PoCUS for the management of Fournier's gangrene in the emergency department: A case report

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Abstract. Serious soft tissue infections in the spectrum of rapidly progressive necrosis of the fascia and subcutaneous tissue represent a clinical challenge in emergency department clinical practice. Fournier's gangrene (FG) is a presentation thereof that compromises the urogenital area. A low threshold of clinical suspicion complementary to laboratory evaluation and imaging is necessary to act rapidly and perform diagnostic and therapeutic surgical intervention for this condition. The present study reported the case of a 63-year-old woman who was admitted with buttock skin changes for 72 h. The diagnostic impression was septic shock due to FG. Point-of-care ultrasound (PoCUS) was performed, indicating free fluid in the muscle planes, discontinuity of the muscle fascia and the presence of gas in the subcutaneous cellular tissue. The patient was taken to surgery 2 h after admission. PoCUS was indicated to have an acceptable diagnostic performance that may optimize the care of this type of patient depending on the conditions of the emergency department and the availability of other resources.

Introduction

The term Fournier's gangrene (FG) was used for the first time in 1886 by the French venereologist Jean Fournier to describe a necrotizing polymicrobial infection of the soft tissues of the urogenital or anogenital area (1). This pathology is rare but potentially fatal, accounting for 0.02% of hospital admissions, with an incidence of 1.6 per 100,000 men and 0.25 per 100,000 women. The literature describes a mortality rate ranging from 3 to 67% of patients (2,3). Among the positive findings on physical examination are edema, erythema, local heat and necrotic lesions in the genital and anorectal region with rapidly progressive worsening, expanding to the abdomen, flanks or thorax (3). FG is a life-threatening condition that requires urgent medical attention and treatment. Certain relevant aspects that must be considered in FG include rapid progression, polymicrobial infection, predisposing factors (diabetes mellitus, immunosuppression, obesity, peripheral vascular disease, alcohol abuse, compromise of the immune system or blood supply to the genital area), clinical presentation, systemic signs, diagnostic imaging, early diagnosis and treatment, surgical intervention, intensive care and support, and mortality risk. Given the critical nature of FG, a multidisciplinary approach involving surgeons, infectious disease specialists, critical care physicians and other healthcare professionals is essential to achieve the best possible outcomes (1-3).

Studies using bedside ultrasonography [point-of-care ultrasound (PoCUS)] have described marked thickening of the scrotal fascia with edema, free unilateral or bilateral peri-testicular fluid and areas of subcutaneous gas. PoCUS has the potential to have a valuable role in the diagnosis of FG. Early diagnosis and prompt treatment are crucial for improving patient outcomes and reducing morbidity and mortality. Potential utilities of PoCUS in the diagnosis of FG include rapid assessment, detection of gas in soft tissues, visualization of fluid collections and abscesses, monitoring disease progression, guiding surgical interventions and screening in high-risk populations (4,5).

The present case report highlights the usefulness of PoCUS in facilitating diagnostic and therapeutic decision-making in a patient with FG in an emergency department.

Case report

A 63-year-old woman with a history of arterial hypertension, type 2 diabetes mellitus and obesity consulted the emergency department of the Hospital San Vicente Fundación (Rionegro, Colombia) due to a 3-day history of pain in the left buttock associated with changes in local inflammation

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and purulent discharge, extending to the anorectal region. On admission, the patient was hypotensive (mean arterial pressure, 50 mmHg; lower limit of normal, 65 mmHg), with tachycardia, without fever and reporting intense pain in the affected area. On physical examination, redness, flushes and local heat with an approximate induration area of 15x10 cm were observed in the left gluteal region, along with an ulcer with necrotic edges and purulent discharge, without subcutaneous emphysema (Fig. 1).

The diagnostic impression was septic shock due to FG-type necrotizing soft tissue infection. PoCUS was performed, revealing free fluid in the muscle planes, discontinuity of the muscle fascia and the presence of gas in the subcutaneous cellular tissue (Figs. 2 and 3). Pharmacological management was started with intravenous crystalloids and antibiotic therapy with piperacillin/tazobactam and vancomycin, together with prior blood culture collection. The paraclinical tests on admission showed an increase in acute phase reactants: Leukocytes, 17,400/μl (normal range, 4,500-11,500/μl); neutrophils, 15,430/ml (normal range, 2,000-7,500/ml); and C-reactive protein, 33 mg/dl (normal range, 0.4-1 mg/dl). Hyperlactatemia (lactate, 2.2 mmol/l; normal range, 0.6-1.6 mmol/l), hyponatremia (sodium, 132 mmol/l; normal range, 135-145 mmol/l), creatinine abnormality (2.01 mg/dl; normal range, 0.57-1.11 mg/dl) and high urea nitrogen (60.5 mg/dl; normal range, 9-23 mg/dl) were found, findings that suggest a diagnosis of acute kidney injury.

The patient was taken to surgery 2 h after admission in accordance with the Surviving Sepsis guidelines (6). The patient exhibited necrosis in the skin, subcutaneous cell tissue and fascia, with extension to the right greater vaginal lip, without anorectal involvement. In the hospital's surgical report and medical record of the patient, abundant purulent material was described; washing and debridement were performed and cultures were collected.

In the immediate postoperative period, the patient was taken to the intensive care unit, where septic shock management was continued, including vasopressor support with norepinephrine 0.2 μg/kg/min and vasopressin 0.06 IU/min. Linezolid was adjusted to vancomycin due to persistent renal damage. At 48 h after admission, a new lavage and surgical debridement were performed, revealing a large coverage defect that included the mons pubis, running through the right labia majora to the inner face of the buttock, and compromising the perineum and midline, with a necrotic pocket and septate abscesses towards the posterior area.

At six days after admission, the patient was transferred to the intermediate care unit. No positive microbiological isolation was achieved in the blood cultures or surgical cultures according to standard procedures (6) and a 14-day course of linezolid and piperacillin/tazobactam was completed. Subsequently, the coverage defect was corrected with local flap without complications, achieving adequate metabolic control. The patient was discharged after being hospitalized for 33 days, without any limitations in mobility and under hemodynamic stability after completing intrahospital therapy. After hospital discharge, the patient was followed up for 6 weeks and exhibited a favorable healing process.

Figure 1. Patient's lesion with suspected soft tissue infection led to suspicion of fasciitis vs. Fournier's gangrene.

Discussion

The diagnosis of FG in the emergency department is challenging, as the clinical, laboratory and imaging findings are not specific. Furthermore, patients may newly develop the disease without having any of the conventionally described risk factors, such as age, history of diabetes mellitus, alcoholism, obesity or immunosuppression (3,7).

Approximate mortality rates of 20-50% have been described, with the main sources of infection being the gastrointestinal tract (30-50%), genitourinary system (20-40%), skin lesions (20%) and idiopathic infections (<20%) (2,8). The pathogens involved in these infections are microorganisms stemming from the perineal and genital region, including aerobes (*Escherichia coli*, *Klebsiella pneumoniae*, *Streptococcus aureus*), anaerobes (*Bacteroides fragilis*, *Clostridium*), other bacterial species such as vibrio, streptococci, enterococci and corynebacteria, and fungal agents such as *Candida albicans* and zygomycetes (2,4).

The infection compromises the superficial and deep muscle fascia, facilitated by etiological factors and depending on the patient's immune status and the route of entry of the microorganism (8). These pro-inflammatory mechanisms favor hypoxia, producing micro-infarcts in the nervous tissue that result in high-intensity pain in the affected area and necrosis (8).

In patients with suspected FG, it is necessary to carry out a detailed anamnesis and physical examination of the genital and perineal areas in search of wounds or infectious processes that may go unnoticed. The findings in the initial stages of the disease are edema (80%), disproportionate pain (79%) and erythema (70%). Bullae and dermal necrosis, together with crepitus in the abdominal region that may extend to the thorax, are findings related to the late stages of the disease, the latter being highly specific to *Clostridium* infection (3,7). Finally, the presence of hypotension and septic shock are ominous

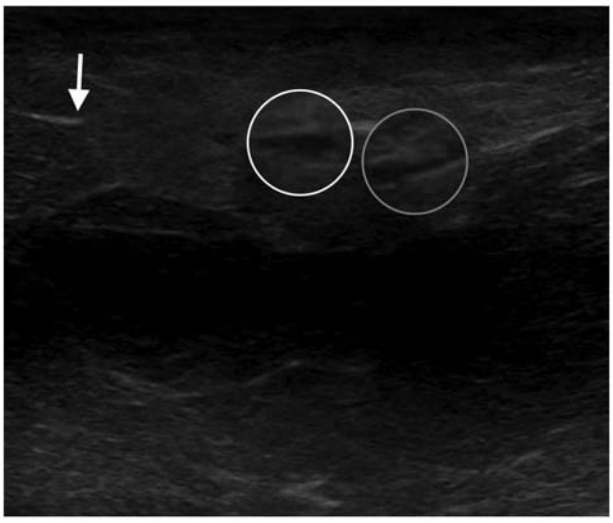

Figure 2. Point-of-care ultrasound examination on hospital admission indicated hypoechoic material due to the presence of fascial discontinuity (white arrow) and air-gas areas in subcutaneous tissue (white circles).

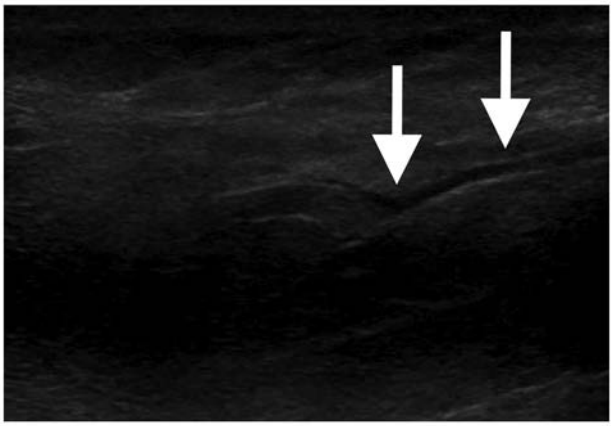

Figure 3. During hospital admission, the echography revealed the presence of edema in the subcutaneous tissue and hypoechoic material between the fascial planes corresponding to fluid (white arrows).

signs associated with high mortality and multi-organ failure, which is the main cause of death in necrotizing soft tissue infections (2,9).

The diagnosis of FG is mainly clinical and imaging should not delay the surgical approach (7,9). Images are useful when it is necessary to know the extension, or in atypical presentations of the disease. According to the literature, plain radiography has a sensitivity of 49% and a specificity of 94% because gas formation is present in almost half of all patients with FG. Computed tomography has a sensitivity of close to 90% and a specificity of 93.3% for necrotizing soft tissue infections, which allows for the determination of the possible extension of the disease and other less obvious lesions. Magnetic resonance imaging is another diagnostic modality; a sensitivity of 100% and a specificity of 86% have been described for the detection of necrotizing soft tissue infections. However, in the acute setting of the emergency service, it is limited mainly by its high cost, institutional availability and time spent performing the procedure (10).

PoCUS has emerged as a useful tool for the assessment of soft tissue inflammation. Certain studies have recorded a sensitivity of 88% and a specificity of 93% for the detection of necrotizing soft tissue infections (9-11). Positive findings include the 'cobblestone' sign described at the subcutaneous level, hyperechoic reverberation artifacts called 'snow globe' or 'dirty shadow', free fluid in the muscle fascia and intrascrotal gas (4,5,9). Furthermore, studies suggest that ultrasound may have better diagnostic accuracy in patients with negative tomography or magnetic resonance imaging findings, and may be used in hemodynamically unstable patients and in cases where transport to a radiology room is usually unsafe due to the patient's hemodynamic condition (2,9,10).

Considering the rapid hemodynamic deterioration of the patient, the use of PoCUS may help guide a possible diagnosis of FG. In addition, the use of intravenous contrast is contraindicated in certain patients due to renal failure associated with soft tissue sepsis, which may limit the use of contrast imaging, and at certain hospitals nuclear magnetic resonance is not available; for these reasons, PoCUS would be useful in investigating some of the signs mentioned. Likewise, the usefulness of PoCUS lies in the search for other identifiable causes, such as epididymitis, orchitis, abscess and incarcerated or strangulated hernia, among others. The sensitivity of PoCUS in necrotizing fasciitis may range from 88 to 100%, with a specificity of 87.5 to 93% and a negative predictive value of 95.4% (12).

The availability of ultrasound at the patient's bedside allows for the rapid diagnosis of infections, revealing certain signs that may suggest them, such as the presence of gas or fluid. Furthermore, significant time can be saved by making a timely diagnosis of FG with PoCUS compared to taking the patient to the radiological service and performing contrasting imaging (13).

The therapeutic pillars for FG include adequate hemodynamic resuscitation, emergent surgical debridement and the early initiation of broad-spectrum parenteral antibiotic therapy (14,15). Among the first-line antibiotics are carbapenems (imipenem, meropenem) or beta-lactams with beta-lactamase inhibitors (piperacillin/tazobactam), combined with clindamycin plus drugs with a Gram-positive target spectrum, such as vancomycin, daptomycin or linezolid. However, in scenarios where the patient is at high risk of fungal infections, starting amphotericin B or fluconazole should be considered (8,10). The final disposition of these patients depends on their hemodynamic status and comorbidities, although they generally require intensive care unit stays in the hospital (16,17).

It is important to highlight that, although in the present case the microbiological results were not positive either at the emergency department or in the operating room, the microbiological findings may help guide the patient's antibiotic therapy. However, it has been reported that positivity for microorganisms in cases of FG is relatively low (18). For this reason, in the current setting, a broad-spectrum empirical therapy was chosen.

Advanced imaging, such as computer tomography, is currently the gold standard for diagnosis; however, its application may be difficult due to the instability of numerous affected patients, as well as the additional time, costs and radiation and contrast exposure involved (19).

PoCUS provides valuable real-time information to surgeons, aiding in the planning of further surgical treatment for patients. Its ability to provide rapid diagnosis, procedural guidance, treatment monitoring, preoperative planning, bedside assessment and enhancement of patient safety make it an indispensable tool in surgical decision-making. By incorporating PoCUS into their practice, surgeons may optimize patient care, improve surgical outcomes and implement appropriate interventions (20,21).

In conclusion, the use of ultrasonography in the emergency setting is able to provide adequate diagnostic support for necrotizing soft tissue infections, including FG. It is necessary to carry out studies to evaluate its impact on patient outcomes, such as the time from hospital admission to surgical treatment, to establish it as a tool for systematic use in the event of clinical suspicion in the emergency department.

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Availability of data and materials

The datasets used and/or analyzed during the present study are available from the corresponding author on reasonable request.

Authors' contributions

MZG, JCVR, SQV, DGO, DGA and CMA contributed to the conception and design of the study. CMA wrote the manuscript. MZG, JCVR, SQV, DGA and DGO searched the literature. MZG, JCVR, SQV, DGA and DGO provided clinical assistance to the patient and were responsible for the treatments. MZG and CMA revised the manuscript. MZG and CMA confirm the authenticity of all the raw data. All authors have read and approved the final manuscript.

Ethics approval and consent to participate

The Bioethics Committee of San Vicente Fundación Hospital (Rionegro, Colombia) approved the publication of this case.

Patient consent for publication

Written informed consent for the publication of clinical details and images was obtained from the patient.

Competing interests

The authors declare that they have no competing interests.

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