INTRODUCTION

Osteomyelitis of the metacarpal and phalangeal bones of the hand is relatively uncommon, but can have severe consequences such as functional impairment or amputation. Precipitating events can include an open fracture or a puncture injury, local infection or surgery, or, less commonly, hematogenous spread (1). The presenting signs of osteomyelitis, regardless of location, include local and systemic symptoms such as pain, swelling, erythema, fever, and chills. These findings are nonspecific and often not helpful in differentiating osteomyelitis from other infections. In most cases of osteomyelitis of the hand, the correct diagnosis is made more than 1–6 months after symptoms begin (1). The successful management of osteomyelitis requires early diagnosis along with a combined surgical and medical approach.

CASE REPORT

A 53-year-old man with a history of hypertension presented to the Emergency Department (ED) with 1 month of pain and swelling in his left middle finger. He described a wasp sting to the finger 4 weeks prior to presentation. He had ongoing swelling for 2 weeks, when he then smashed his finger between a drill handle and a metal pillar. He finally decided to seek medical attention secondary to continued pain and swelling that was limiting his ability to work. On examination he was afebrile and had fusiform swelling along the length of the third finger, with slight flexion at rest (Figure 1). He had some pain with active and passive extension, but was able to extend and hold his hand flat without severe pain. Pain to palpation was most significant over the proximal interphalangeal (PIP) joint. Based on his history and physical examination, the diagnostic considerations included tenosynovitis, cellulitis, abscess, osteomyelitis, foreign body, and gout.

Clinician-performed ultrasound was used to evaluate the soft tissue of the left third digit for abscess and foreign body. Sonography was performed by placing the left hand in a water bath and using a high frequency, linear array transducer to acquire images. Sonographic findings included soft tissue swelling around the PIP joint and marked cortical irregularity and erosion of metaphysis just distal to the PIP (Figure 2). Doppler evaluation showed dilatated blood vessels and hypervascularity, but no fluid collection. After the ultrasound examination, a plain radiograph of the hand was obtained showing soft tissue swelling of the left third digit with osteolysis and periosteal reaction of the proximal aspect of the middle phalanx (Figure 3). These findings were interpreted as likely osteomyelitis with overlying cellulitis of the middle phalanx. Of note, laboratory analysis was unremarkable.

Consent of the patient was obtained for use of images and for a review of the medical record looking at outcome.
including normal white blood cell count of $6.9 \times 10^3/\mu L$ (ref: 3.9–10.7), erythrocyte sedimentation rate of 11 mm/h (ref: 0–20), and C-reactive protein of 5.1 mg/L (ref: < 10.0).

Orthopedic hand surgery evaluated the patient and proceeded with operative intervention for exploration, biopsy and culture, and debridement. The operative report described “purulence within the PIP joint, which was removed and sent for culture. The middle phalanx showed soft bone with a large amount of necrosis, which correlated with the osteolytic lesion on preoperative x-rays. The bone was noted to be completely replaced by the purulent material. Flexor tendon sheath was noted to be free from any signs of infection.” Management included debridement and copious irrigation with 6 L of normal saline, followed by administration of intravenous antibiotics (vancomycin and ciprofloxacin) after culture acquisition. The tissue culture subsequently grew methicillin-sensitive Staphylococcus aureus and the patient was transitioned to intravenous nafcillin.

The patient was discharged after 3 days in the hospital, and then completed 5 weeks plus 2 days of nafcillin. The nafcillin was discontinued 5 days early due to a rise in serum creatinine from 0.84 to 1.63 mg/dL (ref: 0.70–1.50). The patient was transitioned to oral doxycycline for 5 days, which he tolerated without complication. At his most recent follow-up approximately 3 months after his presentation, the infection had completely resolved, the patient’s functional status is excellent, and he is able to work without limitations.

**DISCUSSION**

In cases of osteomyelitis of the hand, a high clinical suspicion in combination with imaging as well as intraoperative biopsy and culture are often needed for diagnostic
certainty. In a review of 46 patients with osteomyelitis involving the tubular bones of the hand, the correct diagnosis was made more than 1 month after the onset of symptoms in 74% of patients. Almost 20% of the patients in this series were diagnosed after 6 months of symptoms (1). As in our case, laboratory studies in this series were rarely helpful, as the white blood cell count and inflammatory markers were often normal (1).

Given the rarity of osteomyelitis of the hand, the test characteristics of imaging modalities for osteomyelitis in this area have not been well studied. Most studies have focused on the detection of osteomyelitis in diabetic foot infections. In these cases, the laboratory evaluation and plain radiography have poor sensitivity and specificity compared with the gold standard, bone biopsy with characteristic pathology and a positive culture. More advanced imaging modalities such as computed tomography (CT) and nuclear imaging (technetium, indium, and white blood cell scans) are more sensitive, but have poor specificity in the diagnosis of osteomyelitis (2,3). In a meta-analysis, magnetic resonance imaging (MRI) for diagnosing foot osteomyelitis demonstrated good sensitivity (90%, range 77–100%) and specificity (83%, range 40–100%), but this modality, which is time consuming and expensive, is usually obtained only when the clinician has a high suspicion for this diagnosis (4).

The sonographic findings of osteomyelitis vary depending on duration of disease. Soft tissue swelling and periosteal thickening are the earliest signs of acute osteomyelitis. Later findings include increased periosteal thickening, sub-periosteal exudate or abscess formation, and finally, cortical erosion (5). In one pediatric study, Riebel et al. found that the sonographic features of osteomyelitis preceded plain film radiographic changes by several days in most cases (6).

Clinician-performed ultrasound is a valuable tool that is now being used with increased frequency in point-of-care settings (7). One such area of use is for the evaluation of soft tissue and musculoskeletal infections, which are common complaints encountered by the emergency clinician (8). Ultrasound can serve as the primary imaging modality, or can serve as a useful adjunct to plain radiography, CT, nuclear imaging, or MRI (5,6,9). Clinician-performed sonography has many advantages, including lack of ionizing radiation, low cost, availability for use at the bedside, and short scan time. In our case, point-of-care sonography helped to quickly rule out an abscess and foreign body, and demonstrated erosion of cortical bone suggestive of osteomyelitis within minutes of the initial patient encounter. The emergency clinician must be able to accurately make this diagnosis to initiate proper therapy and prevent functional impairment of the hand. This case demonstrates the sonographic findings and the utility of ultrasound in rapidly identifying osteomyelitis of a phalanx.

REFERENCES