Unexpected Findings on Point-of-Care Superficial Ultrasound Imaging Before Incision and Drainage

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Cutaneous abscesses are typically incised and drained on the basis of clinical assessment. In most cases this procedure is a safe practice. We report 6 cases in which point-of-care ultrasound interrogation of obvious abscesses revealed potential serious complications with planned incision and drainage. Management was altered in 5 of 6 cases, and potential vascular disasters were avoided. In 1 case, the ultrasound results were ignored, and incision and drainage was completed, confirming the suspected abscess was indeed a solid mass later diagnosed as a carcinoma. In this case series, point-of-care ultrasound interrogation provided rapid assessment and discovery of potentially catastrophic anatomic relationships, avoiding serious complications.

Key Words—abscess; emergency ultrasound; incision and drainage; musculoskeletal ultrasound; skin infection; soft tissue infection

Cutaneous abscesses are commonly encountered in emergency departments (EDs), urgent care centers, and primary care practice.[1,2] With the high prevalence of community acquired methicillin-resistant *Staphylococcus aureus* (MRSA) infections, the incidence of cutaneous abscesses requiring incision and drainage is increasing nationwide.[3,4] The physical examination is not always reliable in differentiating cellulitis from an abscess; however, there are some abscesses that are clinically obvious and easily drained.[5] Such presentations typically show local erythema, palpable tenderness, and focal swelling with or without induration. In such cases incision and drainage is usually performed without any imaging unless there is an obvious complicating factor such as extensive soft tissue involvement or an immunocompromised host.[2,6]

Incision and drainage of a simple cutaneous abscess is performed under aseptic conditions after local anesthetic infiltration at the site of drainage. Once purulent drainage is obtained, after scalpel incision, blunt dissection may be used to expand the incision and lyse any septations in the abscess. The abscess is then irrigated and typically packed.[2] Antibiotics may be used if there is evidence of cellulitis; otherwise, incision and drainage is generally adequate for most cutaneous abscesses.[7]

We describe 6 cases of accidental discovery of complicating factors in apparently simple-appearing cutaneous abscesses. Ultrasound images and video, coupled with photographs of the cutaneous abscesses, help illustrate the utility of point-of-care ultrasound imaging in discovering unexpected findings before incision and drainage.

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Abbreviations

ED, emergency department; IV, intravenous; MRSA, methicillin-resistant Staphylococcus aureus

Case Descriptions

Case 1

A 52-year-old man presented to the ED with painful swelling on his right wrist. The patient stated that his symptoms started approximately 5 days before presentation, and the swelling suddenly increased in size, becoming erythematous and more painful 1 day before presentation. The patient's medical history was unremarkable; he knew of no trauma that may have caused a skin break. The patient's vital signs were normal except for a mildly elevated blood pressure. The physical examination revealed a 2 × 1.5-cm mass on the volar surface of the right wrist (Figure 1A). It was warm to the touch, erythematous, and nonpulsating. The resident physician examining the patient concluded that it was an abscess, and the supervising attending emergency physician concurred.

The patient's skin was prepared for incision and drainage, but before local anesthetic administration, the resident expressed curiosity regarding the appearance of this abscess on ultrasound imaging. A bedside ultrasound examination was performed, showing a heterogeneous appearance (Figure 1B). The addition of color Doppler imaging revealed robust arterial flow in the mass (Figure 1C). Incision and drainage was deferred, and a plastic surgeon was consulted. The consultant was unable to see the patient in the ED and followed him up in the office. The patient underwent exploration of mass in the operating room. Despite a surprising amount of blood loss, the mass was successfully removed, and a vascular connection was tied off. A vascular surgeon had been asked to assist in the operating room. The mass was discovered to be cancerous on pathologic examination, with findings suggesting liposarcoma.

Case 2

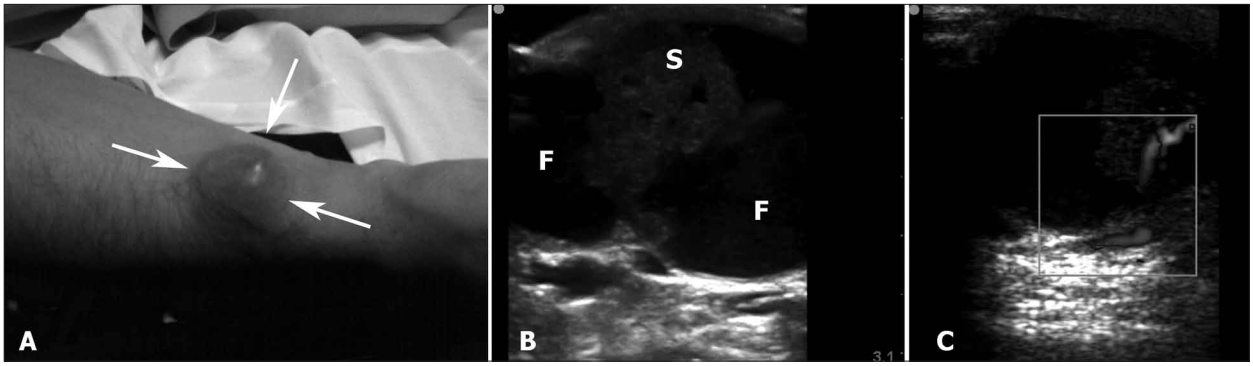
A 46-year-old previously healthy woman with a strong family history of coronary artery disease presented with an abscess at the site of intravenous (IV) line placement during a cardiac catheterization for positive stress test results. The catheterization was performed 5 days earlier and revealed normal coronary arteries. The patient noted the swelling and redness 2 days before presentation. She stated that nurses had difficulty inserting an IV catheter, and one was placed into her wrist. The physical examination revealed normal vital signs and a small area of erythema and tender fluctuant swelling suggesting an abscess at the site of the IV insertion (Figure 2A).

The resident physician involved in this patient's care prepared for simple incision and drainage. Before the procedure, the attending physician decided to perform a point-of-care ultrasound examination to assist with the incision and drainage. The image revealed the abscess directly over the patient's radial artery (Figure 2B). It showed no direct connection with the radial artery but revealed very minimal separation from the abscess. The patient's incision and drainage was changed to simple deroofing of the abscess, which allowed it to drain. The patient was treated with IV antibiotics and admitted for observation. Further review of the patient's records showed that the cardiology service had just begun to perform cardiac catheterizations through the radial artery, and this case was an abscess at the site of catheterization.

Case 3

A 34-year-old woman with a history of chronic abdominal pain, pancreatitis, and difficult vascular access presented to the ED with swelling and redness in the antecubital region of her right arm. The patient stated that it started ap-

Figure 1. Case 1: 52-year-old man with painful swelling on his right wrist. **A**, A 2-cm fluctuant mass on the right wrist (arrows) is shown. **B**, Ultrasound imaging shows a heterogeneous appearance with solid (S) and fluid (F) components. **C**, Doppler imaging reveals robust pulsatile arterial flow in the solid portion the mass.



proximately 2 days before presentation. The redness was spreading slowly, and she had increasing pain. The patient was afebrile, and the rest of her vital signs were normal. The physical examination revealed a small cutaneous abscess in the lateral aspect of the antecubital fossa (Figure 3A). No veins were palpable or visible at this site. Additionally, the patient stated she had "no veins left there" after years of medical treatment. The treating physician elected to proceed with planned incision and drainage. Before the procedure, the physician was called away to attend an emergency, and this patient's care was turned over to an incoming physician at the end of the shift. The incoming physician performed a point-of-care ultrasound examination as part of his ultrasound credentialing and found that the abscess sat directly over a large vein (Figure 3B).

Instead of a standard approach, the roof of the abscess was gently removed. Manipulation was kept to a minimum, and the abscess cavity was irrigated. No bleeding complications were encountered. The patient received oral antibiotics and recovered uneventfully.

Case 4

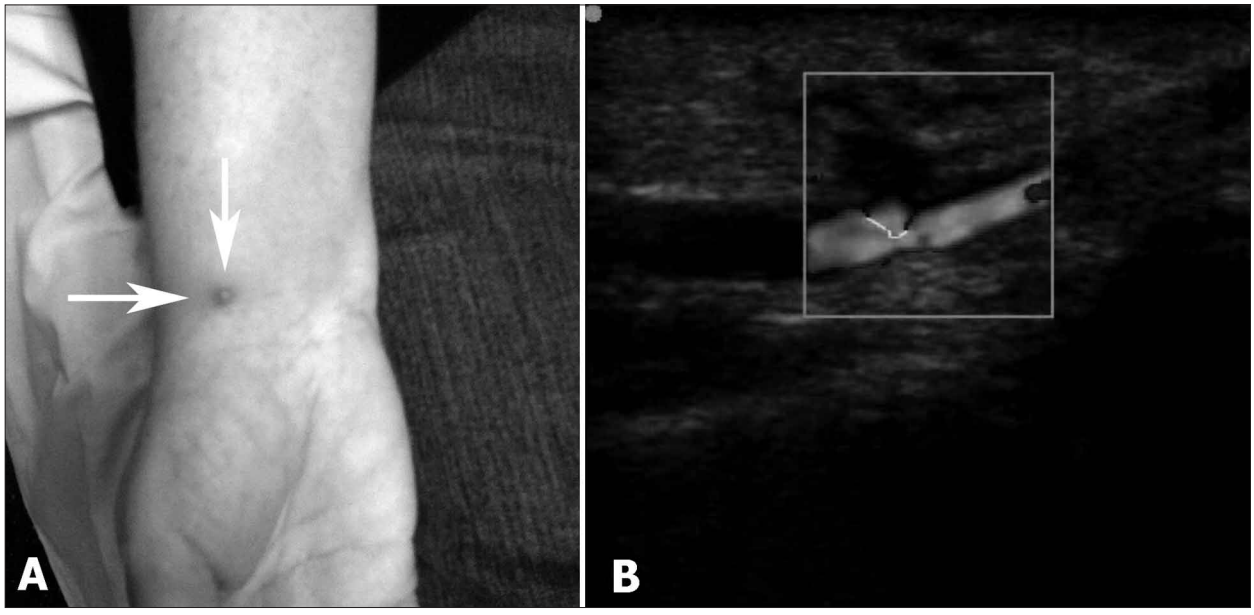
A 62-year-old man with a history of hypertension, a cutaneous MRSA abscess, and atrial fibrillation who was receiving warfarin presented with mild swelling and erythema on his abdomen. The patient had a history of abdominal wall and axillary abscesses, requiring multiple drainage procedures in the past. He noted identical previous presentations of moderate swelling, tenderness, and erythema in the mid-upper abdomen. The patient was afebrile and had a 1.5-cm erythematous fluctuant and tender subcutaneous mass in the midline of the upper abdomen.

The treating resident physician performed a bedside ultrasound examination to assess the extent of the abscess cavity. The examination revealed a small gall-filled hernia sac with bowel peristalsis within it (Figure 4). The incision and drainage procedure was canceled, and the patient was admitted for general surgery. The patient had a diagnosis of an incarcerated hernia with no strangulation. He was taken to the operating room, and the hernia was successfully repaired. The patient had a complicated recovery with cellulitis of the abdominal region and was discharged home 7 days later.

Case 5

A 42-year-old woman with a history of MRSA abscess formation presented with swelling and erythema in her right inguinal area. The patient was discharged from the hospital 2 days earlier after an intensive care unit admission for sepsis from pneumonia. On returning home, she noticed another abscess building in her right inguinal area, the same location as 2 previous abscesses that required incision and drainage. The patient was afebrile and had an elevated

Figure 2. Case 2: 46-year-old woman with an abscess at the site of intravenous line placement during a cardiac catheterization. **A**, A small area of erythema and an obvious abscess (arrows) at the site of intravenous insertion (wrist catheterization) are shown. **B**, Ultrasound imaging reveals that the abscess is directly over the patient's radial artery.



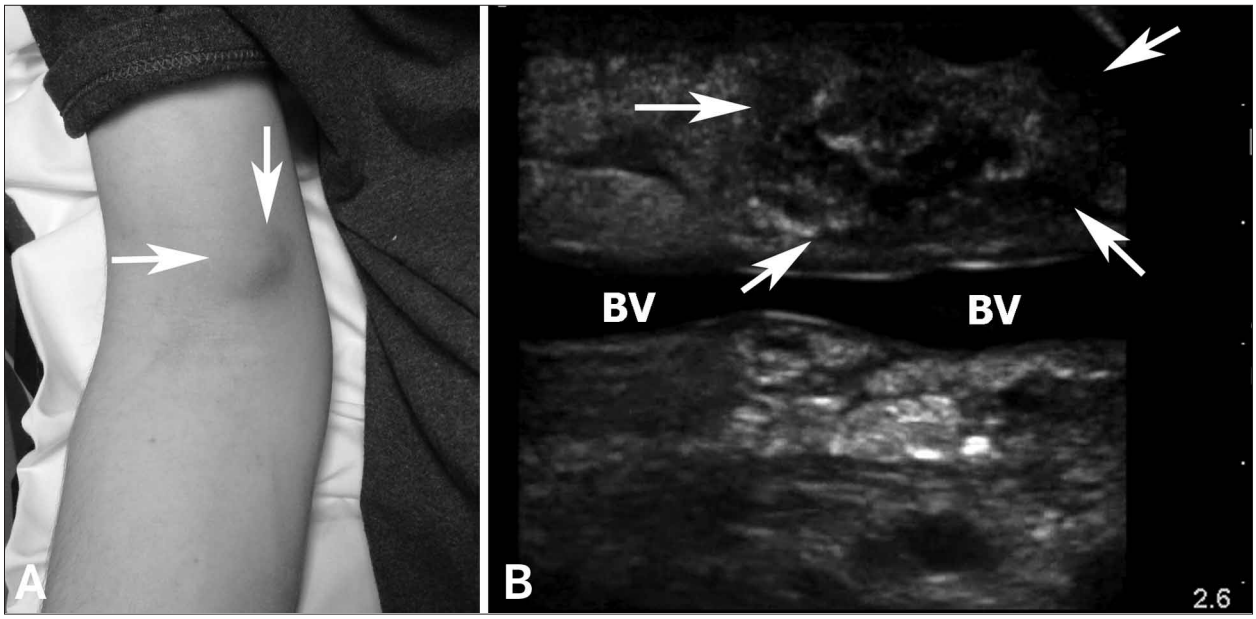


Figure 3. Case 3: 34-year-old woman with swelling and redness in the antecubital region of her right arm. **A**, A small cutaneous abscess in the medial aspect of the antecubital fossa (arrows) is shown. **B**, Ultrasound imaging shows the abscess (arrows) sitting directly over a large basilic vein (BV).

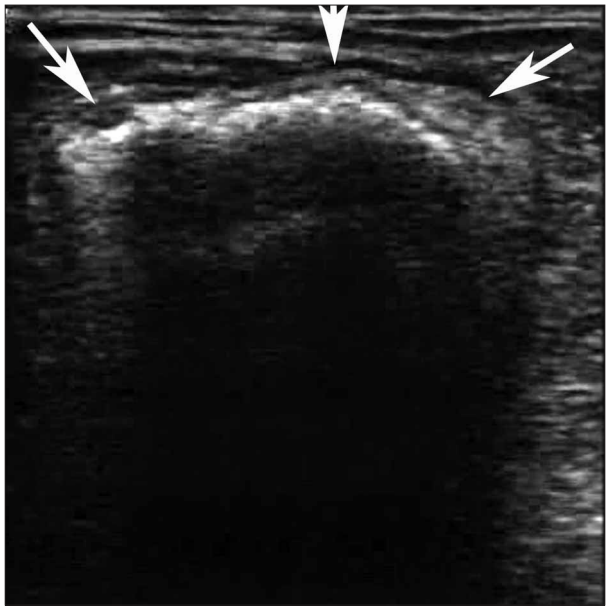
blood pressure but otherwise normal vital signs. There was no leg pain, and the physical examination findings were otherwise normal. The induration and swelling in her right inguinal region were thought to be classic for an abscess, and the resident physician prepared for incision and drainage.

Although the patient was already prepared with sterile field established, the attending physician asked to examine the area with ultrasound to determine the size of the abscess. The abscess appeared to be positioned directly over the common femoral artery (Figure 5). However, the examination revealed a complex appearance with obvious inflow of blood into the cavity (Video 1). The attending physician confirmed the presence of a pseudoaneurysm. The incision and drainage procedure was canceled, and compression was performed for 30 minutes under ultrasound guidance. The pseudoaneurysm was successfully treated. Further review of medical records from her prior hospital stay revealed failed femoral vein catheterization on the right as the likely cause of the pseudoaneurysm.

Case 6

A 27-year-old woman presented with swelling in her right labial region. The patient had previously been treated for an infected Bartholin cyst and stated that this swelling had just erupted several days ago and was somewhat painful (Figure 6). The patient's vital signs were within normal limits. The physician treating the patient thought strongly that the swelling was an abscess but asked a colleague to

Figure 4. Case 4: 62-year-old man with mild swelling and erythema on his abdomen. Ultrasound imaging shows a small hernia sac with air-filled bowel within it (arrows).



scan the patient out of curiosity. A point-of-care ultrasound examination revealed a solid mass inconsistent with an abscess. The attending physician treating the patient decided that it was an atypical abscess on ultrasound imaging and attempted to perform an incision and drainage procedure.

A solid mass was evident after incision, and further attempts to drain were halted. The patient was instructed to follow up with the gynecology service. She had a diagnosis of labial cancer that required extensive excision. Review of the ultrasound examination confirmed a solid mass, not consistent with an abscess or a fluid collection.

Discussion

Cutaneous abscesses are common presenting conditions in the ED, and the spread of community-acquired MRSA has made this problem even more prevalent.[8] Most simple cutaneous abscesses are treated with incision and drainage without a requirement for an imaging study.[2] Antibiotics are prescribed for associated cellulitis; however, an isolated abscess is generally treated with incision and drainage only.[7] Typically, ultrasound plays a relatively small role in simple cutaneous abscess evaluation and treatment. Traditionally, most clinicians rely on the history and physical examination to make the diagnosis of an abscess. In many cases, the clinical presentation and physical examination findings are considered so obvious that incision and drainage is typically performed without any imaging.

Prior studies have showed the utility of point-of-care ultrasound in differentiating cellulitis from an abscess in ED patients.[9–11] A study by Tayal et al[12] noted that physicians' assessments were frequently inaccurate in determining the presence or absence of an abscess. The management was changed in 48% of patients with what appeared to be clear-cut cellulitis without need for incision and drainage because ultrasound imaging revealed an abscess. In 73% of patients suspected of having an abscess with plans for incision and drainage, ultrasound imaging allowed clinicians to avoid an invasive procedure because no abscess was present.[12]

Our cases illustrate some potential pitfalls that may be thought of less often than simple absence of an abscess. Four vascular disasters were probably avoided with likely penetration of vascular structures on incision and drainage. The biggest potential complications were the arterial near mishaps. The wrist mass required assistance from a vascular surgeon in addition to a plastic surgeon to control bleeding, which would have been a challenge at the patient's bedside. Although venous laceration is less serious, it would still have been a complication resulting in additional procedures, consultation, and follow-up. A carcinoma was correctly identified as a solid mass before eventual incision and drainage, providing an important lesson for trusting the ultrasound images you see.

Figure 5. Case 5: 42-year-old woman with swelling and erythema in her right inguinal area. The abscess (arrows) appears to be positioned directly over the surprisingly shallow common femoral artery (FA).

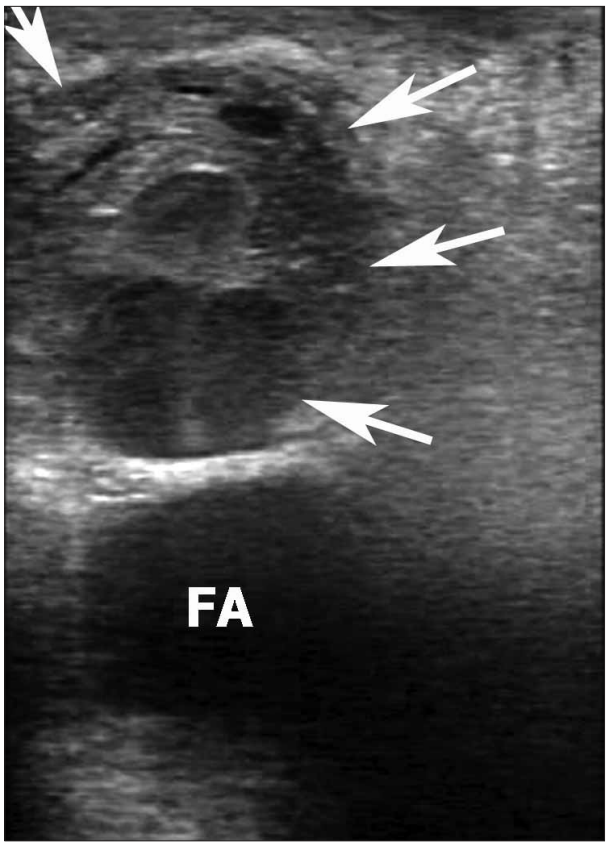
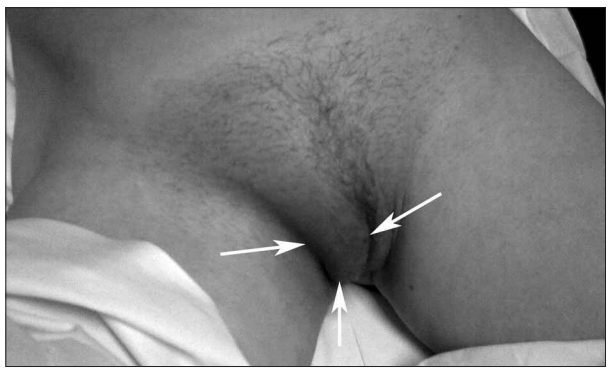


Figure 6. Case 6: 27-year-old woman with swelling in her right labial region. The suspected labial abscess is shown (arrows) before incision and drainage.



Given the spiraling cost of health care and especially imaging, we do not wish to encourage point-of-care ultrasound overuse in this article. Although editorialists have suggested that the physical examination has become or is quickly becoming extinct, it is in reality simply in transition.[13] Little doubt exists that point-of-care ultrasound in the hands of a novice clinician enables him or her to have superior diagnostic accuracy when compared to physical examination experts. This point was proven when medical students performed focused echocardiographic examinations that were compared to the physical examinations of attending cardiologists.[14] The medical students were far more accurate, with very limited training. Ultrasound has been accepted nationwide as a bedside tool that is far superior to the physical examination for diagnosing the presence of an abdominal aortic aneurysm.[15] These as well as other examples are compelling evidence that the physical examination frequently fails in comparison to point-of-care ultrasound imaging. Point-of-care ultrasound's uncanny ability to allow a novice at physical examination or invasive procedures to surpass the skills of an expert keeps it high on the list of diagnostic options at the physician's side. This simple fact will have to be balanced against overuse of a readily available technology that delivers no ionizing radiation and costs a tiny fraction of computed tomography and magnetic resonance imaging.

Although it is probably unreasonable to make an argument that all patients with an obvious abscess should have a point-of-care ultrasound examination, on the basis of these cases, coupled with the previous study by Tayal et al,[12] there is reason to be cautious even with the most obvious abscesses. The proliferation of compact ultrasound devices in a variety of clinical settings has made the technology accessible in a large number of emergency settings and urgent care facilities.[16] If there is doubt about potential abscess identity, even after an ultrasound examination, careful needle aspiration under direct guidance can minimize complications in comparison to incision and drainage performed with a scalpel. In addition, it is sometimes helpful to scan the incised area after the procedure to confirm that all loculations of an abscess were successfully disrupted and as much of the abscess was drained as possible.

In summary, even obvious abscesses slated for incision and drainage may hold surprising dangers in the ED. In this case series, point-of-care ultrasound interrogation provided rapid assessment and discovery of potentially catastrophic anatomic relationships, avoiding serious complications.

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