CE

1.5 ANCC Contact Hours

A 52-Year-Old Man With a Tuft Fracture and Hand Cellulitis

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A 52-year-old man presented to the emergency department (ED) 1 week after getting his right index finger shut in a car door. The patient complained of right index finger pain. His entire hand was edematous and reddened. After evaluation in the ED and x-ray, the patient was diagnosed with a tuft fracture, right index finger/hand cellulitis, and possible osteomyelitis. The patient received tetanus diphtheria i.m., vancomycin 1 g i.v., and ceftriaxone (Rocephin) 2 g i.v. while in the ED and was admitted with referral to a hand specialist. The patient was discharged after 10 days of parental antibiotics. He has a history of sarcoidosis, hypertension, diabetes mellitus, and scleroderma. He is currently not taking any medications and denies allergies to medications and latex. The patient had no significant somatic findings. He was afebrile.

Case Discussion

Upper limb infections account for approximately 35% of the patients admitted to hand surgery practice (Clinics in Plastic Surgery, 2014; UpToDate, 2013d). Typically, these patients have delayed treatment because they neglect to receive treatment for what they perceive is minor trauma. Evaluation should include a focused medical history to determine the infection source, infection progression, immune status especially tetanus, and relevant medical history. Symptoms such as fever, pain onset, and loss of function as well as drainage should be noted. Throbbing pain that is severe suggests an abscess. In addition, any prior injuries to the affected extremity should be noted as well as occupation as this may increase their exposure to infectious agents (Clinics in Plastic Surgery, 2014).

Evaluation of the affected extremity for inflammation can indicate lymphangitis, cellulitis, or an abscess. Tenderness and limited movement due to increased pain with passive extension of the finger, whole finger with fusiform swelling, a finger in a partially fixed posture, and tenderness along the flexor tendon sheath are referred to as "Kanavel" signs and point to synovial space infection (Family Practice Notebook, 2014; Wheeless Textbook of Orthopedics, 2012). Fluctuance suggests an abscess.

While the mainstay of hand infections is the clinical examination, lab testing of those with systemic illness or are immunocompromised should include baseline labs such as a complete blood cell count as well as a comprehensive metabolic panel based on underlying medical condition and antibiotic potential. Septic or febrile patients should have blood cultures sent, whereas those with draining or open wounds should have samples sent for aerobic and anaerobic culture and Gram stain. Fluctuant areas should be aspirated and sent for Gram stain and culture (UpToDate, 2013d).

The comprehensive metabolic panel is a group of blood tests routinely ordered as part of a yearly physical or medical examination. It evaluates the body's chemical and metabolic status, while assessing organ function and disease states like renal disease, diabetes, and hepatic disease (Labtestsonline, 2013; MedLinePlus, 2014). Assessment of creatinine, blood urea nitrogen, and CrCl (Creatinine clearance) is necessary before starting therapy and at intervals to monitor renal status as the use of vancomycin can lead to acute renal function decline (MedScape, 2014; UpToDate, 2013a). This patient's blood urea nitrogen is 13 mg/dl, creatinine 1.0 mg/dl, and CrCl ratio 22, all within normal range, which indicates that he can receive the initial dose of vancomycin without risk of renal damage. Further evaluation of renal function is warranted to determine whether vancomycin dosing needs to be adjusted. His electrolytes, glucose, calcium, and liver enzymes were normal. His liver enzymes were evaluated because of prior alcohol abuse and prior history of elevated enzymes.

The complete blood cell count assesses health status by screening and assisting in diagnosing various conditions such as inflammation, anemia, leukemia, bleeding disorders, and infection; monitoring treatment effectiveness, as well as assessing the effects of radiation or chemotherapy that affects blood cells (Labtestsonline, 2014; UpToDate, 2013c). A normal white blood cell (WBC) count varies from 4,440 to 11,000 cells/μl, of which

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approximately 60% are neutrophils. An elevated WBC count is termed leukocytosis. An important part of the physical examination is to determine whether a patient is experiencing inflammation, infection, or malignancy (Merck Manual, 2013b; UpToDate, 2013d). Causes for these disorders include fever, lymphadenopathy, evidence of pleural effusion or pulmonary consolidation, abdominal tenderness with rebound as well as symptoms of sepsis (i.e., shock, hypotension, hypothermia, and tachycardia), and evidence of infection or an abscess, joint erythema, tenderness, and/or swelling. This patient has signs of infection to the right index finger, which is swollen, warm, red, and tender as well as having right hand swelling with associated redness and tenderness indicating cellulitis. This patient has leukocytosis (WBC count 13.75), as well as a left shift (neutrophils 77%), which indicates an acute infection and possibly osteomyelitis (Medscape, 2013; Wiley Online Library, 2013).

Cellulitis presents as warmth, erythema, and edema to an affected skin area that is disrupted because of inflammation, preexisting skin infection such as tinea pedis or impetigo, edema from venous insufficiency, or trauma. Diagnosis of cellulitis is based upon clinical manifestations with the most common causative organisms being streptococcal and staphylococcal. The hand and other digits can be impacted by blood flow spreading the infectious organisms. Patients who are immunocompromised or diabetic are susceptible to developing cellulitis from minor skin breaks. Diabetic patients are often polymicrobial with approximately one third of wounds containing gram-negative organisms (MD Consult, 1999). The drug of choice is vancomycin 15 mg/kg i.v. every 12 hours (Merck Manual, 2013c). Differential diagnoses include gout, insect stings, various rashes, blood clot, and burns (American Osteopathic College of Dermatology, 2014; Merck Manual, 2013c; UpToDate, 2014a).

Osteomyelitis results from either of two ways: (1) the infection being directly injected into the bone via surgery or from trauma or (2) from the spread of infection to bone from adjacent joints or soft tissue, a term known as hematogenous seeding (Merck Manual, 2013a; UpToDate, 2014b). Furthermore, osteomyelitis can be classified as either acute or chronic.

Acute osteomyelitis develops gradually over several days with patients complaining of dull pain at the affected site that occurs with or without movement. Warmth, swelling, tenderness, and erythema may be present. Septic arthritis is a type of acute osteomyelitis and often involves the hip, shoulder, and knee. Patients with hip, vertebrae, and pelvis osteomyelitis present with pain but without other signs or symptoms (Merck Manual, 2013a; UpToDate, 2014b).

Patients with chronic osteomyelitis may experience swelling, erythema, and pain, occasionally with a draining sinus tract. When ulcers lie over bony prominences and fail to heal despite several weeks of appropriate care, chronic osteomyelitis should be considered (Clinical Infectious Diseases, 2012; National Institutes of Health, 2012; UpToDate, 2014b).

Treatment of osteomyelitis should be guided by the causative pathogen, which is best accomplished through bone biopsy, of which two specimens should be obtained, one for histopathology and the other for culture and Gram stain. Superficial wound cultures are of no value because they do not correlate with the underlying bone pathogen. Broad spectrum empiric antibiotic treatment should be used because 95% of the cases are caused by *Staphylococcus aureus* (Department of Orthopedics,

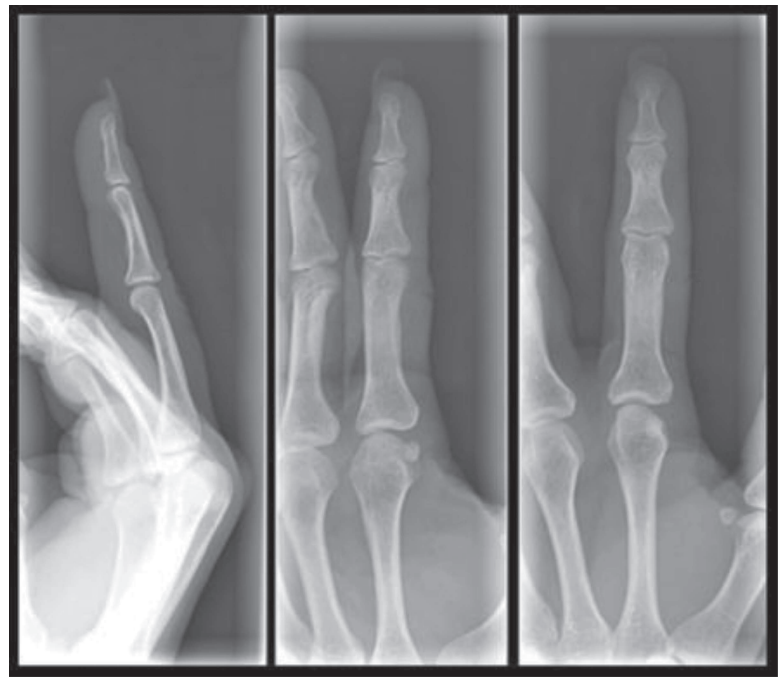

Figure 1. Left view is lateral, middle is oblique, and right is AP (anterior–posterior). Reproduced with permission from "Distal Phalanx Fractures," by R. Bassett, In: UpToDate, Post TW (Ed.), *UpToDate*, Waltham, MA. (Accessed October 7, 2014). Copyright © 2014 UpToDate, Inc. For more information visit, www.uptodate.com.

Figure 2. Transverse fracture with displacement. Reproduced with permission from "Rockwood and Green's Fractures in Adults," C. Brown and J. Heckman, In UpToDate, Post TW (Ed.), *UpToDate*, Waltham, MA (Accessed October 7, 2014). Copyright © 2014 UpToDate, Inc. For more information visit www.uptodate.com.

2012). Empiric therapy should include vancomycin 1 g i.v. every 12 hours plus another agent active against gram-negative organisms such as ceftriaxone (Rocephin) 2 g i.v. every 24 hours (American College of Physicians, 2011; Global RPh, 2012; Medscape, 2014; PubMed, 2011; UpToDate, 2014a, 2014b).

Radiographic evaluation or x-rays should include three figures or views of the distal phalanx: lateral, AP, and oblique (see Figure 1). The most common distal phalanx fractures include (1) transverse fractures that should be further evaluated for angulation due to greater displacement risk (see Figure 2); (2) longitudinal fractures are stable and usually nondisplaced (see Figures 3 and 4); (3) avulsion fractures result when bone

Figure 3. The longitudinal fracture is shown in the distal portion (highlighted in black box). There is also a transverse midshaft fracture of the proximal interphalangeal joint as well as a midshaft fracture of the same joint (Highlighted in lower box). Reproduced with permission from "Distal Phalanx Fractures," by R. Bassett, In UpToDate, Post TW (Ed.), *UpToDate*, Waltham, MA. (Accessed October 7, 2014). Copyright © 2014 UpToDate, Inc. For more information visit www.uptodate.com.

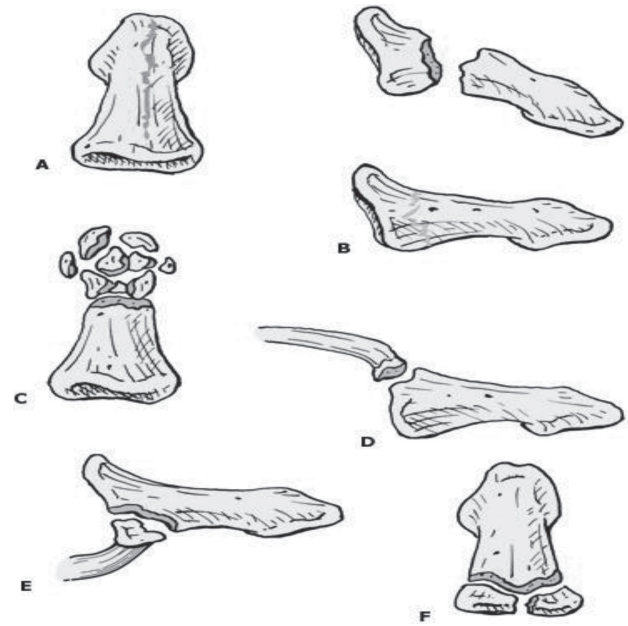

Figure 4. Fracture patterns seen in the distal phalanx are (A) longitudinal, (B) transverse, (C) tuft, (D) dorsal base, (E) volar base, and (F) complete articular. Reproduced with permission from "Rockwood and Green's Fractures in Adults," C. Brown and J. Heckman, In UpToDate, Post TW (Ed.), *UpToDate*, Waltham, MA (Accessed October 7, 2014). Copyright © 2014 UpToDate, Inc. For more information visit www.uptodate.com.

is pulled away by an underlying ligament; and (4) intra-articular fractures of the base (see Figure 4) occur when a tendon avulses bone. Two common types of intra-articular fractures are mallet fractures resulting from the extensor tendon avulsing or jersey fractures due to flexor digitorum profundus avulsion; and (5) tuft

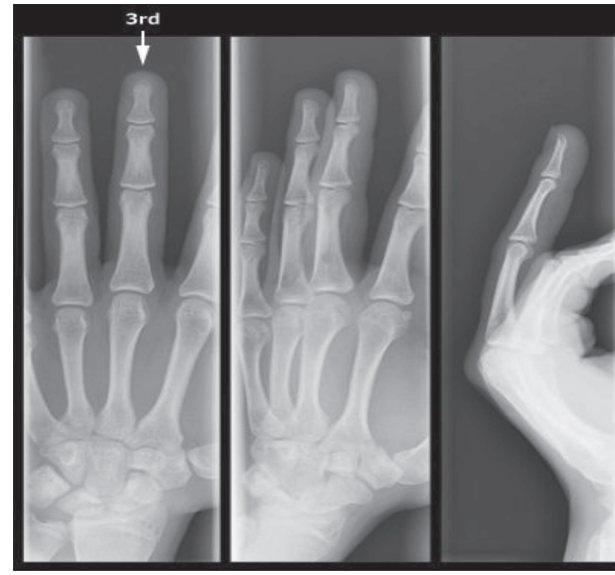

Figure 5. Tuft Fracture of the cancellous bone of distal phalanx. Reproduced with permission from "Distal Phalanx Fractures," by R. Bassett, In UpToDate, Post TW (Ed.), *UpToDate*, Waltham, MA. (Accessed October 7, 2014). Copyright © 2014 UpToDate, Inc. For more information visit, www.uptodate.com.

fracture, which is a fracture cancellous bone of the distal phalanx tip (see Figure 5). These fractures are common, are work-related or sports-related due to either trauma or crush injuries, and account for approximately 50% of hand fractures (American Family Physician, 2011; Duke Orthopaedics, 2012; Medscape, 2012; UpToDate, 2013b). On the basis of the right hand x-ray film, this patient has a Tuft fracture of his right index finger. Management is conservative with splinting of the distal interphalangeal joint in extension for 3–4 weeks. However, this patient has an underlying cellulitis, possibly osteomyelitis secondary to an open fracture of the right index finger requiring parental antibiotics and evaluation by a hand surgeon/specialist (Practical Plastic Surgery, 2011; UpToDate, 2013b).

Nursing management includes educating the patient about increased risk factors for infection related to diabetes, to teach the patient about the signs of infection and verbalize what these signs are, to elevate the affected extremity at heart level to decrease swelling, to note worsening signs of infection such as streaking up the arm, to note signs of healing, and to administer intravenous antibiotics as indicated. In addition, tetanus prophylaxis should be administered if more than 5 years has elapsed since last immunization (Clinical Infectious Diseases, 2014; Lippincott Nursing Center.Com, 2010).

The morbidity rate from untreated hand infections is significant (Journal of Hand Surgery, 2000). Diabetic patients with hand infections are at an increased risk for amputations and pyogenic infections so they must be treated aggressively (Surgical Infections, 2004). Untreated hand infections can cause pain, dysfunction, and limited motion as well as lymphangitis (Current Orthopedic Practice, 2010).

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