Scrotal Gangrene Secondary to *Staphylococcus Aureus* Infection: A Case Report

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AIM: To present a case of scrotal gangrene secondary to *Staphylococcus aureus* infection, highlighting the importance of early intervention and multidisciplinary care in the management of Fournier's gangrene.
CASE PRESENTATION: This case report details the clinical course of a 67-year-old male who presented with severe perineal pain and swelling, later diagnosed as Fournier's gangrene due to *Staphylococcus aureus* infection. The patient underwent emergency surgical debridement and received antibiotic therapy. Postoperative care included wound cleaning, pain management, and continuous monitoring of clinical and laboratory parameters.
RESULTS: The patient showed significant improvement post-surgery, with a marked decrease in white blood cell (WBC) count and C-reactive protein levels, as well as normalization of body temperature. A successful second-stage wound debridement and closure were performed, and the patient experienced no major complications during recovery. The patient reported minimal pain postoperatively and improved daily functioning, contributing to an enhanced quality of life.
CONCLUSIONS: This case underscores the critical importance of early aggressive treatment and comprehensive multidisciplinary care in managing Fournier's gangrene. Prompt surgical intervention combined with effective postoperative management can lead to positive outcomes, with significant improvement in clinical and laboratory parameters, enhanced patient comfort, and improved quality of life. Further research is needed to optimize treatment protocols and improve outcomes in similar cases.

Keywords: scrotum; gangrene; Fournier's gangrene; *Staphylococcus aureus* infection; emergency surgery; antibiotic therapy; case report

Introduction

Fournier's gangrene is a serious and potentially life-threatening condition that affects the genital and perineal regions of the body. This condition is a type of necrotizing fasciitis, which is a rare but severe bacterial infection that can rapidly spread throughout the body [1]. The microbiological profile of Fournier's gangrene is characterized by the presence of various bacterial species [2]. Common Gram-negative bacilli involved include *Escherichia coli* and *Klebsiella pneumoniae*. *Escherichia coli* is a facultative anaerobic bacterium commonly found in the intestines. It can become pathogenic when it invades other tissues, leading to severe infections [3]. *Klebsiella pneumoniae*, another facultative anaerobe from the gut, is known for causing serious infections in the urinary tract and respiratory system and frequently contributes to necrotizing infections [4]. In addition to Gram-negative bacilli, Gram-positive cocci are also prevalent in Fournier's gangrene. *Staphylococcus aureus* is a notable pathogen due to its virulence and toxin production, which can result in a wide range of infections, including skin and soft tissue infections [5, 6]. *Streptococcus* species, particularly Group A *Streptococcus* (*Streptococcus pyogenes*), are also significant contributors, known for their rapid and severe soft tissue infections, including necrotizing fasciitis [7]. Anaerobic bacteria play a critical role in the polymicrobial environment of Fournier's gangrene [2]. *Clostridium perfringens* is known for its gas and toxin production, leading to gas gangrene, a severe form of necrotizing infection [8]. In addition, peptostreptococcus species, commonly found in the mouth, skin, gastrointestinal tract, and respiratory tract, also contribute to mixed anaerobic infections. These bacteria often enter the body through a break in the skin, such as a cut or wound.

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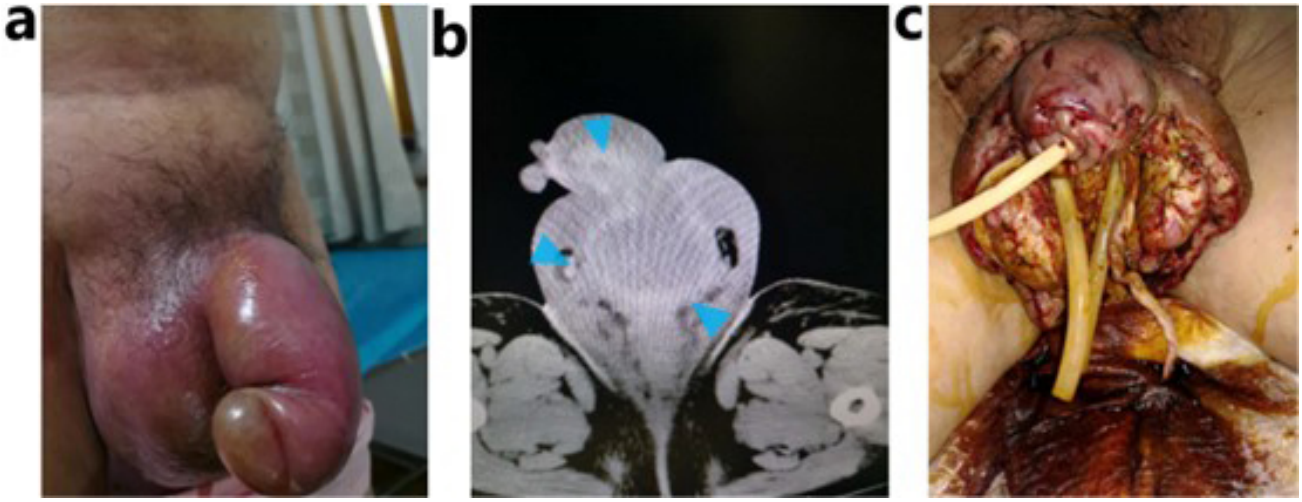

Fig. 1. Physical and radiological images of the scrotum and the penis. (a) shows swollen, ulcerated, and oozing pus, (b) shows the computed tomography (CT) imaging, (blue arrows) shows the ulceration and the swollen parts, (c) presents multiple incisions were made for drainage.

The infection can quickly spread to the surrounding tissues, causing extensive damage and tissue death [9]. Individuals with certain risk factors such as diabetes, obesity, and immunocompromised states are more susceptible to developing Fournier's gangrene. Prompt medical intervention is critical to prevent the spread of infection and to reduce the risk of complications [10]. Diagnosing Fournier's gangrene typically involves a combination of medical history, physical examination, and laboratory tests. The healthcare provider will first perform a thorough physical examination of the affected area, which may reveal characteristic symptoms such as severe pain, swelling, redness, and skin discoloration. In addition, blood tests may be ordered to check for signs of infection, such as an elevated white blood cell (WBC) count. Imaging tests, such as ultrasound or computed tomography (CT) scans, may also be used to determine the extent of tissue damage and to guide surgical interventions [10]. Treatment for Fournier's gangrene typically involves a combination of surgery and antibiotics to remove infected tissue and control the spread of infection. With timely and appropriate treatment, many individuals with Fournier's gangrene can recover from this serious condition [11]. In this article, we present a rare case of scrotal gangrene secondary to *Staphylococcus aureus* infection.

Case Report

Initial Presentation and Symptoms

On 22 August 2018, a 67-year-old male who lives alone began experiencing swelling and pain in the perineum and scrotum without an obvious cause. These symptoms were accompanied by difficulty urinating and defecating, as well as gross hematuria. Despite the severity of these symptoms, the patient did not seek medical attention at that time.

Hospital Admission and Diagnostic Findings

The patient was admitted to the hospital on 27 August 2018, due to severe, unbearable pain in the perineum and scrotum, which had been worsening over the previous five days. The pain was accompanied by purulent and bloody discharge (Fig. 1a). At the time of admission, the patient reported no significant family or psychosocial issues. A review of his medical history revealed that he had two plastic buttons implanted in his perineal area ten years prior.

Upon admission, the patient presented with the following vital signs: body temperature of 38.90 °C, pulse rate of 105 beats/min, respiratory rate of 22 breaths/min, and blood pressure of 140/75 mmHg. Physical examination revealed abdominal distension, a lower abdominal mass, and tense, shiny, purplish-brown skin with blood and pus oozing from the scrotum, penis, and perineum, accompanied by a strong foul odor.

Laboratory and Imaging Results

Preoperative laboratory tests showed a WBC count of 20.1 $\times$ 10^9/L, a highly sensitive C-reactive protein (CRP) level of 173.89 mg/L, a D-dimer level of 4664 units, a creatinine level of 109 µmol/L, and a quantitative determination of B-type natriuretic peptide (pro-BNP) of 106 pg/mL. Imaging studies, including ultrasonography and CT, revealed bilateral hydronephrosis, thickening of the bladder wall, and a dense shadow in the spongeous part of the urethra, with an incomplete lumen (Fig. 1b). Additionally, swelling and exudation changes were observed in the penis, scrotum, and lower abdominal wall, suggesting a possible urethral injury.

Diagnosis and Surgical Intervention

The patient was diagnosed with cellulitis (acute and complicated with necrotizing fasciitis) in the perineal area, a urethral foreign body with ulceration, and urinary retention.

Fig. 2. A significant improvement in the healing and recovery of the scrotum after one year follow-up.

On 28 August 2018, an emergency surgical procedure was undertaken to address these conditions. The surgical team began by expanding the necrotic tissue in the perineal area to fully expose the affected regions. Following this, a thorough debridement was performed to remove all necrotic and infected tissue, ensuring the area was as clean as possible to prevent further infection. During the debridement, two plastic buttons, each measuring 2.5 cm × 2.5 cm, were identified and carefully removed from the perineal region. After the removal of these foreign bodies, a bladder fistula surgery was performed to create an alternative pathway for urine drainage, bypassing the obstructed and damaged urethra. Multiple incisions were made in the perineal and scrotal regions to facilitate effective drainage of the infected material, which was a crucial step in preventing the spread of the infection. Drainage tubes were inserted to maintain the continuous outflow of fluids from the surgical site (Fig. 1c). The surgical wounds were left open, and a plan for further wound management, including frequent cleaning and dressing changes, was established.

Postoperative Care and Recovery

Following the surgery, the patient was treated with intravenous imipenem and cilastatin 0.5 g every 6 hours (VA 22827, Merck Sharp & Dohme Corp, Elkton, MD, USA). He received three liters of enteral nutrition support daily to prevent wound contamination by feces. The perineal wound was cleaned twice daily with hydrogen peroxide (manufactured by Guangdong Hengjian Pharmaceutical Co., Ltd, H44023919, Jiangmen, China), povidone-iodine solution (manufactured by Guangdong Hengjian Pharmaceutical Co., Ltd, H44023924, Jiangmen, China), and normal saline (manufactured by Shandong Qidu Pharmaceutical Co., Ltd, H20113297, Zibo, China). To manage pain, 100 mg of intramuscular tramadol hydrochloride (manufactured by Jiangsu Jiuxu Pharmaceutical Co., Ltd, H20023537, Jiuxu, China) was administered ten minutes before each wound wash. A culture of drainage fluid and necrotic tissue taken two days after surgery revealed the presence of *Staphylococcus aureus*.

During his hospitalization, the patient's liver and kidney function, blood electrolyte levels, and other vital parameters were regularly monitored. The patient's clinical and laboratory parameters showed significant improvement following the intervention. The WBC count decreased from 20.1×10^9/L pre-operatively to 9.7×10^9/L one week post-operatively, and further to 9.4×10^9/L at discharge. CRP levels dropped from 173.89 mg/L pre-operatively to 31.34 mg/L one week post-operatively, and 2.2 mg/L at discharge. The patient's body temperature normalized from 38.9 °C on admission to 37.0 °C at discharge on 19 October 2018. Renal function, indicated by stable blood creatinine levels between 43–46 μmol/L, was maintained.

Follow-up and Long-term Outcomes

On 21 November 2018, the patient underwent a successful second-stage wound debridement and closure procedure, with the removal of the drainage tubes. He was

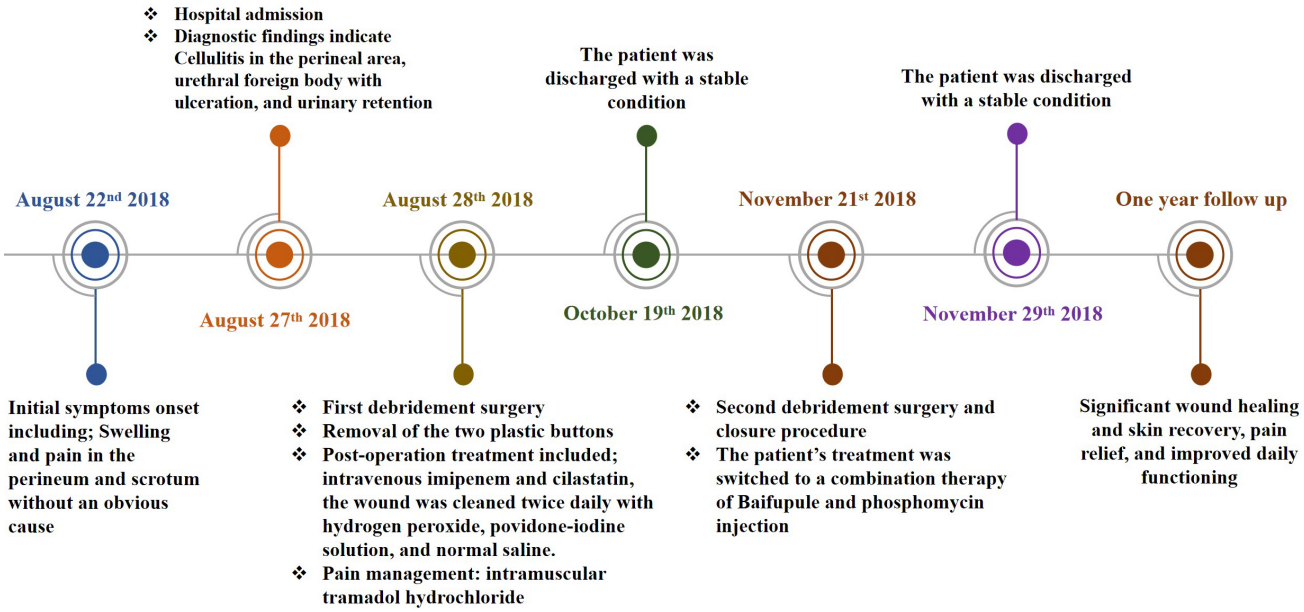

Fig. 3. The timeline of the patient's treatment and recovery.

switched to a combination therapy of Baifupule (manufactured by Sichuan Kelun Pharmaceutical Co., Ltd, H20193110, Chengdu, China) and phosphomycin injection (manufactured by Harbin Pharmaceutical Group Sanjingmingshui Pharmaceutical Co., Ltd, H20033224, Suihua, China). Upon discharge, the patient continued to follow up as an outpatient for one year and reported significant pain relief and improved daily functioning (Fig. 2, Fig. 3).

The patient experienced no major adverse or unanticipated events during his treatment. Expected post-operative pain was effectively managed with tramadol hydrochloride. Minor complications, such as localized skin irritation from frequent dressing changes, were managed with topical treatments and did not impede his recovery.

Patient's Perspective and Quality of Life

The patient expressed satisfaction with the care received, particularly noting the effectiveness of pain management strategies that greatly improved his comfort during recovery. He appreciated the psychological support and clear communication provided by the healthcare team, which helped him manage the stress and anxiety associated with his condition. The patient also reported improved sleep patterns, better mobility, and enhanced independence in performing daily tasks, all contributing to an improved quality of life.

Discussion

Fournier's gangrene or Fournier's necrosis is a rare urological emergency characterized by rapid onset and progression, which can pose a serious threat to the patient's life. The incidence of this disease is reported to be 1:7500 to 1:75,000, and although current treatment measures have been improved, the mortality rate can still be as high as 3% to 67% [10, 11, 12]. In our article, a patient with scrotal necrosis was admitted to our department with a history of perineal foreign body implantation 10 years ago. At the onset of the disease, he experienced pain in the penis and scrotum, accompanied by symptoms of rupture and purulent discharge. Imaging suggested urethral injury with rupture. Based on the patient's symptoms, physical examination findings, B-ultrasound, and full abdominal CT examination, acute perineal cellulitis with local necrotizing fasciitis was considered. Scrotal necrotizing fasciitis most commonly occurs in the male scrotum, and according to previous literature reports, *Escherichia coli*, *Streptococcus*, *Klebsiella*, *Clostridium perfringens*, *Proteus mirabilis*, *Staphylococcus*, and *Candida* are common symbiotic bacteria are mostly found in the scrotum [13, 14]. This disease is very rare in China. Through a literature search, Chen *et al.* [15] reported a successful case of early discovery and treatment of scrotal necrosis after anal abscess debridement in 2018. The article mentioned that multidisciplinary treatment is necessary, and that wide cellulitis should be treated with surgical debridement immediately and repeatedly until the wound appears clean. Currently, early use of broad-spectrum antibiotics and timely surgical debridement and drainage are the main methods for treating Fournier's gangrene [16, 17].

When repairing or reconstructing wounds to the penis and scrotum, the extent and severity of the injury determine the method used. Small, superficial wounds can often be closed using sutures or stitches in a process known as primary closure. For larger wounds that cannot be closed primarily, skin grafts may be used, where the skin is taken from another part of the body and used to cover the wound. Flap reconstruction may be required for complex or extensive

Table 1. Comprehensive overview of the repair and reconstruction techniques used for managing injuries to the penis and scrotum.

Type of Injury	Repair	Reconstruction
Penile laceration	The wound is carefully cleaned and stitched together with absorbable sutures.	In case of significant loss of tissue, a flap of skin or graft may be used to reconstruct the penis.
Penile fracture	Surgical repair is necessary to realign the broken ends of the penis and stitch them together.	In severe cases, tissue grafting may be needed to reconstruct the penis.
Penile amputation	Surgical reattachment is attempted, and the severed portion of the penis is carefully reattached and stitched together.	In cases where the penis cannot be reattached, a reconstruction using tissue flaps or grafts may be necessary.
Scrotal laceration	The wound is cleaned and stitched together.	In severe cases, tissue grafts may be necessary to reconstruct the scrotum.
Scrotal hematoma	A small incision may be made to drain the accumulated blood from the hematoma.	In severe cases, surgery may be necessary to remove the blood clot and repair any damaged blood vessels.
Testicular injury	Surgery may be required to repair the damaged testicle, remove the injured testicle, or place it back into the scrotum if it has been dislocated.	In cases of significant loss of tissue or complete removal of the testicle, a prosthetic testicle may be implanted.

wounds that involve multiple tissue layers. In cases where the penis is injured, surgery may be required to reconstruct the damaged tissue, and this may involve tissue transfer, grafting, or the use of prosthetic devices. Similarly, scrotal reconstruction may also involve tissue transfer or grafting, and in some cases, testicular implants may be used to restore the appearance of the scrotum. The specific repair or reconstruction technique chosen depends on factors such as the size, location, and severity of the injury, as well as the patient's overall health and medical history [18, 19, 20] (Table 1). In the case of our patient, multiple incisions and drainage were immediately performed in the perineum upon admission. The drainage fluid and necrotic tissue tested positive for *Staphylococcus aureus*, indicating that the patient initially presented with painless cellulitis caused by bacterial invasion. Subsequently, the condition rapidly progressed to scrotal swelling, severe pain, ulceration, suppuration, and systemic symptoms, resulting in the typical presentation of Fournier's syndrome in this case. Therefore, an urgent debridement surgery was performed, followed by daily irrigation and dressing changes were maintained, and suitable antibiotic treatment was given. After the initial surgical interventions, removal of the two plastic bottoms, and successful wound closure, the patient was placed on a regimen of Baifupule and phosphomycin injections to prevent the recurrence of the infection. Lifestyle adjustments were necessary, including careful wound care, regular follow-ups, and adherence to prescribed medications. Despite the severity of his initial presentation, the patient reported minimal pain and improved daily functioning, with no significant adverse events during his recovery. These outcomes underscore the importance of a comprehensive, multidisciplinary approach to post-operative care, including lifestyle modifications and continued medical supervision, to ensure long-term success and prevent the recurrence of such severe conditions.

Conclusions

This case report highlights the importance of prompt surgical intervention and aggressive antibiotic therapy in managing Fournier's gangrene secondary to *Staphylococcus aureus* infection. Early recognition, timely debridement, and comprehensive post-operative care were crucial in achieving a successful outcome. The patient's perspective underscores the significant role of pain management and psychological support in recovery. This case emphasizes the need for vigilant clinical practices and multidisciplinary collaboration to improve patient outcomes and reduce mortality in severe necrotizing infections.

Availability of Data and Materials

The dataset supporting the conclusions of this article is included with the article.

Author Contributions

HL, JHZ, and AA designed the article. JHZ and AA contributed to the manuscript's writing (original draft). YZD, SAA, and HYZ acquired and analyzed the data. SAA and HL participated in the review and drafting of the manuscript. All authors have been involved in revising it critically for important intellectual content. All authors gave final approval of the version to be published. All authors have participated sufficiently in the work to take public responsibility for appropriate portions of the content and agreed to be accountable for all aspects of the work in ensuring that questions related to its accuracy or integrity.

Ethics Approval and Consent to Participate

Written informed consent was obtained from the patient for the publication of any potentially identifiable images or data included in this article. The study was approved by the First Affiliated Hospital of Zhejiang University, School

of Medicine (IIT20230386A), and conducted in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

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Conflict of Interest

The authors declare no conflict of interest. Hui Lu is serving as one of the Editorial Board members of this journal. We declare that Hui Lu had no involvement in the peer review of this article and has no access to information regarding its peer review.

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