

## Ultrasound in Emergency Medicine



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### POINT-OF-CARE ULTRASOUND DIAGNOSIS OF NECROTIZING FASCIITIS MISSED BY COMPUTED TOMOGRAPHY AND MAGNETIC RESONANCE IMAGING

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**Abstract—Background:** Necrotizing fasciitis (NF) is a rare but deadly disease. Diagnosis of necrotizing soft tissue infections can be challenging for a variety of reasons. Point-of-care (POC) ultrasound (US) has been described as a diagnostic tool to help the acute care clinician make the early diagnosis that is imperative to optimize outcomes. **Objective:** To report a case of Group A *Streptococcus* NF recognized with POC US, and subsequent negative findings on computed tomography (CT) and magnetic resonance imaging (MRI). **Case Report:** A 54-year-old diabetic woman presented to the Emergency Department with atraumatic right foot and lower leg pain associated with fever. Examination was concerning for NF, and a POC US was performed, which showed thickened deep fascia and fluid tracking along the deep fascial plane, with fluid pockets measuring 6 mm in depth, consistent with NF. Surgical consultation was obtained. Per request, CT and MRI of the patient's lower extremity were performed; both were interpreted by the radiologist as showing changes consistent with cellulitis. Septic shock and multisystem organ failure ensued; the patient was eventually taken to the operating room, where operative findings were consistent with NF. Operative cultures grew *Streptococcus pyogenes*. **Conclusion:** NF is a surgical emergency. Early and accurate diagnosis is critical to ensure the necessary aggressive management needed to optimize outcomes. This case illustrates the utility of POC US to make the prompt diagnosis

of NF, particularly in light of subsequently negative CT and MRI. © 2014 Elsevier Inc.

**Keywords—**point-of-care; ultrasound; necrotizing fasciitis

### INTRODUCTION

Necrotizing soft tissue infections represent a rare but extremely dangerous clinical entity. Mortality rates vary widely, but estimates of up to 76% appear in the literature (1). Emergency physicians frequently encounter nonnecrotizing soft tissue infections including cellulitis, erysipelas, impetigo, and abscess; however, it is imperative to include the possibility of necrotizing fasciitis (NF) in the differential diagnosis of these commonly encountered conditions. Delay in diagnosis and operative management are associated with further worsening of already poor outcomes (1). Diagnosis can be difficult, particularly early in the disease course, and physical examination findings are variable and unreliable. Diagnosis based solely on clinical findings is incorrect in up to 64% of cases (2). Pain out of proportion and tenderness past margins of apparent skin change are notable early clinical findings, but these can be clinically indistinguishable from cellulitis. Findings later in the disease course include hemorrhagic blister formation, cutaneous anesthesia, and skin necrosis (1). In addition to laboratory analysis, current recommendations for work-up for equivocal cases include ultrasound (US), computed tomography (CT), and magnetic resonance imaging (MRI).

Streaming videos: Two brief real-time video clips that accompany this article are available in streaming video at [www.journals.elsevierhealth.com/periodicals/jem](http://www.journals.elsevierhealth.com/periodicals/jem). Click on Video Clips 1 and 2.

This article presents a case of Group A Streptococcal (GAS) NF that was diagnosed clinically and confirmed with point-of-care (POC) US. Per the request of the consulting surgeon, CT and MRI imaging were subsequently performed and read by the consulting radiologists as showing changes consistent with cellulitis, delaying operative care, which eventually confirmed the initial clinical and sonographic concern.

### CASE REPORT

A 54-year-old woman with history of poorly controlled type 2 diabetes mellitus presented to our Emergency Department (ED) with complaints of 4 days of progressively worsening right foot and lower leg pain. She reported indolent onset of right foot pain with progression of the pain up her lower leg to the distal knee. She also complained of increasing “bruising” of her foot. She denied trauma to her foot, leg, or back. She complained of fevers, with a maximum temperature at home of 38.9°C, chills, generalized malaise, and nausea. She reported recent difficulty controlling her hyperglycemia. Past medical history included type 2 diabetes mellitus with a recent hemoglobin A1C level of 10.8, complicated by peripheral neuropathy, hypertension, hyperlipidemia, osteoarthritis, obesity, tobacco abuse, tubal ligation, depression, and a previous positive methicillin-resistant *Staphylococcus aureus* screen. Medications included metformin, insulin detemir, quinapril, cyclobenzaprine, and simvastatin.

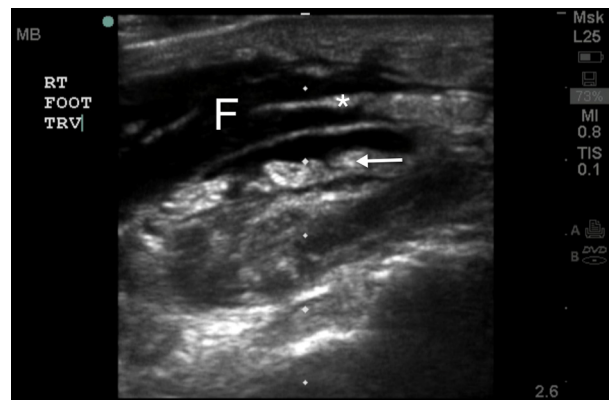
Triage vital signs showed a temperature of 39.4°C, heart rate of 115 beats/min, blood pressure 141/76 mm Hg, respiratory rate of 20 breaths/min, and pulse oximetry of 96% on room air. Physical examination showed a middle-aged woman who appeared acutely ill. She was awake, alert, and oriented to person, place, and time. Extremity examination was notable for diffuse erythema of her right dorsal foot and anterior right lower extremity. On the dorsum of her right foot was a solitary hemorrhagic bullae approximately 1 cm in diameter. Her entire dorsal right foot was exquisitely tender to palpation. Her dorsal pedal pulses were difficult to palpate but easily found with handheld Doppler. She had diminished sensation to light touch in her distal lower extremities, suggestive of diabetic neuropathy. Motor examination of her lower extremities showed that her strength was 5/5 in all major muscle groups, but limited in her right foot secondary to pain. Laboratory analysis showed a white blood cell count of 33,000, with 88% polymorphonuclear leukocytes, venous lactic acid 2.4, erythrocyte sedimentation rate 112, creatinine 1.0, blood urea nitrogen 15, bicarbonate 20, glucose 345, and an anion gap of 15. The Laboratory Risk Indicator for Necrotizing Fasciitis score was 9, indicating high risk for necrotizing fasciitis

(1). Blood cultures were sent prior to antibiotic administration. X-ray studies of the distal left lower extremity were performed and showed nonspecific venous congestion. There was no evidence of gas in tissue planes.

The attending emergency physician, a fellowship-trained sonologist, performed POC US, imaging the area of interest on the dorsum of the patient’s foot in orthogonal planes using a 10-5 MHz linear probe (SonoSite, Bothell, WA). Findings were consistent with NF, including diffuse fascial thickening, irregularity of the fascia, and fluid accumulation along the deep fascial layer measuring 6 mm in depth (Figure 1, Videos 1 and 2) (3,4). Fluid was also noted around the second, third, and fourth extensor tendons.

Broad-spectrum antibiotics were initiated in addition to resuscitation with intravenous crystalloids. Surgical consultation was immediately obtained with concern for NF. The consulting surgeon requested CT scan of the right lower extremity, which was performed using intravenous contrast. The radiologist interpreted the CT scan as showing soft-tissue edema consistent with cellulitis, and superficial varicose veins, but no other acute findings. The surgical consultant recommended admission to a medical service and treatment for cellulitis. The patient was seen and admitted by the Internal Medicine resident on call. An Infectious Disease consult was obtained; the consulting physician recommended MRI of the right lower extremity, which was performed with and without gadolinium on hospital day #2. The image was interpreted by the radiologist as subcutaneous edema most indicative of cellulitis, but without discrete fluid collection to suggest abscess. Mild reactive muscle edema was noted. Blood cultures sent in the ED remained negative.

Despite intravenous antibiotics, the patient’s clinical condition worsened and she developed distributive shock



**Figure 1.** Transverse image of dorsal foot with deep fluid pocket (F), irregular thickened fascia (\*) with fluid tracking along deep fascial planes, and extensor tendons (arrow) surrounded by anechoic fluid.

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