Hand infections

Introduction

Hand infections account for a significant number of attendances to the emergency department, with the NHS reporting an incidence of hand cellulitis alone as 16.4/1000 person years (Office of Population Censuses and Surveys, 1992; Masson, 2002). Prompt treatment allows a rapid return of function; however, delayed diagnosis risks significant disability and suboptimal outcomes for patients. The spectrum of clinical presentation and pathophysiology varies immensely and can be diagnostically challenging.

This review provides an overview of the clinical management of this common pathology to help guide a trainee's assessment, diagnosis and management of these conditions.

Pathophysiology and epidemiology

Systemic factors

While there are limited data in the literature regarding the incidence, in the authors' unit the following systemic factors are implicated in hand infections. Immuno-compromised patients are at higher risk of serious hand infections, including atypical, digit and life-threatening infections. Diabetics and patients who abuse intravenous drugs make up a high proportion of this cohort. Any cause of decreased vascularity to the digit (e.g. peripheral vascular disease, scleroderma) is another risk factor for severe infection.

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Local factors

Traumatic wounds, particularly with significant soft tissue damage, increase the risk of infection. Foreign material of any kind will also provide a nidus for infection. This includes surgical implants as well as splinters of any material.

Repeated trauma and continued exposure to environmental insults are risk factors for chronic infections, thereby placing manual workers at higher risk of infection.

History and examination

A careful history, including time and site of inoculation, will help clarify possible responsible organisms and the speed and distance that the infection has spread. Delayed presentation (i.e. greater than 48–72 hours) of a neglected wound significantly worsens outcomes (Glass, 1982). In addition to systemic risk factors highlighted in the past medical history (see above), the patient's profession and hobbies determine the required level of hand function and possible sources of infection, e.g. *Mycobacterium marinum* in people exposed to tropical fish. Clarification of tetanus status and treatment already undertaken is mandatory, including antibiotics used and any first aid performed.

On general examination, signs of systemic sepsis, including acute or chronic inflammation, may be evident, with infective foci distant from the site of inoculation. Careful observation of hand and finger position, skin colour and swellings on either the palmar or dorsal surfaces should guide more focused examination. All potential spaces should be palpated, especially along the flexor tendon sheaths located on the palmar aspect of the fingers. Assessment of the range of movement of all hand and wrist joints should be performed. Pain, swelling and stiffness of any joint may indicate underlying infection. Common specific infections are discussed below.

Specific infections

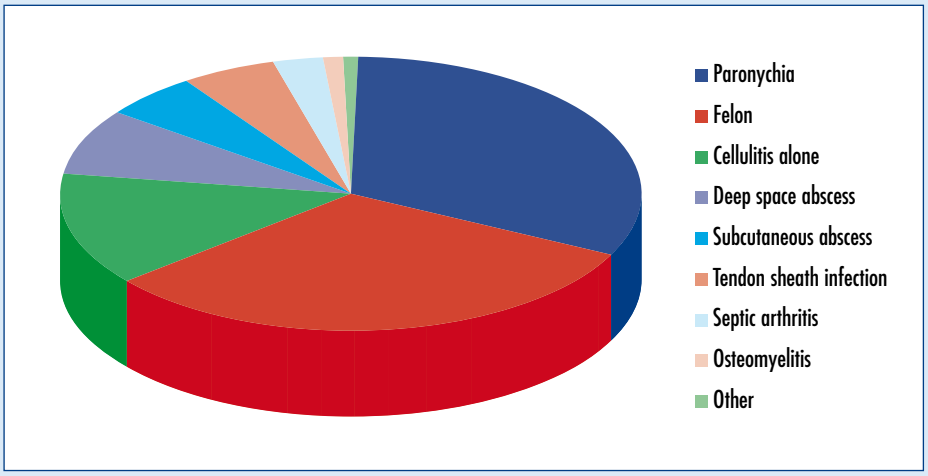
Figure 1 outlines the frequency of different hand infections.

Cellulitis

This is a non-suppurative infection of the soft tissues often caused by a mixed group of pathogens including *Staphylococcus aureus* and beta-haemolytic *Streptococcus* spp. Inflammation tracks subcutaneously along fascial planes and can rapidly become quite extensive. The typical appearances are of erythematous skin, often with oedema affecting the area. The skin will be warm and tender to palpation and there is often regional lymphadenopathy (axillary). Marking the extent of visible erythema on the skin to track progress is useful.

Treatment is with rest, splintage, elevation and appropriate antibiotics (usually flucloxacillin, given intravenously for severe infections). Failure to respond to

Figure 1. Frequency of specific hand infections. From Belcher and Clare (2003).



appropriate treatment can be indicative of abscess formation (Leonard, 2011). Simple cellulitis should not be confused with necrotizing fasciitis that spreads rapidly, causes systemic symptoms, responds poorly to antibiotic therapy and leads to necrosis of the cutaneous and subcutaneous tissues. Clinically this presents as a patient who is in septic shock with the clinical features of rapidly spreading cellulitis. There can be subcutaneous emphysema and it is often caused by a mixed flora of organisms (often includes group A *Streptococcus* spp). Treatment is by emergent debridement of all affected tissues where necrosis of the fascial planes is encountered. This is a limb-threatening condition with significant morbidity and mortality if not treated rapidly.

Figure 2 shows a pointing abscess on the forearm with surrounding cellulitis marked to note speed of spread.

Deep abscesses

The multiple potential spaces within the hand mean that infections can coalesce into abscesses, whose symptoms depend upon the anatomical location (*Figure 3*). Treatment is with incision, drainage, debridement by an appropriately skilled surgeon, antibiotics, splintage and elevation. Subsequent aggressive hand therapy is then required to regain function. The spaces in which abscesses can form are:

1. Thenar space abscess – at the base of the thumb, causing pain and restricted thumb movement
2. Hypothenar space abscess – at the base of the little finger, causing pain and restricted little finger movement
3. Mid-palmar space abscess – in the centre of the palm, deep to the flexor tendons and communicating to the forearm, via the space of Parona, with the potential for large abscess formation. Local clinical signs may be subtle, but the patient may be systemically unwell
4. Webspace abscess – limited by connections between the metacarpal heads, and may present in both the dorsal and volar tissues – a 'collar-stud' abscess
5. Dorsal space abscess – located superficially on the dorsum of the hand.

Figure 2. A small, pointing forearm abscess with surrounding cellulitis marked in pen. Local trauma can be seen neighbouring the abscess.

Bites and open wounds

Over 60% of hand infections are the result of trauma, 10% are the result of animal bites and 30% are the result of human bites (Linscheid and Dobyns, 1975). A common injury pattern of human bites occurs following a punch to the mouth – a so-called 'fight bite'. Presentation is often an innocuous puncture wound over the metacarpal head, overlying a penetrating injury through the extensor tendon. These injuries risk septic arthritis, rapid joint destruction and long-term morbidity if not treated promptly (Dunbar, 1988; Long et al, 1988).

A radiograph should be obtained for all bites and open wounds to exclude a fracture or retained foreign body. Broad-spectrum antibiotics, e.g. intravenous co-amoxiclav, should be started and tetanus cover provided as local protocols dictate. All such injuries require surgical treatment, in particular penetrating injuries involving joints. *Figure 4* shows the level of debridement required to eradicate infection if a fight bite is neglected.

Figure 3. Some areas of abscess formation within the palmar aspect of the hand.

Paronychia

Paronychias are infections of the tissues surrounding the nail fold that can rapidly progress and be very painful. They are often associated with minor, repetitive local trauma, such as nail biting, with typical organisms including *Staph. aureus* or anaerobes.

Chronic infections present more insidiously and are often related to repeated water contact. These can be problematic to treat and often involve atypical organisms such as fungi and non-tuberculous mycobacteria. Housewives, bartenders, dishwashers, nurses, swimmers, and children who suck their fingers are often affected. Diabetics and patients with psoriasis may also develop this condition.

Acute paronychia is treated by surgical drainage of pus and appropriate antibiotics. For chronic infections, strenuous efforts should be made to culture the causative organism and surgery is frequently needed although pus is not encountered. Extended courses of antimicrobial treatment are often also needed. *Figure 5* shows a neglected paronychia after debridement of devitalized tissue.

Figure 4. A metacarpophalangeal joint after debridement of infected tissue following a 'fight bite'.

Figure 5. Neglected paronychia after thorough debridement.

Pyogenic flexor tenosynovitis

Flexor tendons are enclosed by flexor sheaths and synovial fluid to allow the tendons to glide and function. Once this closed system is infected – acute pyogenic flexor tenosynovitis – pus may rapidly track along the tendon longitudinally; this is a surgical emergency. *Staphylococcus* or *Streptococcus* species are the commonest causal organisms (Boles and Schmidt, 1998), although haematogenous spread may lead to gonococcal infection of the flexor sheath. This is especially important to note if there is no history of trauma (Lille et al, 2000).

Kanavel (1939) originally described the four cardinal signs of flexor tenosynovitis:

1. Fusiform swelling of the entire digit
2. Finger held in a partially flexed position
3. Tenderness along the entire flexor sheath
4. Pain along the tendon sheath on passive extension of the digit.

The presence of these signs following penetrating trauma to the flexor surface of the finger should prompt the clinician to seek urgent referral to an emergency hand service. The fourth of these signs has been shown to be the most reproducible (Neviaser, 1989; Boles and Schmidt, 1998). Surgical treatment methods include percutaneous and open exploration and washout of the affected tendon sheath followed by close observation and often repeated washouts. The hand should be splinted in the Edinburgh position of function between washouts, to prevent contracture of the soft tissues of the hand (*Figure 6*).

Figure 7 shows the typical appearances of a pyogenic flexor sheath infection. Note the fusiform swelling of the digit and puncture wound directly overlying the flexor tendon.

Felon

A felon is an infection of the palmar pad of the finger. The patient often gives a history of a minor penetrating injury to the fingertip, e.g. a fingerstick test for glucose estimation. The tight compartments in the pulp cause pressure to rise rapidly which results in severe pain, swelling and throbbing of the digit. Tissue breakdown can occur, with progressive ischaemia and osteomyelitis a risk if the condition is not promptly treated. The commonest organism isolated is *Staph. aureus* with meticillin-resistant strains being reported. In the authors' unit the suggested empirical antibiotic therefore is flucloxacillin (intravenous for severe infections)

If the felon is treated very early, antibiotics and elevation may suffice when no collection of pus has formed, otherwise treatment involves incision and drainage with antibiotic coverage. *Figure 8* shows the comparative positions of a typical felon and paronychia.

Herpetic whitlow

The commonest viral infection of the hand is the herpetic whitlow. This is caused by herpes simplex virus (HSV) 1 and 2. HSV-1 infections usually occur following contact with infected saliva (e.g. finger sucking in children and occupational exposure in dentists). HSV-2 infections occur following genital contact. The incubation period is 2–14 days. Early in the course of the disease there is intense throbbing, tingling and pain in the affected digit. Erythema and mild swelling develop followed by the appearance of clear vesicles that gradually coalesce. The clear fluid may become turbid mimicking a purulent infection. The lesions gradually resolve over a 3-week period. Super-added bacterial infection can occur.

Figure 9 shows the classical appearance of a herpetic whitlow.

The Tzanck smear is mostly of historic interest and can be performed on vesicular fluid but is less sensitive than viral cultures and polymerase chain reaction at confirming the diagnosis. Immunofluorescent serum antibody titres can also be diagnostic. No active treatment is usually indicated

Figure 6. The Edinburgh position of safety for hand splintage. 0–30° extension at the wrist, 90° flexion at the metacarpophalangeal joint and full extension at the interphalangeal joints (0°).

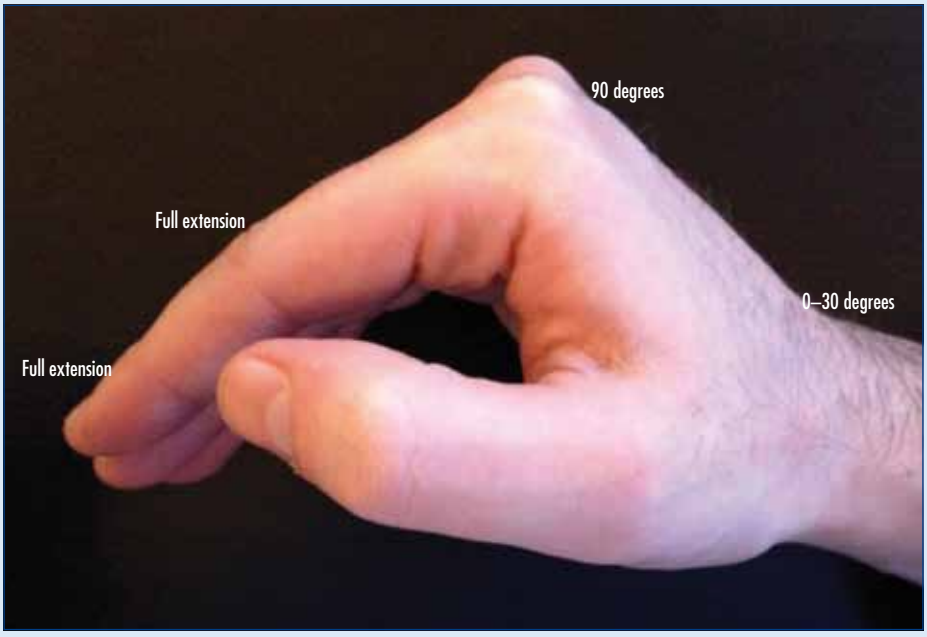
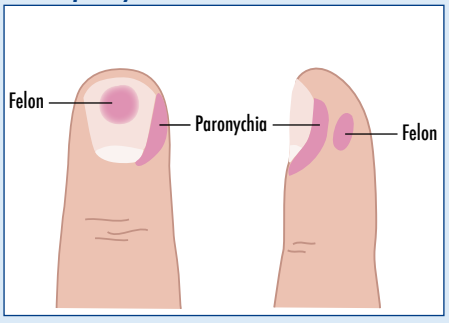


Figure 7. A pyogenic flexor sheath infection. Note the puncture wound and fusiform swelling of the middle finger.

Figure 8. Anteroposterior and lateral photographs of typical positions of felon and paronychia. A felon is typically within the pulp space of a digit while a paronychia lies next to the nail fold.



but attempts should be made to avoid autoinoculation and transmission. De-roofing the vesicles and careful partial nail excision, to reduce subungual pressure, may provide symptom relief, but the vesicles can recur, particularly in the immunocompromised.

Complications

Giuffre et al (2011) highlighted that time to diagnosis and treatment, the number of incision and drainage procedures were major factors influencing outcome of pyogenic infection of digital joints.

Stiffness and contracture

Soft tissue scarring caused by infection or prolonged immobility during recovery risks stiffness, especially if the position of function is not maintained. Contractures may result from intrinsic muscle damage, tendon adhesions, skin scarring or capsular tightening. Rapid diagnosis, treatment and maintenance of mobility is vital in their prevention.

Figure 9. A herpetic whitlow.

Tendon rupture

Severe tenosynovitis may lead to tendon rupture. A Boutonnière deformity may arise following proximal interphalangeal joint sepsis. Sudden loss of movement around a joint in the finger or hand after infection should lead to suspicion of this complication.

Compartment syndrome

Compartment syndrome following infection in the hand is rare and usually associated with necrotizing fasciitis or a crush injury. Symptoms include pain out of proportion to the clinical setting and a swollen hand. The classical clinical signs of pulselessness, paraesthesia, pallor, paralysis and prolonged capillary refill are late signs and often present after significant damage has occurred.

Amputation

Complicated bone or joint infections may lead to amputation, either primarily or secondarily. Antibiotic therapy should be guided by local microbiology advice and any suspicion of bone or joint involvement warrants prolonged treatment courses (6 weeks or longer). Often multiple bone or tissue biopsies and culture is the best means of guiding therapy. *Figure 5* shows how even a simple paronychia if neglected can lead to significant loss of tissue. BJHM

Conflict of interest: none.

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KEY POINTS

- Hand infections are a common diagnosis in both the emergency department and inpatient setting.
- There is a wide spectrum of presentation that can lead to diagnostic challenges.
- Rapid diagnosis and treatment can lead to optimal outcomes.
- Delayed diagnosis is associated with serious complications and poor function.
- Adequate treatment may require prompt surgery as well as appropriate antimicrobials.