and lateral abdominal wall and the successful treatment using the method of temporary abdominal closure.

Case Report

A 70-year-old female with a history of right hemicolectomy due to adenocarcinoma of the right colon (cecum) Stage IIIB (pT4N2M0), operated one year ago, presented to the emergency

room of Asklepieion General Hospital Surgical Department in septic shock due to extensive anterior and lateral abdominal wall necrotizing fasciitis. (Figure 1) We obtained a CT (computed tomography) scan of abdomen, which revealed deep fascial thickening and enhancement, fluid, and gas in soft-tissue planes, signs of extensive soft tissue necrosis of the right anterior lower and lateral abdomen, and a loop of small intestine attached to the anterior abdominal wall on the right side.

The patient was admitted to our clinic, and we immediately received treatment with broad spectrum antibiotics (meropenem, linezolid and metronidazole) and aggressive fluid resuscitation. She was taken urgently to the operating room, where we found pervasive soft tissue infection of the abdominal wall, extending from the right iliac fossa to the right hypochondrium due to small intestine rupture (terminal ileum) to the anterior abdominal wall, which was located about 10cm cephalad to the previous ileo-transverse anastomosis due to recurrence of cancer. The peritoneal cavity was thoroughly checked and washed, although there was no fecal peritonitis. She underwent considerable/ aggressive surgical debridement of the skin, subcutaneous tissue and abdominal wall aponeurosis, culture samples were taken. Resection of the ruptured small bowel that was attached to the wall was performed as well as a side-to-side ileo-transverse anastomosis. Due to septic shock and the inability to achieve abdominal wall closure, the method of

open abdomen was decided. Within the open abdominal cavity, we instated surgical towels covered with sterilized membrane which were perforated multiple times with a 19G needle to cover and protect the abdominal viscera. We placed two 19 French silicone tubes on top of this envelop of surgical towels and another sterile surgical towel to cover the tubes. Another sterile membrane was used to cover the surgical site. The silicone tubes were connected to a Y adapter which was then connected to continuous negative pressure of 100-150 mmHg. The patient remained intubated and was transferred to the Intensive Care Unit (ICU). She underwent another two revisory surgical debridements and change the envelope with surgical towels in the next 5 days (Figure 2-5).

The samples' cultures revealed *Proteus* species and *E. coli* (sensitive to the already administered empirical antibiotic treatment). On the 11th postoperative day complete closure of the abdominal wall aponeurosis was achieved and a negative pressure device was placed on the patient's trauma (Vacuum Assisted Closure- VAC) to achieve skin and subcutaneous tissue closure. The patient, while remained intubated in ICU due to respiratory failure, suffered from deep vein thrombosis of her lower right extremity on the 42nd postoperative day and was immediately diagnosed by Doppler ultrasonography and initiated appropriate treatment with therapeutic doses of Low Molecular Weight Heparin. She ultimately passed away on the 68th postoperative day due to massive pulmonary embolism.

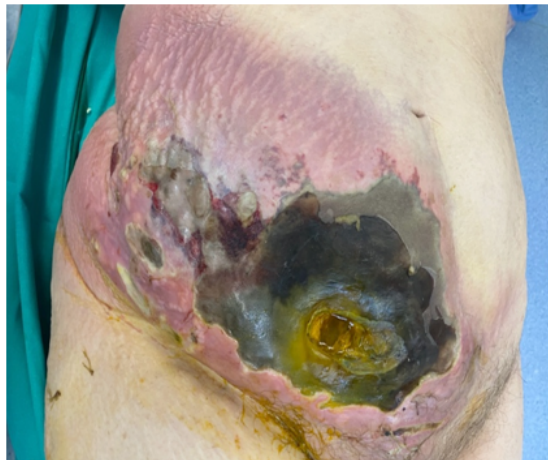


Figure 1: Initial presentation of our patient in the emergency room.



Figure 2: Method of temporary abdominal closure.



Figure 3: Fascial defect after the second re-exploration.



Figure 4: Fascial closure on the 11th postoperative day.



Figure 5: Placement of a Vacuum Assisted Closure device for skin and subcutaneous tissue closure.

Discussion

NF is a rare condition with high morbidity and mortality if not treated in its early stages. At its onset it is difficult to differentiate from other soft tissue infections, thus delaying the appropriate treatment [6]. This case illustrates the severity of the disease and the disastrous complications that can occur when medical attention is inquired at its late stages, as long as the open abdominal management technique. Early diagnosis and differentiation from other soft tissue infections is crucial in order to proceed to the appropriate treatment [7]. A diagnostic scoring system based on laboratory parameters routinely performed for all soft-tissue infections and readily available at admission (complete

blood count, electrolytes, and C-reactive protein) is used called Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC). This scoring system though it is very basic, is used to distinguish NF from other soft tissue infections before imaging and surgical consultation [8]. This case demonstrates the difficulty (and sometimes the impossibility) to appropriately treat this calamity especially at its later stages. Immediate initiation of empiric antibiotic treatment is very important, but it is crucial to understand that antibiotics generally reduce the systemic bacterial load and the incidence of organ failure but have little effect on the primary disease site. Despite the administration of antibiotics, progression of the infection is the rule in Necrotizing Fasciitis, due to angio-thrombotic microbial invasion and liquefactive necrosis [9,10].

Aggressive surgical debridement is of utmost importance in order to remove all necrotic fascia [11]. Removal of skin and subcutaneous tissue is still debatable; some authors suggest that skin and subcutaneous tissue should be completely excised, which is the appropriate way concerning infectious clearance, but it leads to large skin defects that are difficult to resurface [12]. Reoperation(s) are often required in order to remove subsequent necrotic remnants. Temporary abdominal closure (TAC) is a term used to describe the process of deliberately leaving the fascial edges of a laparotomy wound open and it is used to shorten the operative time, facilitate abdominal re-exploration without additional fascial trauma, and prevent or treat intraabdominal hypertension. TAC is most commonly utilised in trauma when DCS is performed to prevent the most feared Trinity (hypothermia, coagulopathy, acidosis). It can be also used in non-trauma surgery, such as septic shock with haemodynamic instability mandating an abbreviated laparotomy, necrotising infections involving the abdominal wall, haemodynamic instability during the treatment of ruptured abdominal aortic aneurysms and other vascular catastrophes, planned second-look laparotomy after surgery for acute mesenteric ischemia and in the treatment of ACS [13,14]. The ideal TAC technique serves as a barrier, thus preventing evisceration and contamination. It assists with evacuation of abdominal fluid and decreases bowel edema. It prevents adhesions and avoids repeated damage to the bowel, fascia, or skin due to exposure. Furthermore, it allows easy access to the abdominal cavity, avoids damage to the fascial edges, prevents fistula formation and allows fistula isolation if present, and prevents abdominal wall retraction while allowing for expansion of abdominal contents to prevent the development of ACS [15].

Several techniques for temporary abdominal wound closure have been proposed. They include (i) skin-only closure with suture or towel clips, (ii) patch closure (Bogotá bags, mesh closure, Wittmann's patch, and (iii) Negative Pressure Therapy (NPT) using towel or sponges.

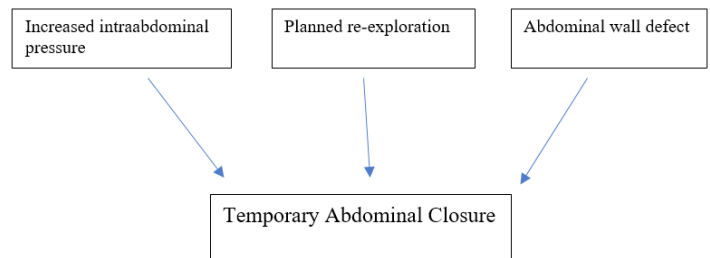
Skin-only closure is most commonly achieved using towel

clips or suture material to close the skin. Many sources, including consensus guidelines, reviews, and textbooks, suggest that skin closure techniques should be abandoned [6-11]. Skin closure alone may lead to peritoneal fluid leakage, saturation of external dressings leading to dermatitis and ultimately composes a great risk for peritoneal cavity contamination. Other arguments against skin-only closure include an inability to control abdominal effluents, interference with radiographic imaging (as observed in the index case), high incidence of ACS, failure to prevent loss of domain, high incidence of evisceration, and the high incidence of skin complications. Moreover, the use of biosynthetic materials lingers even more severe complications, such as adherence of viscera to the mesh and if re-exploration is required, repetitive suturing of foreign materials to the already damaged fascia may even lead to fascial necrosis [13,16,17]. On the other hand, Negative Pressure Therapy (NPT) has been shown to increase local blood perfusion and nutrient delivery to the wound, accelerate growth of granulation tissues, and decrease wound bacterial concentrations. It also reduces bowel edema and the application of mechanical stress to the wound accelerates cellular proliferation and angiogenesis. NPT also effectively removes third-space fluid from the abdomen. This is particularly useful in patients who have an open abdomen (OA) for sepsis. The removal of infected fluid and inflammatory mediators has a positive impact on patient outcomes. The negative pressure therapy, by the principle of reverse tissue expansion in the wound, brings together the wound edges. It is a sutureless closure that avoids mechanical trauma to the abdominal wall and surrounding tissues. NPT can be made using laparotomy towels or using commercially available sponge-based systems.

Placement of the polyethylene sterile drape beneath the peritoneum helps contain the viscera and prevents adherence to peritoneum adjacent to the abdominal wound and to the other vacuum pack layers, thus diminishing the chance of bowel injury. Small holes/cuts in the drape before placement allow removal of excess peritoneal fluid. Peritoneal fluid losses can be measured and replaced if needed. The surgical towel(s) placed over the polyethylene drape provides support to the vacuum pack once suction is applied. It prevents direct application of suction to the underlying bowel and absorbs fluid. Suction applied through the drains collapses the layers of the vacuum pack making it semiadamant. Application of the adhesive drape stabilizes the dressing and seals the wound edges, preventing passage of fluid/air in or out of the wound. The surrounding skin is protected and skin soilage is minimized. The vacuum pack technique can be easily adjusted according to the size of the trauma [14,17,18].

Consensus guidelines are unanimous in their recommendation that NPT is the TAC technique of choice, advising against other techniques because of low facial closure rates and high incidence

of enterocutaneous fistulae [19]. This system has the advantage of employing consumables that are widely available and are low cost. NPT may be superior for patients with sepsis, while the skin-only closure technique may be more beneficial in trauma patients. In our case we used the TAC method with compresses until the abdominal fascia was finally closed. Then a commercially sponge-based negative pressure device was placed on the patient's trauma (Vacuum Assisted Closure- VAC) to achieve skin and subcutaneous tissue closure.



Conclusions

Necrotizing fasciitis is a rare, potentially fatal surgical emergency which requires early and correct diagnosis, immediate resuscitation, initiation of treatment with antimicrobials and urgent, aggressive surgical debridement. The temporary abdominal closure technique can be applied in the context of damage control in cases of extensive infection/necrosis and in trauma surgery. NPT is the TAC technique of choice, advising against other techniques especially in septic cases. A major long-term complication of the temporary closure is a ventral hernia, which is much less catastrophic than the deleterious effects of a forced primary abdominal closure.

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