Chapter 36

HAND INFECTIONS: GENERAL INFORMATION

KEY FIGURE:
Elevation and splinting

Hand infections are relatively common problems. Seemingly minor injuries can sometimes lead to significant infections. Proper treatment is vital to prevent long-term disability.

Cellulitis vs. Abscess

Cellulitis is a diffuse infection of the soft tissues. No localized area of pus can be drained. The affected area is described as indurated (i.e., warm, red, and swollen). The hand is also painful. A component of lymphangitis (infection involving the lymphatics) may be indicated by red streaking in the tissues, progressing proximally up the arm. The treatment of cellulitis centers on the administration of the appropriate antibiotic regimen.

An **abscess** is a localized collection of pus, often with a component of cellulitis in the surrounding soft tissues (with the above signs). One sign of an abscess is an area of fluctuance. When you apply gentle digital pressure over the area of the presumed abscess, you feel a "give," indicating the presence of fluid beneath the skin. Another sign is that an abscess often seems to "point"; that is, the skin starts to thin from the pressure of the fluid underneath. The primary treatment of an abscess is incision and drainage (I & D)—cutting open the roof of the abscess to allow the pus to drain. Antibiotic therapy may be needed, but the infectious process will not resolve with antibiotics alone.

From the above information, you can see that the distinction between the two entities is important because their treatments are different. I & D is indicated for an abscess, whereas cellulitis does not warrant this intervention.

Gangrene

The term *gangrene* is used to describe tissues that are dead. There are two subtypes of gangrene, wet and dry. The distinction is important.

Dry gangrene describes tissues that are generally black and dried out. There is a distinct border between the dead tissue and surrounding healthy tissue. Sometimes the dead tissues fall off on their own; dry gangrenous fingertips can fall off with minimal manipulation. However, debridement usually is required, but it is not emergent. Dry gangrene usually places the patient at no health risk as long as it does not become infected (see below).

In contrast to dry gangrene, **wet gangrene** can be a significant health risk. Wet gangrene connotes active infection (noted by pain, swelling, redness, and drainage of pus) in the tissues surrounding the obviously dead tissue. Urgent debridement is required to prevent further tissue loss and worsening of soft tissue infection.

Necrotizing Fasciitis

Necrotizing fasciitis is a serious, potentially life-threatening infection of the fascia (the thin connective tissue overlying the muscle under the skin and subcutaneous tissue). The popular press calls it the disease of flesh-eating bacteria.

Necrotizing fasciitis is not common. However, it must be considered in the evaluation of patients with a hand infection that seems to be rapidly progressing proximally up the forearm. Necrotizing fasciitis should also be considered when the patient is sicker than you would expect for simple cellulitis.

The skin is swollen, but often without the typical signs of cellulitis. The skin simply does not look "right." You may be able to feel subcutaneous air in the soft tissues of the arm, or you may see air in the soft tissues on x-rays (normally, no air is present in soft tissues on x-ray).

The patient is often quite ill (high fever, low blood pressure, general weakness, and even shock may be present). The infection can spread quickly up the arm and into the chest. Radical debridement and even amputation may be necessary to save the patient's life.

Treatment requires aggressive operative debridement (opening up the soft tissue spaces, as with an abscess) to remove diseased tissue, intravenous antibiotics, and close monitoring for aggressive treatment of septicemia. Hyperbaric oxygen also may be indicated but does not replace aggressive operative treatment. Patients with necrotizing fasciitis should be treated by a surgeon with critical care expertise.

Evaluation of an Infected Hand

History

Ask the patient about events that may have led to the development of the infection. This information may help to guide your treatment.

Antecedent Trauma

A history of being cut by glass or sustaining a puncture wound should raise concern about the presence of a foreign body in the soft tissues.

Ask whether the patient was bitten by an animal. An animal's canine teeth, especially those of a cat, may penetrate much deeper into the underlying tissues than you expect. Find out what type of animal was involved; different animals have specific bacterial organisms that may require a particular antibiotic. Ask about the possibility of rabies exposure (see chapter 6, "Evaluation of an Acute Wound," for information about rabies prevention).

If the patient has a wound over a metacarpophalangeal knuckle, you must ask specifically whether the wound is due to human teeth. People are often embarrassed to admit that they have been in a fight. Ask point-blank: Did you punch someone in the mouth? Did someone bite you? This information is important because the human mouth has strong pathogens that can lead to significant soft tissue destruction. Choice of specific antibiotics is based on the usual organisms found in the human mouth.

Recent History of Swimming

Well-managed swimming pools usually are treated adequately with chemicals, and the ocean has such a high salt content that neither venue is associated with specific organisms that cause infection. However, streams, ponds, lakes, and aquariums are associated with specific bacteria that can cause significant infections. In addition, ask whether the injury occurred while the patient was working on a boat or fishing.

Medical Issues

Patients with diabetes often develop infections that are unexpectedly difficult to treat. You must treat such infections aggressively and ensure that blood sugar is well controlled.

Ask about the patient's tetanus immunization status.

Physical Examination

1. The classic signs of a hand infection are redness, warmth, swelling, and pain. The swelling associated with a hand infection is often quite pronounced.
2. Look closely for puncture wounds and other signs of trauma.
3. Determine whether the patient has a localized collection of pus that requires drainage or diffuse soft tissue infection.
4. Look for induration extending proximally up the forearm.
5. Look for red streaks extending up the arm.
6. If the forearm is involved, palpate for crepitus or subcutaneous air in the forearm tissues (signs of necrotizing fasciitis). To test for crepitus, press on the soft tissues. If air is present under the skin, it will feel as if you are pressing on crinkled layers of cellophane or popping air bubbles beneath the skin.
7. Look for signs of systemic illness (fever, chills, low blood pressure, generalized weakness, and malaise).
8. Look for evidence of enlarged lymph nodes in the armpit or back of the elbow.

Additional Studies

The basic studies include complete blood count with a white blood cell count and x-ray evaluation of the infected area. Include the forearm if the induration extends proximally up the forearm. Blood cultures should be done if the patient is febrile or looks ill. If there is an open wound present, culture it.

What to Assess on X-rays

1. Foreign bodies
2. Unsuspected fractures or dislocations
3. Evidence of joint contamination: air in the joint, destruction of joint surfaces, foreign material in the joint. Any of these findings warrants operative exploration.
4. Underlying bone infection: the bone edges appear irregular if bone is involved with the infectious process. If bone is involved, 4–6 weeks of antibiotic therapy are needed.
5. Air in the soft tissues strongly indicates necrotizing fasciitis. Localized air may be present in the soft tissues at the immediate vicinity of an I & D site, but diffuse air in the tissues is a sign of necrotizing infection.

Importance of Key Elements in the History and Physical Examination

Foreign Bodies

If a foreign body is located in the infected tissues, the infection will not resolve unless it is removed. However, a foreign body in soft tissues without cellulitis does not have to be removed unless it is causing symptoms.

Animal Bites

Pasteurella multocida and *Staphylococcus aureus* are associated with cat and dog bites. Treatment with an antipseudomonal and antistaphylococcal antibiotic (amoxicillin/clavulanate, cefuroxime) is required. Cat bites often penetrate more deeply than you expect and may involve underlying joints or tendons. Exploration and washout of the joint and tendon may be required. Cat bites have a much higher incidence of subsequent infection than dog bites (80% vs. 5%, respectively).

Human Bites

Eikenella corrodens, other anaerobes, and *Streptococcus viridans* are associated with infections caused by a human bite. If the patient is seen early after the injury, before signs of infection have developed, treat with amoxicillin/clavulanate. Once signs of infection are present, intravenous antibiotics, such as amoxicillin/sulbactam or ticarcillin/clavulanate, are indicated. Operative exploration also may be required if the underlying joint is affected. In addition, abscess formation is common after a human bite.

Seawater and Shellfish-related Injury

If the infected tissues are swollen and red but not particularly hot or tender, the causative organism may be *Mycobacterium marinum*. Treatment requires long-term (3 months) administration of doxycycline or rifampin/ethambutol. An infectious disease specialist should be involved in the treatment of such patients.

If the infected area has all of the typical signs of cellulitis, treatment should cover bacteria of the *Vibrio* species; tetracycline or an aminoglycoside may be used.

Freshwater Injury

Aeromonas hydrophila is associated with freshwater infection. A fluoroquinolone or trimethoprim/sulfamethoxazole should be used for treatment.

Red Streaking

Red streaking is a sign of lymphangitis, which means that the infection is traveling through the lymphatic system. Staphylococcal infections are most commonly associated with this physical finding.

Enlarged Lymph Nodes Around the Elbow or Armpit

The presence of enlarged lymph nodes may indicate cat-scratch disease, a *Mycobacterium marinum* infection, sporotrichosis or nocardial infection. An infectious disease specialist should be consulted because these unusual infections can be difficult to treat.

General Initial Treatment

The infected hand is often diffusely swollen. Initially it may be difficult to determine whether the patient has an abscess in need of drainage. If the patient otherwise looks well and has no signs of flexor tenosynovitis (see chapter 37, "Specific Types of Hand Abscesses"), underlying joint infection, or necrotizing fasciitis, treat conservatively. Do not make cuts in the skin looking for an abscess; you may well find nothing.

Conservative Approach

1. Start the appropriate antibiotics.
2. Splint the hand in neutral position (see chapter 28, "Hand Splinting and General Aftercare"), and elevate the hand. These two interventions are the cornerstone of treatment for all hand infections. Splinting and elevation significantly reduce swelling, thus making it easier to determine whether an abscess is present.

The proper way to elevate an injured hand. The hand should be higher than the elbow to promote drainage and decrease swelling in the hand.

3. Warm (not hot) compresses applied to the inflamed area of the hand may be useful.
4. After 24 hours reevaluate the hand.
   - Significant improvement may be seen. If there is no evidence of an abscess, continue splinting, elevation, and antibiotics. The splint should be removed once pain and swelling have resolved. Regular exercise then becomes important to prevent stiffness. Continue the antibiotics for 7–10 days until the infectious process has resolved completely.
   - Alternatively, a localized collection of pus in need of drainage may be identifiable. The following chapter discusses specific types of hand abscesses and their treatment.

Bibliography

1. Gilbert DN, Moellering RC, Sande MA (eds): The Sanford Guide to Antimicrobial Therapy, 29th ed. Vermont, Antimicrobial Therapy, Inc., 1999.
2. Lampe EW: Clinical Symposia: Surgical Anatomy of the Hand. 40th anniversary issue 40(3):31–36, 1988.