



First Hand News

Topics in Upper Extremity Care

A publication of the Christine M. Kleinert Institute for Hand and Microsurgery, Inc.

The Painful Hand and Wrist: Causes and Care Part 2

By Brett A. Miller, MD, Lorraine Brady, MD, and Raymond G. Hart, MD, MPH

This is a two-part article on the hand and wrist. It is reprinted in its entirety from the journal *Emergency Medicine*, February 2007

NAIL BED AND FINGERTIP INJURIES

The fingertip is defined as the area distal to the insertion of the FDP and extensor tendons. The tuft of the distal phalanx is the well-padded area on the volar surface of the finger. The nail lies on the surface of the dorsal surface of the fingertip. The sides of the nail fold are the paronychia; the base fold is the eponychium; between the nail fold and the nail bed is the nail groove; and at the distal end under the edge of the nail is the hyponychium. The dermis of the nail bed is directly attached to the periosteum of the distal phalanx, deriving its blood supply from a rich capillary bed.

A careful history of a nail bed injury should include the time elapsed since the injury, what occurred at the injury site, and the posture of the hand at the time of the injury. Careful inspection of the fingertip for color and swelling or deformity should be done. Sensation should be assessed by two-point discrimination. Anesthesia, in most cases achieved with a transthecal or digital nerve block, is usually necessary prior to irrigation and inspection. The wound should be copiously irrigated to remove debris, reduce bacterial contamination, and lessen the risk of subsequent infection. An 18-gauge needle attached to a 60-ml syringe will provide adequate pressure to dislodge foreign material, using at least 250 to 500 ml of normal saline.

Nail bed lacerations should be repaired to minimize deformity and the duration of functional impairment. Following placement of a digital block for anesthesia, the nail overlying the injured nail

bed can be removed by spreading a small pair of scissors or hemostat beneath the nail, carefully separating the eponychium from the nail edges. The nail bed laceration can then be repaired using a 6-0 or 7-0 absorbable suture. After the removed nail is cleansed with normal saline, a 5-0 nylon suture can be placed through the proximal end of the nail plate and then through the center of the eponychial fold, avoiding the nail bed. This returns the nail to its anatomic position; it also acts as a natural splint to the distal phalanx and protects the sensitive nail bed. A separate hole should be placed through the center of the nail to allow drainage from the subungual area.

If a nail is too damaged or lost to be repaired, a piece of aluminum used in suture packaging or a piece of lubricated gauze can be inserted into the eponychium to maintain an open nail fold that will allow for new nail growth. This also helps prevent formation of synechiae and scarring. The fingertip can then be placed in a nonadherent gauze and volar splint.

Wound care should include hand elevation, neurovascular checks, and adequate analgesia. The dressing should remain untouched for five to seven days, unless there are signs of obvious purulence.

Objectives

After reading this issue you should be able to:

- LIST components in the repair of nailbed injuries
- DISCUSS high pressure injection injuries and nerve injury patterns
- LIST features of burns and cold injuries to the hand
- DISCUSS common infections of the hand

The suture attached to the nail may be removed after three weeks. New nail growth may take one to three months.

An avulsion of the nail often includes pieces of the nail bed attached to the undersurface of the nail. In these cases, optimal results are obtained if the nail is replaced as accurately as possible onto the avulsion site. If the tissue is not available and the defect is small, it will heal well by secondary intention. If the defect is large, a hand surgery consult should be obtained because grafting may be needed.

Subungual hematomas result from blunt trauma or crush injuries to the nail bed and present with red-to-black discoloration. An x-ray should be obtained to identify a possible associated fracture. Treatment is based on the percentage of nail bed discoloration. If the hematoma covers less than 50% of the area under the nail, adequate decompression can be achieved by trephination, which is the creation of a hole, or by a scalpel, 18-gauge needle, or electrocautery. Anesthesia is usually unnecessary, and the digit should be splinted in cases with associated fracture.

If more than 50% of the nail bed area is involved, the nail may be removed to evaluate the nail bed and repair any lacerations. There is a 60% incidence of nail bed lacerations involving more than half of the nail bed and an incidence of 95% with an associated fracture. However, about 85% of patients can be adequately treated with trephination alone, regardless of hematoma size.

HIGH-PRESSURE INJECTION INJURIES

While an uncommon presentation in emergency departments, high-pressure injection injuries are potentially devastating in terms of future hand function. These types of injuries are associated with a high rate of amputation. Early presentations can be misleading to the examining physician because the injury may appear very benign. However, potentially lethal damage lies beneath the skin, most notably to the flexor tendon sheath if the injection was in the finger.

The mechanism of injury usually involves industrial equipment such as grease or spray guns. There are a number of potentially injectable substances,

most notably paint, paint thinner, grease, water, and certain oils. Knowing what substance was injected is critical to proper evaluation and treatment. Damage is inflicted by the pressure, the toxicity of the injected substance, and possibly by heat from an injected hot substance.

If the patient presents early, the complaint may be only mild pain near the injection site. Physical examination may show only a subtle entrance wound or no break at all in the skin, and mild swelling may be apparent. The patient who presents several hours after the injury will have a much different presentation. He will complain of extreme pain in the hand or affected digit. Examination may reveal significant swelling in the affected areas with associated signs of vascular compromise and tissue necrosis. In either case, x-rays of the soft tissues should be obtained to determine the extent of the injection if the material is radio-opaque. Urgent hand surgery consultation is critical because surgical debridement and wound exploration are necessary with these injuries.

The affected area should be immobilized with splinting. Tetanus prophylaxis should be given and intravenous broad-spectrum antibiotics should be started early. Some hand surgeons advocate the use of steroids for these injuries.

NERVE INJURY PATTERNS

Nerve injuries usually result from lacerations, contusions, or puncture injuries to the hand. There are three classifications of nerve injuries: neuropraxia, axonotmesis, and neurotmesis. Neuropraxia is a localized conduction block with intact axons, usually from a contusion injury. Light touch is intact but diminished and usually returns to normal spontaneously within days to weeks. Axonotmesis results from a crushing injury, in which the axon is severed but the endoneurium remains intact. Presentation is similar to that of neuropraxia, but Tinel's sign is present (light percussion of the nerve proximal to the injury elicits paresthesias distally). Recovery is complete but slow due to axonal regeneration.

Neurotmesis refers to complete transection of the nerve; recovery is unlikely without formal nerve repair. Radial motor function can be tested by wrist

extension, thumb extension, and abduction. Radial sensation includes the dorsal aspect of the hand from the thumb to half of the fourth finger. Ulnar motor function is tested by the patient's ability to pinch a piece of paper between the thumb and index finger. Ulnar sensation includes both the dorsal and palmar lateral hand from the fifth digit laterally to half of the fourth digit. The median nerve is tested by having the patient oppose the thumb to the index finger, flexion of that finger, and thumb abduction and opposition. Median nerve sensation includes the medial two thirds of the palmar hand as well as the dorsal aspect of the second and third and half of the fourth digits.

BURNS TO THE HAND

Burns can be divided into thermal, chemical, and electrical injuries. Direct heat exposure accounts for up to 50% of all thermal injuries, although scalding injuries occur most commonly in children. Acids cause coagulation necrosis, while alkalis can produce liquefaction necrosis and are generally more severe than burns caused by acids. Electrical burns are classified based on source voltage. High-current injury occurs with sources greater than 600 V. Typical residential power lines in the United States are 7620 V; household current is 110 V and large home appliances require 220 V. Current flow through body areas with a small cross-sectional area, such as the hand, will result in more damage from electricity. Air bag injuries represent a unique mix of frictional, chemical, and thermal burns.

A careful history and documentation of neurovascular and motor exams are important in determining the extent and depth of injury. The digits and hand should be evaluated for circumferential burns, which are associated with a high risk of compartment syndromes.

The degree of burns should be determined. First-degree (superficial) burns are limited to the epidermis, present with erythema and pain, and heal well in a short period of time. Second-degree (partial-thickness) burns involve the epidermis and varying amounts of the dermis. These are further divided into superficial and deep partial-thickness burns, depending on their ability to heal within three weeks.

Third-degree (full-thickness) burns involve the epidermis, dermis, and dermal appendages. Patients present with a painless, charred wound. These wounds require debridement and skin grafting. Fourth-degree burns involve the underlying muscle, tendon, and bone and require extensive skin grafting.

Superficial and superficial partial-thickness burns can be managed with simple care at home and should heal well in 7 to 10 days. All other burns require referral to a specialist. Analgesic agents should be taken for pain relief. Large blisters may be debrided, but intact blisters should be left as a biological dressing. The patient's tetanus vaccine should be updated. If necessary, a dressing should be fashioned with sterile gauze Xeroform separating the digits and a cock-up wrist splint when the burns are extensive. Systemic antibiotics should not be administered prophylactically in the emergency department, but antibiotic creams such as silver sulfadiazine are generally used on all burns.

Criteria for hospitalization include the following: circumferential hand and finger burns; full-thickness burns involving more than 2% to 3% of the total body area; high-voltage electrical injuries; significant burns of the hands, face, genitalia, perineum, feet, or major joints; and other significant injuries or comorbid conditions. Discharged patients should be instructed to rinse the wound with soap and water, apply antibiotic cream, and then redress the wound once or twice daily. They should also keep the hand elevated and watch for signs of infection, and they should be told that wound drainage is normal. Burns should be rechecked in 24 hours and full-thickness burns should be seen by a specialist within a day or two.

COLD INJURIES

Management of cold injuries is determined by the extent of the injury and the area involved. They are categorized as freezing injuries if ice crystals have formed in the involved tissue and nonfreezing if ice crystals are absent. Nonfreezing injuries require no specific treatment other than rewarming.

Chilblain results from long-term exposure to cold and damp conditions and is characterized by burn-

ing, itching, and erythema. Tender blue nodules may appear on rewarming and will resolve spontaneously. Frostnip is a superficial freezing injury without ice crystal formation in the tissue. The involved skin is pale due to intense vasoconstriction. Symptoms resolve on rewarming. Frostbite is the most severe form of freezing injury, characterized by ice crystal formation and often resulting in permanent tissue injury and loss.

Treatment for cold injuries is removal of the patient from further cold exposure and rewarming. Cold, wet, and constrictive clothing must be removed, and the patient should be placed in a warm water bath of 104° to 107.6°F for 10 to 30 minutes with active movement of the hand. Rewarming is often painful and analgesia is usually required. Current recommendations are to debride clear blisters and leave hemorrhagic blisters intact. Aloe vera cream and ibuprofen may be used by the patient at home. Sterile gauze dressings should be applied, and the hand should be kept elevated.

COMMON INFECTIONS OF THE HAND

Infections of the hand, such as paronychia, felon, flexor tenosynovitis, and herpetic whitlow, are common presentations in the emergency department. Most hand infections are “surgical” rather than “medical,” in that most require some type of incision and drainage and often debridement. Care must be taken with these patients to determine which infections should be treated in the emergency department with systemic antibiotics and which require surgical intervention. A careful history is critical and should include the mechanism of injury and any comorbid conditions that might complicate treatment and healing, such as diabetes, chronic steroid use, and other immunocompromised states.

Close monitoring of vital signs is necessary to determine if a systemic inflammatory response or shock is present. Physical examination must include a careful inspection of the entire limb to assess for adenopathy and lymphangitis.

Paronychia. A paronychia is a superficial infection or abscess formation involving the lateral nail folds of individual phalanges. This is the most commonly encountered infection of the hand seen in the

STAT REVIEW

- Common fractures involving the hand and wrist include boxer's, Bennett, Rolando, Colles, and scaphoid fractures.
- A scaphoid fracture is the most common fracture of the carpal bones seen in the emergency department.
- High-pressure injection injuries are potentially devastating in terms of future hand function. These types of injuries are associated with a high rate of amputation.
- There are three classifications of nerve injuries: neuropraxia, axonotemesis, and neurotmesis.
- Chilblain results from long-term exposure to cold and damp conditions and is characterized by burning, itching, and erythema.
- Infections of the hand, such as paronychia, felon, flexor tenosynovitis, and herpetic whitlow, are common presentations in the emergency department.

emergency department. Patients will present complaining of distal finger pain with obvious swelling, redness, and tenderness involving one or both sides of the lateral nail beds.

Treatment is determined by the stage of the infection. If the infection is a cellulitis prior to abscess formation, antibiotics are indicated. Antistaphylococcal agents are the mainstays of therapy. The patient should also be advised to elevate the hand and apply warm compresses to the affected area. If the infection has progressed to abscess formation, incision and drainage are indicated. If it has spread beneath the nail, removal of all or part of the nail plate may be necessary. This can be accomplished by inserting a closed, straight hemostat directly underneath the affected nail proximally while gently spreading the hemostat to displace the nail from the nail bed. A digital block or wrist block anesthesia will most likely be required.

Although commonly prescribed, antibiotics are not necessarily indicated in a properly drained paronychia. Patients should be advised to avoid further trauma to the soft tissues surrounding the nail beds, which can result from nail biting or, in children, thumb sucking.

Felon. A felon is a soft-tissue infection of the

pulp of the distal finger or thumb. The most common mechanism of infection is penetrating trauma to the distal finger or thumb with secondary bacterial invasion. This can be a complicated infection to manage because the pulp of the distal finger or thumb is divided into several compartments by vertical septa. The patient may present with redness, swelling, pain, and throbbing in the affected distal finger or thumb. Treatment involves complete incision and drainage of the affected area under digital block anesthesia.

Special care must be taken because of these septal divisions. Incisions should never cross a flexion crease at right angles. A lateral incision to the ulnar aspect of digits two, three, and four is recommended, as is an incision to the radial aspect of digits one and five. The incised wounds should be irrigated and packed. Application of zinc oxide ointment can be very useful to help keep the wound open and draining. Gram stain, culture, and sensitivity must be done for any purulent exudates. Antistaphylococcal antibiotics should be prescribed.

Appropriate follow-up is necessary because of the many potential complications, most notably osteomyelitis of the distal phalanx, that may occur from the infection itself or treatment. If osteomyelitis is suspected, x-rays should be obtained and studied carefully for signs of bony involvement. If it is present, operative debridement with IV antibiotics is mandatory.

Flexor tenosynovitis. Acute synovial infections of the hand usually involve the flexor tendon sheaths, which are covered by the ulnar and radial bursa. Infections of the synovial spaces in the hand tend to spread along these sheaths to the midpalmar, thenar, and lumbrical compartments. Infections are usually caused by penetrating trauma, and the most common organism is *Staphylococcus aureus*. Clinical features include tenderness along the course of the flexor tendon, symmetric swelling of the finger, pain on passive extension, and a flexed posture of the finger.

Flexor tenosynovitis requires hospital admission and hand consultation. In uncertain cases, the hand should be splinted and elevated and the infection treated with a broad-spectrum penicillin or a cephalosporin, with close follow-up.

Herpetic whitlow. Herpetic whitlow is a relatively frequent presentation in the emergency department, especially in pediatric patients. It is simply a viral infection of the distal finger that can be caused by



Herpetic whitlow. A relatively frequent presentation in the emergency department, herpetic whitlow is a viral infection of the distal finger that can be caused by either type of herpes simplex virus.

either type of herpes simplex virus (see image). It can be seen in adult patients following an outbreak of genital or gingival herpes. It can also be seen in children with coexistent herpetic gingivostomatitis. Another group particularly at risk is medical and dental professionals because of increased exposure to the patient's oral cavity and saliva.

The patient with herpetic whitlow will present with one or more painful vesicles on or near the fingerpad and will complain of pain and soreness around the fingerpad. These vesicles can later coalesce to form an ulcer with a hemorrhagic base. A detailed history should be obtained to determine if the patient has had prior herpetic lesions, either genital or oral. The diagnosis is typically made by the clinical appearance of the affected area, but if the diagnosis is uncertain, it can be confirmed by fluorescent antibody testing. Gram stain and cultures of the lesion will be of little value.

No specific treatment is indicated because these lesions are self-limiting. Incision and drainage should not be performed because of the risk of viral dissemination. Pediatric patients should be instructed to avoid putting the fingers in contact with the mouth, especially by thumb sucking. This will prevent recurrence and further spread of the virus.

DISCUSSION

This concludes this two-part series.

SUGGESTED READING

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First Hand News is the education journal of the Christine M. Kleinert Institute (CMKI). CMKI is a center for hand care research and education. CMKI encompasses research and education in the areas of hand care, hand and microsurgery, physical therapy, rehabilitation, and injury prevention.

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To earn credit, read First Hand News carefully, answer the questions below, submit your completed quiz to The Christine M. Kleinert Institute for grading, and obtain a passing score (minimum of 75%). Each quiz may be submitted only once for credit.

QUESTIONS

True or False

1. The best approach to nail bed repair is to remove the nail regardless of the size of the subungual hematoma.

True False

2. High pressure injection injuries are usually obvious and a sine qua non is immediate, severe pain and swelling.

True False

3. Criteria for hospitalization related to burns of the hand include circumferential burns to the hand and fingers and high voltage electrical burns.

True False

4. A felon is an infection of the soft tissue of the distal phalanx that extends into the flexor tendon sheath.

True False

OBJECTIVES

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After reading this issue you should be able to:

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- DISCUSS common infections of the hand

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