

Sonographic Findings in Necrotizing Fasciitis

Two Ends of the Spectrum

William Shyy, MD, Roneesha S. Knight, MD, Ruth Goldstein, MD, Eric D. Isaacs, MD,
Nathan A. Teismann, MD

Necrotizing fasciitis is a rare but serious disease, and early diagnosis is essential to reducing its substantial morbidity and mortality. The 2 cases presented show that the key clinical and radiographic features of necrotizing fasciitis exist along a continuum of severity at initial presentation; thus, this diagnosis should not be prematurely ruled out in cases that do not show the dramatic features familiar to most clinicians. Although computed tomography and magnetic resonance imaging are considered the most effective imaging modalities, the cases described here illustrate how sonography should be recommended as an initial imaging test to make a rapid diagnosis and initiate therapy.

Key Words—emergency medicine; musculoskeletal infections; necrotizing fasciitis; soft tissue infections

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Address correspondence to William Shyy, MD, Department of Emergency Medicine, University of California, 505 Parnassus Ave, Room M24, San Francisco, CA 94143-0203 USA.

E-mail: william.shyy@ucsf.edu

Abbreviations

ED, emergency department

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Necrotizing fasciitis is a rapidly progressive, life-threatening infection of the deep soft tissue.¹ The most commonly cultured organisms include *Staphylococcus*, *Streptococcus*, and anaerobes. Presenting signs such as erythema and tenderness may be subtle and easily mistaken for uncomplicated cellulitis. Because the time to surgical debridement is the most important prognosticator for survival, early diagnosis using imaging, laboratory tests, and clinical findings is essential.^{2,3} Computed tomography and magnetic resonance imaging are generally considered the imaging modalities of choice for this condition, with sensitivities between 80% and 100%.^{4,5} However, because sonography has also been shown to have high sensitivity and specificity (88% and 93%, respectively),⁶ and given that it can be performed rapidly and, at many centers, at the point of care, it is increasingly being used as the initial imaging modality in cases in which this condition is suspected.

Although necrotizing fasciitis is classified into 2 subtypes based on the identity of the infectious agent—type 1 (polymicrobial) and type 2 (isolated group A *Streptococcus* or *Staphylococcus* species)—the clinical characteristics are generally similar regardless of the microbiological type.^{7,8} In either type of necrotizing fasciitis, however, both the clinical and radiographic features can range from extremely subtle to quite dramatic at initial presentation.

Most prior literature on the sonographic appearance of this condition emphasized 4 findings: diffuse thickening of the subcutaneous tissue, perifascial fluid, air within the deep soft tissue, and a deep fascia with an “irregular” or “distorted” appearance.^{9–12} It is important to recognize, however, that for any individual case, the sonographic appearance of necrotizing fasciitis may range from quite dramatic, in which all of the above findings are present, to extremely subtle, in which only a thin anechoic rim of perifascial fluid provides a clue to the diagnosis. Below, we present 2 recent cases from our institution side by side to highlight each end of this spectrum and to describe the important role of early sonography in the care of these patients.

Case Descriptions

Case 1

A 47-year-old man presented to our emergency department (ED) with 5 days of pain, redness, and swelling of his upper arm after injecting heroin into his left deltoid muscle. He presented to the ED after his symptoms started to rapidly progress and the swelling, redness, and pain became circumferential around his upper arm. On presentation, he was afebrile with a blood pressure of 148/89 mm Hg and a heart rate of 102 beats per minute. His physical examination revealed substantial edema, warmth, erythema, and exquisite tenderness to palpation of the soft tissue of the upper arm. A small area of fluctuance was noted along the posterior aspect of the arm between the deltoid and upper border of the triceps muscle.

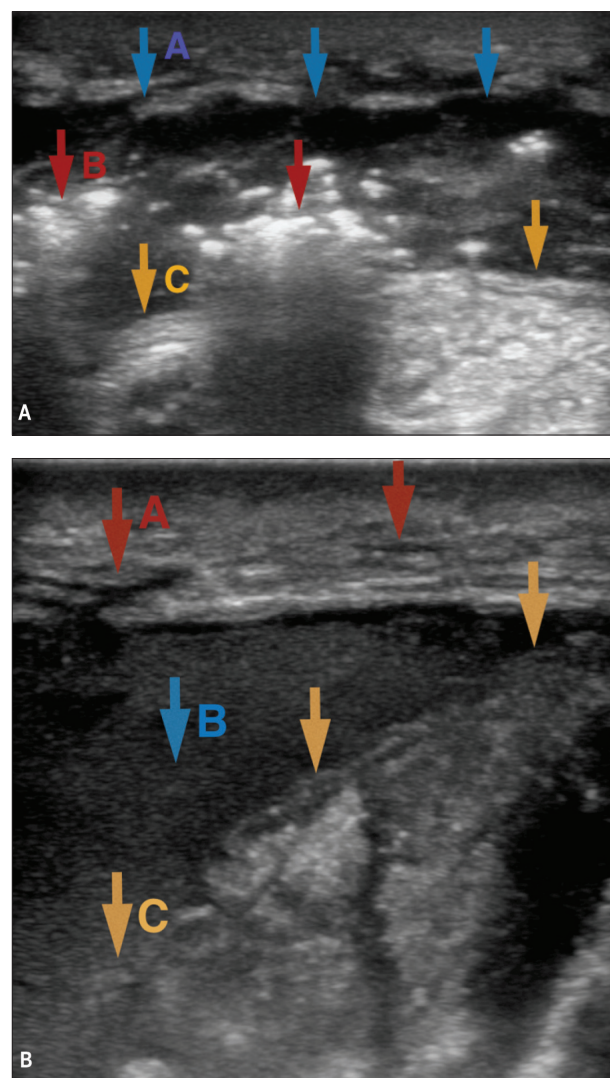
A point-of-care sonographic examination performed by ED staff showed a large amount of subcutaneous air, edematous soft tissue, and a complex fluid collection deep to the superficial fascia (Figure 1, A and B). Our general surgery service was consulted on the basis of these findings, and broad-spectrum antibiotics were administered. Subsequent radiography and computed tomography (Figure 1, C and D) confirmed these findings, and the patient was taken emergently to the operating room for surgical debridement (Figure 1E). Surgical wound cultures grew polymicrobial flora. After an extensive stay in the intensive care unit and 4 further debridements, the patient was discharged to a skilled nursing facility.

Case 2

A 50-year-old otherwise healthy male physician presented to our ED with 3 days of right thigh pain, fever, and chills that were preceded by a week of sore throat and fatigue.

The patient attributed the thigh pain to a “pulled muscle” sustained while playing tennis a few days previously. On presentation, he was found to be febrile to 103.1°F with a blood pressure of 142/88 mm Hg and a heart rate of 115 beats per minute. The physical examination was initially notable for mild tenderness of the anterior thigh without any visible erythema, warmth, or fluctuance. While in the ED, he developed patchy erythema over the area of pain (Figure 2A).

Figure 1. Case 1. **A**, Sonogram of anterior biceps showing a thin fluid layer deep to edematous subcutaneous tissue (A), air in soft tissue (B), and a fascial border (C). **B**, Sonogram showing edematous subcutaneous tissue (A), an abscess (B), and necrotic muscle (C). **C**, Radiograph showing subcutaneous air (A). **D**, Computed tomogram showing fluid collections with air (A) in the medial and lateral muscle groups. **E**, Left upper extremity after first debridement.



A radiology-performed sonographic examination revealed only a subtle anechoic fluid collection tracking along the deep fascia, separating the rectus femoris and rectus lateralis (Figure 2B). The patient received early broad-spectrum antibiotics and intravenous fluids, but despite this treatment, he became increasingly unstable. He was subsequently admitted to the intensive care unit, where he ultimately required ventilator and vasopressor support.

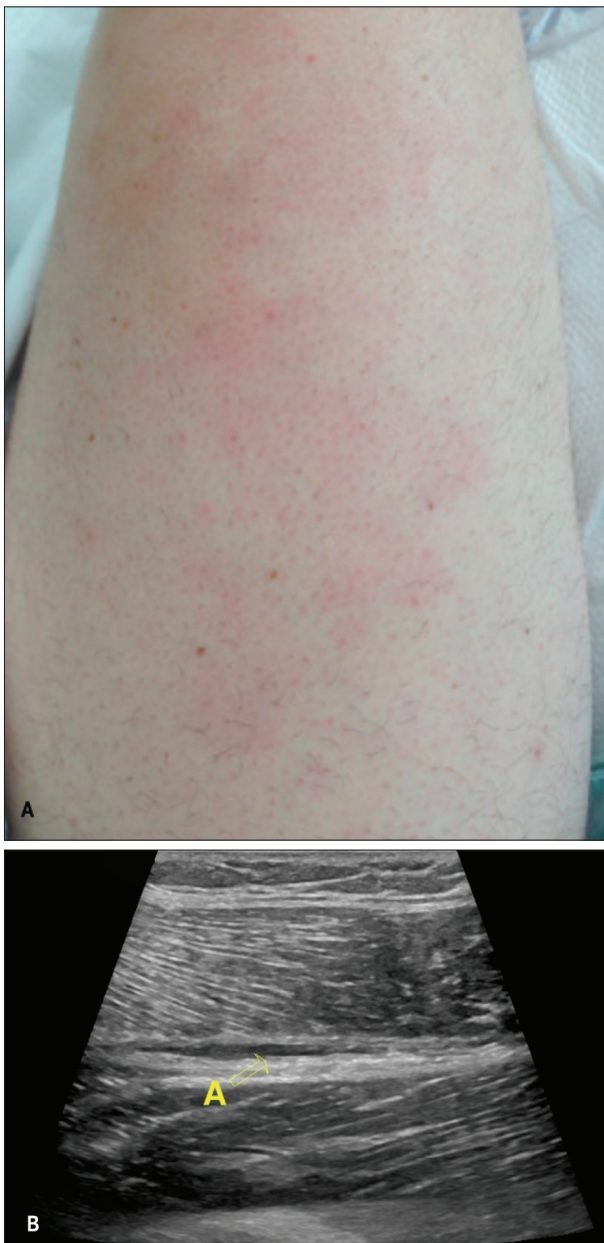
He underwent several surgical debridements before his condition stabilized. His blood and surgical wound cultures grew group A *Streptococcus*, leading to the hypothesis that he seeded his thigh muscles via a minor trauma while playing tennis in the setting of transient bacteremia from a group A *Streptococcus* pharyngitis. The patient was discharged after 11 days and made a full recovery.



Discussion

Necrotizing fasciitis is a rare but serious disease, and early diagnosis is essential to reducing its substantial morbidity and mortality. As the cases above suggest, the key clinical and radiographic features may exist along a continuum of severity at initial presentation; thus, this diagnosis should

Figure 2. Case 2. **A**, Patchy erythema over the right anterior thigh. **B**, Fluid (A) tracking beneath the deep fascia of the rectus femoris and rectus lateralis.



not be prematurely ruled out in cases that do not show the dramatic features of case 1, which are likely to be more familiar to most clinicians. Initial physical and radiographic findings may be deceptively reassuring.

The sonograms obtained in case 1 revealed fairly dramatic subcutaneous tissue edema, as indicated by the “cobblestone” appearance seen in most soft tissue infections. Second, there was a collection of fairly homogeneous hypoechoic material between the subcutaneous tissue and the superficial fascia (Figure 1B), which is characteristic of an abscess. Third, within this collection as well as in the surrounding soft tissue, there were multiple scattered echogenic foci with “dirty” acoustic shadows, representing air in the soft tissue (Figure 1A). Together with the associated physical examination findings, these sonographic abnormalities should allow for prompt diagnosis and treatment.

In contrast, case 2 revealed only subtle findings. On sonography, the soft tissue was only mildly edematous; no gas was seen; and the small amount of perifascial fluid seen anterior to the quadriceps muscle could have been easily overlooked or attributed to minor musculoskeletal trauma. In such cases, clinicians should keep in mind that seemingly innocuous findings on sonography, coupled with a concerning clinical picture, may still indicate a life-threatening condition.

Of course, providers should be aware of the inherent limitations of sonography in the evaluation of necrotizing fasciitis. Frequently, the only findings seen will be soft tissue cobblestoning, which itself is nonspecific and, furthermore, can prevent adequate visualization of deeper fascial layers.¹⁰ Nonetheless, in cases in which the soft tissue is well visualized, both radiologists and clinicians performing point-of-care sonography should be aware of the spectrum of sonographic findings in necrotizing fasciitis. Depending on the clinical factors associated with each case, all of the cardinal features described above—or only a component of this full constellation—may indicate the presence of disease.

In conclusion, necrotizing fasciitis is an uncommon diagnosis but one with severe consequences if not diagnosed promptly. Although computed tomography and magnetic resonance imaging are generally considered the most effective imaging modalities for this condition, the cases above illustrate how sonography can be used as an initial imaging test to make a rapid diagnosis and initiate therapy. Clinicians caring for patients suspected of having necrotizing fasciitis should be aware that individual cases may exist along a spectrum of severity and should be especially careful not to prematurely rule out this diagnosis in cases in which only subtle findings are present.

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