Case Report

A Case of Acute Appendicitis Complicated by Necrotizing Fasciitis Requiring Abdominal Wall Reconstruction

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ABSTRACT

Acute appendicitis represents one of the most common causes of acute abdomen that may warrant emergency surgery. Necrotizing fasciitis complicated by acute appendicitis is considered a rare complication with life-threatening implications. A 65-year-old man presented with abdominal pain, where a scan, revealed a perforated appendicitis complicated by an anterior abdominal wall collection. He underwent percutaneous drainage, but subsequently developed extensive necrotizing fasciitis requiring extensive debridement and reconstruction. The rapid progression of necrotizing fasciitis calls for early recognition and prompt intervention. The key management principles employed were broad spectrum antibiotics and aggressive surgical debridement. This case demonstrated the use of vacuum-assisted closure dressing and multidisciplinary care in wound healing and coverage. To ensure early diagnosis and intervention for acute appendicitis complicated by necrotizing fasciitis, a high degree of clinical suspicion and awareness of this complication is required.

Keywords: abdominal wall, appendicitis, debridement, necrotizing fasciitis

Introduction

Acute appendicitis represents one of the most common causes of acute abdomen that warrants emergency surgical intervention [1]. The complications associated with acute appendicitis include perforation, abscess formation, and resultant peritonitis [2]. Necrotizing fasciitis complicated by acute appendicitis, although not unprecedented, is considered a rare complication with life-threatening implications. We hereby report a case of acute appendicitis complicated by necrotizing fasciitis and review existing literature that reported similar occurrences.

This case highlights the need to have a high index of clinical suspicion to ensure early diagnosis. Despite necrotizing fasciitis being a clinical diagnosis, imaging is frequently used in evaluating the extent of complications to guide surgical planning [3]. The rapid progression of necrotizing fasciitis calls for early recognition and prompt intervention as surgical exploration is the only definitive way to establish the diagnosis [4]. Delay in surgery is correlated with increased mortality and early operative debridement is regarded as a key management principle [5]. This case demonstrates the importance of a targeted approach to achieve source control via aggressive debridement and culture-directed administration of appropriate antibiotics, followed by the showcase of multidisciplinary care in the management of wound healing and coverage.

Case Report

A 65-year-old man with a past medical history of hypertension, presented with a nine-day history of right-sided abdominal pain and associated vomiting. On admission, the patient was hemodynamically stable and afebrile. A physical examination revealed abdominal tenderness. Computed tomography (CT) of the abdomen and pelvis revealed a dilated appendix (Figure 1A) with periappendiceal fat stranding with a rim-enhancing
collection measuring $9 \times 5.2$ cm (Figure 1B) which extended anteromedially to the right anterior abdominal wall (Figure 1C). Blood investigations showed raised inflammatory markers including C-reactive protein (398.2 mg/L; normal laboratory range: 0.2-9.1 mg/L) and a raised white blood cell count (37.8 \times 10^3/\muL; normal laboratory range: 4.0-10.0 \times 10^3/\muL). In this case, the Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score on admission was 7 points [C-reactive protein 398.2 mg/L, white blood cell count 37.8 \times 10^3/\muL, glucose 13.4 mmol/L (4, 2, and 1 point, respectively)]. On the same day of admission, the patient was started on intravenous ceftriaxone and metronidazole, and underwent CT-guided percutaneous drainage of the intra-abdominal collection. The percutaneous drainage amount was initially 70 mL on the 1st day, and was subsequently 15 mL, 15 mL, and 0 mL on the 2nd, 3rd and 4th day, respectively.

Despite percutaneous drainage, the patient continued to have intermittent fever with raised inflammatory markers and increasing fullness over the right flank. This correlated clinically with persistently elevated inflammatory markers [C-reactive protein: 398.2 mg/L > 408.8 mg/L > 432.9 mg/L (laboratory normal range: 0.2-9.1 mg/L); pro-calcitonin 7.23 ug/L (normal laboratory range: < 0.50 UG/L)]. A repeat CT showed resolution of the intra-abdominal collection (Figure 1D) but revealed a new fluid collection around the right abdominal wall muscles (Figure 1E), which extended superiorly to the inferior border of the right scapula, inferiorly to the right gluteal region, and posteriorly to the lower back. Due to the increasing suspicion of necrotizing fasciitis, the decision was made to proceed with diagnostic laparoscopy, appendectomy, and right abdominal wall exploration.

The patient underwent a laparoscopic appendectomy and debridement of abdominal wall necrotizing fasciitis. Intraoperatively, there was a sealed perforated appendix with a localized pocket of pus, extensive necrotic muscle, fascia with copious pus, and dishwater like fluid infiltrating the abdominal wall muscle layers. The abdominal wall was aggressively debrided and the dead tissue was removed. Given the extent of necrotic tissue involvement, plastic surgery was referred on-table and the debridement was performed to all 3 abdominal wall layers. The transversus abdominus was not resected, merely debrided and repaired, but parts of the external and internal obliques were resected. Peri- and intra-operatively, the patient was not on inotropes, he was not tachycardiac, and was not in shock. Wound cultures indicated a polymicrobial infection colonized by Escherichia coli, Bacteroides thetaiotamicron,

Figure 1. (A) Coronal view of computed tomography arterial portography: arrows show a dilated appendix (measuring up to 1.02 mm) associated with periappendiceal fat stranding; (B) coronal view of computed tomography arterial portography: arrows show the collection (measuring approximately 54.1 \times 90.3 mm); (C) axial view of computed tomography arterial portography: arrows show a rim-enhancing collection containing fluid and gas which extend anteromedially to the right anterior abdominal wall; (D) axial view of computed tomography arterial portography after percutaneous drainage: the image shows the interval decreases in size of the abdominal collection in the right iliac fossa; and (E) axial view of computed tomography arterial portography after percutaneous drainage: the image shows an increase in extent of fluid insinuating the right abdominal wall muscles compared with the prior CT.

Figure 2. (A) Wound image during surgical debridement; (B) wound image prior to mesh placement; (C) wound image prior to skin grafting; (D) intra-op wound image after skin grafting; and (E) wound status at discharge.
**Clostridium inoculum** and **Enterococcus avium**. Antibiotics were later titrated to amoxicillin/clavulanic acid and clindamycin to target the specific organisms.

The patient then underwent multiple rounds of wound debridement with negative pressure wound therapy with a wound irrigation system under general anesthesia. The patient continued to improve clinically and biochemically with subsequent (6 weeks after the index operation) wound coverage using AlloMend™ (AlloSource®, Centennial, Colorado) an acellular dermal matrix allograft used to attach the anterior abdominal wall. The patient recovered well and was discharged from hospital, 16 weeks after the index operation, following split thickness skin grafting from the right thigh. Figures 2A-2E show the wound progress from initial debridement to wound status at discharge.

**Discussion**

Necrotizing fasciitis is a life-threatening soft tissue infection that causes necrosis of the muscle fascia and subcutaneous fat. Even though necrotizing fasciitis can occur in a healthy individual, patients with chronic immunocompromised conditions such as diabetes mellitus and cancer are more susceptible [6].

The LRINEC score is a diagnostic scoring system developed to differentiate necrotizing fasciitis from other soft tissue infections, by taking into account various laboratory investigations [7]. A score of ≥ 6 suggests an intermediate risk of necrotizing fasciitis; ≥ 8 suggests high risk. In this case, the LRINEC score on admission was 7, placing the patient at intermediate risk. For patients at intermediate risk of necrotizing fasciitis, close monitoring and further evaluation, and a low threshold for emergent operative debridement if the clinical suspicion grows imperative, as evidenced by this case.

Many of the case reports of necrotizing fasciitis complicated by acute appendicitis highlight the challenge of diagnosing necrotising fasciitis based on clinical presentation and imaging alone. This reflects the need for a high index of suspicion when encountering patients with a possible risk of necrotizing fasciitis [8-11]. Methods of imaging include CT, magnetic resonance, and ultrasound. Features of CT imaging which raise the suspicion of necrotizing fasciitis include increased fat stranding and soft-tissue attenuation, but the hallmark feature is gas within fluid collections along deep fascial planes [3]. In contrast, magnetic resonance imaging represents the modality of choice for detailed soft-tissue evaluation, features of which include dermal and soft-tissue thickening on T1-weighted sequences, and hyperintensity on fluid-sensitive sequences [3]. The choice of imaging modality hinges on the balance between sensitivity and availability. The sensitivity of CT in detecting soft tissue gas and its relatively rapid availability make it appealing [3]. In this case, despite percutaneous drainage which decreased the size of the abdominal collection, CT imaging revealed interval increases of fluid insinuating in the right abdominal wall muscle, which raised the suspicion of necrotizing fasciitis.

For this case, the region of involvement extended from the anterior and lateral abdominal wall, likely due to the location of the abdominal collection. Regions affected by necrotizing fasciitis due to acute appendicitis range from the abdominal wall, to the back, and the lower extremities [9,12-14]. The extent of involvement is related to the point of contact and fluid tracking of the abscess collection, which underscores the need for thorough surgical exploration to ensure that adequate debridement has been performed, and source control is achieved.

The types of microbiological organisms that cause necrotizing fasciitis can be categorized into different types [5]. Type I (polymicrobial) infection is caused by both aerobic and anaerobic bacteria, whereas Type II (monomicrobial) infection is usually caused by Group A Streptococcus or other beta-hemolytic streptococci [15]. Type III infection is usually caused by Clostridium and Vibrios species, while Type IV is caused by fungal infection [15].

In this case, the presence of both aerobic (Escherichia coli) and anaerobic (Bacteroides thetaiotaomicron and Clostridium innocuum) bacteria illustrates a polymicrobial infection causing necrotizing fasciitis. The patient's risk factors for polymicrobial infection included his newly diagnosed diabetes mellitus and his age. Older adults are predisposed to polymicrobial infection whereas monomicrobial infection may occur in any age groups [5]. Comparatively, other case reports of necrotizing fasciitis caused by acute appendicitis also report a range of polymicrobial infections including Escherichia coli, Enterococcus spp., Bacteroides spp., Streptococcus spp., Actinomyces spp., Peptostreptococcus spp. and Klesbieslla spp [8-14,16-18]. It is imperative that the choice of antibiotics be guided by culture sensitivity to optimize treatment.

From wound debridement to biological mesh placement to skin grafting, plastic surgery served a pivotal role in this case and underscores the importance of multidisciplinary care, especially in managing wounds that require large surface coverage such as in the case of necrotizing fasciitis. As the patient in this case had to undergo multiple rounds of surgical debridement, the use of VAC dressing wound management facilitated granulation of tissue prior to biological mesh placement during plastic surgery. The use of negative pressure wound therapy prior to closure of a skin defect by meshed split skin graft has been previously reported [16], in addition to other cases of wound healing where secondary intention occurred [9,17,18].
Conclusion

This case report highlights the occurrence of acute appendicitis complicated by necrotizing fasciitis, a rare life-threatening complication that demands a high index of clinical suspicion to ensure early diagnosis and management. Compared with other case reports, in this case percutaneous drainage was initially employed to manage a complicated appendicitis. However, with close monitoring of patient's clinical presentation combined with the guidance of CT imaging, the decision was made to proceed with surgical intervention. Similar to other cases, the use of broad-spectrum antibiotics and aggressive surgical debridement served as key management principles. This case illustrates how imperative it is to perform a thorough surgical exploration by understanding the region and extent of collection involvement to achieve adequate source control. This case is also unique in that plastic surgery was referred on-table during the index surgery to assist with debridement and guide subsequent wound coverage management. The utility of VAC dressing wound management, biological mesh placement, and skin grafting highlights the importance of multidisciplinary care.

Author Contributions

Conceptualization: QXL, YG, CWGH, and XZ. Methodology: QXL, YG, CWGH, and XZ. Writing original draft: QXL, YG, CWGH, and XJZ. Writing - review and editing: QXL, YG, CWGH, and XZ.

Conflicts of Interest

The authors have no conflicts of interest to declare

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Ethical Statement

Verbal informed consent was obtained from the patient for their anonymized information to be published in this article.

Data Availability

All relevant data were included in this article.

References