



# Common bacterial infections of the hand

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## ABSTRACT

Infections of the hand are commonly encountered in general practice. Delay in diagnosis increases the risk of tissue loss and functional impairment. Staphylococcal infections are most common, but polymicrobial infections are often seen in immunocompromised patients. In this pictorial essay, important and common conditions are illustrated to demonstrate key points and pitfalls in diagnosis and management.

**Keywords:** bacterial infections, hand infections, hand lesions, infections, polymicrobial infections, *Staphylococcus aureus*

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## INTRODUCTION

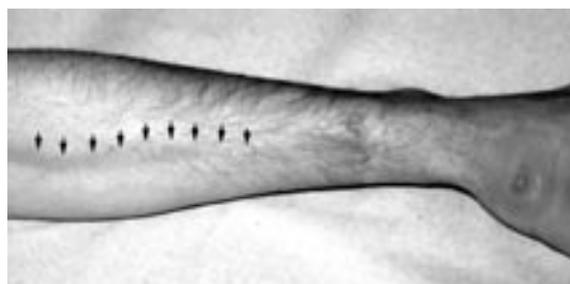
Hand infections are common as the naked hand is the body's first point of physical contact with the environment. This puts it at risk of injury and secondary infection. The hand in its terminal position also makes it susceptible to ischaemia and neuropathy. This increases the likelihood of infection and reduces the healing capability of the organ. The outcome of a hand infection is related to how early it is diagnosed and initially treated. There is very little spare tissue in the hand and any destruction is devastating. This article covers common and serious hand infections with emphasis on important aspects of diagnosis as well as treatment.

## GENERAL ASPECTS OF HAND INFECTIONS

*Staphylococcus aureus*, a gram-positive cocci, is the causative organism in up to 60% of all hand infections<sup>(1, 2)</sup>. As such, empirical antibiotic therapy should include this organism within its spectrum. A wide variety of other micro-organisms may be involved, either individually or as a polymicrobial type of infection. This includes gram-negative organisms such as *Enterobacter*, *Streptococcus*, *Pseudomonas aeruginosa*, anaerobes and fungal organisms. Polymicrobial infections are particularly



**Fig. 1** Photograph of a diabetic patient who presented with a one-week history of swelling after mild trauma to the finger. The little finger was gangrenous and the infection had spread along the flexor tendon sheath through the ulnar bursa to the distal forearm. Amputation had to be performed to control the infection.



**Fig. 2** Cellulitis affects the epidermal and dermal levels of the skin. It commonly follows superficial trauma and is usually caused by *Streptococcus epidermidis*, and occasionally by *Staphylococcus aureus*. Photograph shows associated ascending lymphangitis which is seen as red streaks running longitudinally (arrows). Regional lymph nodes may be enlarged and systemic signs of infection like chills and fever may be present.

common in diabetic infections (Fig. 1). The sensory impairment seen in diabetes mellitus puts the hand at risk of injury and also delays treatment. Diabetic infections tend to be more severe and have a poorer outcome<sup>(3,4)</sup>. In early cases, treatment consists of appropriate antimicrobial therapy supported by warm soaks and dressing with the aim of early mobilisation<sup>(5)</sup>. When there is a collection of pus or significant necrotic tissue, surgical debridement is

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**Table I. Summary of common and important hand infections, outlining the common micro-organisms involved and recommended treatment.**

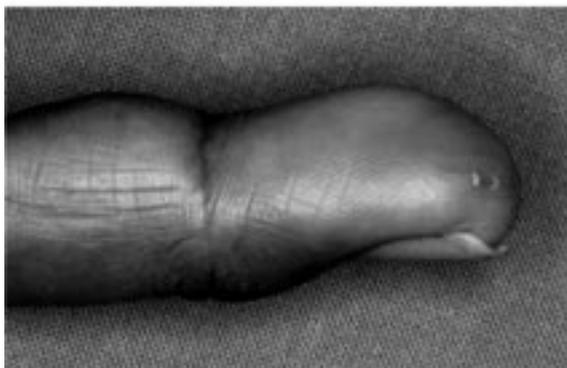
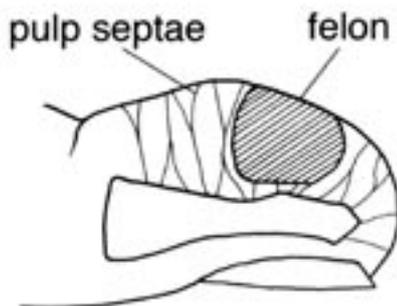
Condition	Common organisms	Anti-microbial treatment (5, 9, 10)	Remarks
Cellulitis/lymphangitis	Streptococci, <i>S. aureus</i>	Dicloxacillin 250-500mg PO 6H or cefazolin 1g IV 8H	Early cellulitis may be treated with oral antibiotics, but failure of rapid resolution should be treated with parenteral antibiotics
Pulp space infection/felon	<i>S. aureus</i> , Streptococci	Dicloxacillin 250-500mg PO 6H or clindamycin 150-300mg PO 6H	Most patients require surgical drainage of pus in addition to antibiotic therapy
Eponychia/paronychia	<i>S. aureus</i> , Streptococci; gram-negative bacilli and pseudomonas if exposed to oral flora	Dicloxacillin 250-500mg PO 6H, or erythromycin 250-500mg PO 6H	In early cases, warm soaks are sufficient adjunct. Surgical drainage is required once pus is present.
“Fight bite”/ clenched fist infections	<i>S. aureus</i> , Streptococci, <i>Eikenella corrodens</i> , gram-negative bacilli, anaerobes	Cefazolin 1g IV 8H plus penicillin 2-4 million U IV 4-6H, or clindamycin 300mg PO 6H plus ciprofloxacin 250-500mg PO 12H, or amoxicillin-clavulanate potassium 250-500mg PO 8H	These patients should have an urgent surgical assessment. In most cases, a formal surgical debridement is necessary.
Osteomyelitis/septic arthritis	<i>S. aureus</i> , ( <i>N. gonorrhoeae</i> occasionally for septic arthritis)	Cefazolin 1g IV 8H or vancomycin 1g IV 12H; ceftriaxone 1g IV 24H for <i>N. gonorrhoeae</i>	Prolonged antibiotic therapy is required.
Pyogenic flexor tenosynovitis	<i>S. aureus</i> , Streptococci	Cefazolin 1g IV 8H or ampicillin-sulbactam 1.5mg IV 6H	Early cases may resolve with antibiotics alone, but surgical assessment should be sought if improvement not seen in the first 12-24 hours.
Webspace infection	<i>S. aureus</i> , Streptococci	Cefazolin 1g IV 8H or ampicillin-sulbactam 1.5mg IV 6H	Surgical debridement is usually necessary
Subepidermal abscess	<i>S. aureus</i>	Dicloxacillin 250-500mg PO 6H or clindamycin 150-300mg PO 6H	Seen in diabetic patients. Deroofing the blister usually leads to rapid resolution.
Necrotising fasciitis	Most commonly polymicrobial: gram-positive, gram-negative, anaerobes; group A Streptococcus	Empirical treatment: broad-spectrum antibiotics e.g. penicillin 2-4 million U IV 4H plus gentamicin IV 4-6mg/kg/d (titrate to serum levels) plus metronidazole IV 400mg 8H	Definitive antibiotics should be guided by definitive cultures and sensitivity tests and an infectious disease consult. Supportive and resuscitative measures are vital. Surgery should be aggressive and done without delay. Further surgical exploration within the next 24-48 hours is frequently necessary.

necessary. Surgery needs to be done on an emergency basis.

Antibiotics are the main treatment modality in certain infections like cellulitis (Fig. 2). However, many hand infections present with a purulent collection or necrotic tissue that necessitates debridement, in addition to antimicrobial therapy. Surgery should be done early and radically to remove infected and necrotic tissue, and limit the spread of infection. The microbiology and treatment modalities of the conditions discussed in this article are summarised in Table I.

## SPECIFIC INFECTIONS

A felon (Fig. 3) is an infection involving the pulp space of the finger. It typically follows a penetrating injury or spread of infection from an adjacent area such as a paronychia. Complications involve the surrounding structures such as necrosis of the overlying skin, pyogenic flexor tenosynovitis, osteomyelitis and septic arthritis. Eponychia and paronychia are infections involving the tissues around the nail bed (Fig. 4). The infective inoculum enters the tissue through the nail fold, via a breach in the cuticle layer. It is more common in nail biters.



**Fig. 3** A felon is a collection of pus in the pulp space, which normally consists of fat separated by pulp septae. Photograph shows the typical features of overlying skin erythema and swelling of the pulp. The pressure caused by the collection of pus causes the patient to complain of severe pain over the site. Surgical drainage was performed.



**Fig. 4** Paronychia is an infection affecting either side of the nail plate. Photograph shows an eponychia where the eponychial fold is involved. The infection can spread under the nail (arrow) to form a subungual abscess.

Infection following bite injuries may occur following both human and animal bites. "Fight bite" or "clenched fist" injuries (Fig. 5) are common forms of human bite infections. They occur when a person sustains a laceration over the knuckle region from the opposite party's teeth after landing a blow. This causes injury to the extensor tendon, joint surface and results in a septic arthritis. The wound may be small and conceal the fact that the injury may extend to the metacarpophalangeal joint.

Animal bites are usually due to domestic animals



**Fig. 5** Photograph of the finger of a patient who presented several days after the injury. The small wound (arrow) belies the fact that a septic arthritis is present underneath. A high index of suspicion for this injury should be suspected in all lacerations around the metacarpophalangeal joints. This condition requires intravenous antibiotics and debridement.



**Fig. 6** Photograph of a patient with septic arthritis which may be difficult to differentiate from more superficial infections. There is overlying inflammation of the skin over the index finger metacarpophalangeal joint which can be confused with cellulitis, and joint fluctuance is difficult to demonstrate in small joints. The swelling has obliterated the normally visible subcutaneous veins over the radial side of the hand. Radiographs in the early stages do not show changes in the joint. Definitive diagnosis is made by sending joint fluid aspirate for gram staining and culture. This should be done before starting antibiotic therapy.

such as dogs and cats. *Staphylococcus aureus* is again the most common organism, but there is a high incidence of anaerobic infection from oral flora. Certain specific organisms such as *Eikenella corrodens* and *Pasturella multocida* are associated with dog and cat bites. Tetanus prophylaxis is essential. If the injury is superficial or infection mild, local wound care and oral antibiotic treatment with close review is sufficient. A broader spectrum antibiotic like amoxycillin-clavulanate is usually chosen if oral antibiotics are used. In all other cases, hospital admission for a proper surgical debridement and intravenous antibiotics is necessary. Local domestic animals are rabies free, but bites from

wild animals or imported cases will need rabies prophylaxis.

Osteomyelitis and septic arthritis are uncommon in the hand<sup>(6)</sup>. When they do occur, it usually follows infection of adjacent areas. One cause of haematogeneous septic arthritis is gonococcal arthritis. This arthritis may present in multiple joints and is seen more commonly in middle-aged males (Fig. 6).

Pyogenic flexor tenosynovitis has become much less common since the introduction of antibiotics. It is still an important condition, because of the risk of complications and late sequelae (Fig. 7). The usual cause is an injury that has penetrated the flexor tendon sheath. The recognition of the classical quartet of a semi-flexed finger, uniform swelling of the finger, tenderness along the whole length of the tendon sheath, and pain on passive extension of the finger are useful diagnostic clues. In early cases, not all the signs may be present.



**Fig. 7** Iatrogenic tenosynovitis following steroid injections in the hand is an important cause of this infection. This patient presented four days after an injection for trigger thumb. Left photograph shows diffuse swelling of the whole thumb. Drainage revealed a frankly purulent tenosynovitis as shown on the right photograph.



**Fig. 8:** Photograph of a web space abscess shows the typical features of such an infection. There is swelling on both volar and dorsal aspects of the web and the abducted fingers. This developed from an infected callosity.



**Fig. 9** Photograph shows a subepidermal infection which may look intimidating but are in most cases very superficial and the patients are quite well. Simple derroofing of the abscess is all that is required in most cases.

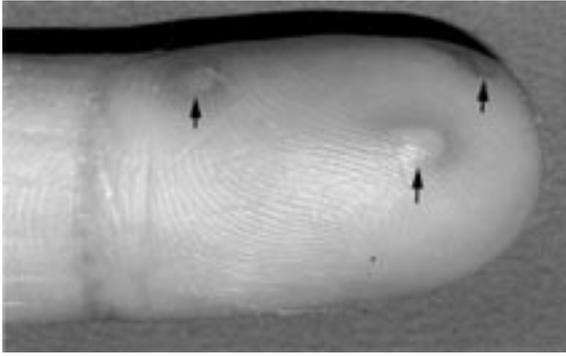


**Fig. 10** Patients with necrotising fasciitis present with rapidly-progressing symptoms and become very ill. The development of blisters seen over the hand dorsum is a late event in the disease progression. There is usually a large amount of skin loss with necrotising fasciitis which requires skin grafting or even flap coverage.

Web space abscesses start on the palmar surface from an infected callosity or blister. The associated oedema is most evident on the dorsum of the web because of the laxity of the skin and soft tissues over the dorsum (Fig. 8). This prominent dorsal swelling is also seen in other palmar deep space infections such as those involving the mid-palm and thenar spaces.

Subepidermal abscesses are peculiar to diabetic patients and appear as pus-filled blisters (Fig. 9). The underlying dermis and deeper tissues may or not be involved. This involvement can be ascertained by derroofing and debridement of the blister. Surgical debridement along with the appropriate antibiotics results in rapid resolution of the symptoms.

Necrotising fasciitis is one of the few extremity infections that is both life and limb threatening. It may follow a localised abscess or may occur in cases with no apparent trauma. The diagnosis may be delayed as in early stages, the overlying skin condition may appear deceptively mild. Necrotising fasciitis may be caused by a variety of organisms including beta-haemolytic *Streptococcus*, gram-negative organisms and anaerobes. The infection spreads rapidly



**Fig. 11** Photograph shows the lesions that appeared on the finger of a healthcare worker. Healthcare personnel are particularly at risk for this condition. The lesion is typical of a whitlow with clear vesicles on an erythematous base (arrows). Definitive diagnosis is made with direct fluorescence antibody testing of the vesicular fluid or a Tzanck smear. She was treated successfully with acyclovir, but developed a recurrence a few months later.

through the fascial planes with subsequent vessel thrombosis and micro-abscess formation. Systemic complications such as septic shock and disseminated intravascular coagulation rapidly develop if not treated, and the mortality is significant<sup>(7, 8)</sup>. A rapid progress of an apparent cellulitis or local infection, or a very ill-looking patient should raise the suspicion of this condition. After successful treatment, which involves radical surgical debridement and broad-spectrum antibiotic therapy, there is usually a skin defect which needs to be covered (Fig. 10).

#### **PITFALLS IN DIAGNOSIS**

While bacterial infections form a large part of the soft tissue disorders of the hand, it is sometimes easy to mistake other conditions for these infections.

One example is the herpetic whitlow, which is caused by the *Herpes simplex I or II* virus (Fig. 11). It is important to distinguish this from bacterial infections as the treatment is symptomatic, and the lesion spontaneously resolves in a few weeks. Antiviral therapy may be used to shorten the course. Surgery is contraindicated as it may cause bacterial superinfection and there is a theoretical risk of viral encephalitis.

Other conditions which may mimic infections include inflammatory arthritides, such as gout and pseudogout which present in a similar manner as septic arthritis. In this situation, a joint fluid analysis can usually differentiate the two. Other conditions that may appear infectious include gouty tophi and pyogenic granuloma.

#### **REFERENCES**

1. Stern PJ, Staneck JL, McDonough JJ, et al. Established hand infections: a controlled, prospective study. *J Hand Surg [Am]* 1983; 8:553-9.
2. Hausman MR and Lisser SP. Hand infections. *Orthop Clin North Am* 1992; 23:171-85.
3. Kour AK, Looi KP, Phone MH, et al. Hand infections in patients with diabetes. *Clin Orthop Relat Res* 1996; 331:238-44.
4. Gunther SF and Gunther SB. Diabetic hand infections. *Hand Clin* 1998; 14:647-56.
5. Clark DC. Common acute hand infections. *Am Fam Physician* 2003; 68:2167-76.
6. Murray PM. Septic arthritis of the hand and wrist. *Hand Clin* 1998; 14:579-87.
7. Li YH, Toh CL, Khoo C, et al. Necrotising fasciitis--an old enemy or a new foe. *Ann Acad Med Singapore* 1997; 26:175-8.
8. Gonzalez MH. Necrotizing fasciitis and gangrene of the upper extremity. *Hand Clin* 1998; 14:635-45.
9. Abrams RA, Botte MJ. Hand infections: treatment recommendations for specific types. *J Am Acad Orthop Surg* 1996; 4:219-30.
10. Hasham S, Matteucci P, Stanley PR, et al. Necrotising fasciitis. *BMJ* 2005; 330:830-3.

## SINGAPORE MEDICAL COUNCIL CATEGORY 3B CME PROGRAMME

### Multiple Choice Questions (Code SMJ 200604B)

True    False

**Question 1.** Regarding hand infections in general:

- |                                                                                                          |                          |                          |
|----------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| (a) They are common as the hand is commonly injured with the risk of secondary infection.                | <input type="checkbox"/> | <input type="checkbox"/> |
| (b) Delayed treatment, provided appropriate antibiotics are used, does not adversely affect the outcome. | <input type="checkbox"/> | <input type="checkbox"/> |
| (c) The most commonly involved micro-organism is <i>Staphylococcus aureus</i> .                          | <input type="checkbox"/> | <input type="checkbox"/> |
| (d) Diabetic hand infections involve only one form of bacteria.                                          | <input type="checkbox"/> | <input type="checkbox"/> |

**Question 2:** Regarding specific infections of the hand:

- |                                                                                                                                                                                     |                          |                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| (a) A felon is an infection involving the flexor tendon sheath.                                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> |
| (b) A small infected wound over a knuckle is invariably superficial, and can be treated with oral antibiotics and dressing.                                                         | <input type="checkbox"/> | <input type="checkbox"/> |
| (c) The classical findings in a pyogenic flexor tenosynovitis are: a semi-flexed finger, uniform finger swelling, tenderness along the tendon sheath and pain on passive extension. | <input type="checkbox"/> | <input type="checkbox"/> |
| (d) A subepidermal abscess in the finger is commonly seen in diabetic patients.                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> |

**Question 3:** Regarding specific infections of the hand:

- |                                                                                                                                          |                          |                          |
|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| (a) Osteomyelitis and septic arthritis are common hand infections.                                                                       | <input type="checkbox"/> | <input type="checkbox"/> |
| (b) Flexor tenosynovitis can occur following a steroid injection for trigger finger if asepsis is breached.                              | <input type="checkbox"/> | <input type="checkbox"/> |
| (c) Necrotising fasciitis is an uncommon but serious infection that can threaten both life and limb.                                     | <input type="checkbox"/> | <input type="checkbox"/> |
| (d) In the early stages, necrotising fasciitis may resemble cellulitis, but is marked by its rapid progress and a seriously ill patient. | <input type="checkbox"/> | <input type="checkbox"/> |

**Question 4:** In the treatment of hand infections:

- |                                                                                                                                      |                          |                          |
|--------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| (a) Administering tetanus prophylaxis is an essential element in the treatment of bite-related infections.                           | <input type="checkbox"/> | <input type="checkbox"/> |
| (b) Bite-related infections often involve anaerobic organisms, that should be covered within the spectrum of the antibiotics chosen. | <input type="checkbox"/> | <input type="checkbox"/> |
| (c) A surgical consultation should be sought for cases of suspected pyogenic flexor tenosynovitis and bite infections.               | <input type="checkbox"/> | <input type="checkbox"/> |
| (d) For suspected necrotising fasciitis, broad-spectrum antibiotics with frequent outpatient review is appropriate treatment.        | <input type="checkbox"/> | <input type="checkbox"/> |

**Question 5:** Regarding the following pitfalls in diagnosis:

- |                                                                                                                                        |                          |                          |
|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| (a) Multiple clear vesicles with an erythematous base suggest a case of herpetic whitlow.                                              | <input type="checkbox"/> | <input type="checkbox"/> |
| (b) Herpetic whitlows are caused only by HSV II.                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> |
| (c) Surgical deroofing of a herpetic whitlow is a necessary part of the treatment.                                                     | <input type="checkbox"/> | <input type="checkbox"/> |
| (d) In cases of suspected septic arthritis, joint aspiration for analysis and culture should be performed before starting antibiotics. | <input type="checkbox"/> | <input type="checkbox"/> |

**Doctor's particulars:**

Name in full: \_\_\_\_\_

MCR number: \_\_\_\_\_ Specialty: \_\_\_\_\_

Email address: \_\_\_\_\_

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1. Photocopy this answer form.
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