

Little Finger Flexor Tendoscopy, Endoscopy of the Ulnar Bursa and Midpalmar Space



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Abstract: Inflammatory, infectious, and even neoplastic processes can involve the deep subfascial space of the hand. Suppurative deep-space infection is treated primarily with surgical drainage. Open approaches to these deep spaces carry the risk of exposed flexor tendons and nerves without adequate soft tissue coverage. The purpose of this Technical Note is to describe the technical details of little finger flexor tendoscopy, endoscopy of the ulnar bursa and midpalmar space, which will reduce the risk of exposed tendons or nerves associated with open approaches and allow aggressive hand therapy in the early postoperative period because of the minimal surgical trauma and small surgical wounds.

Deep hand infections refer to those infections located deep to the tendon sheaths.¹ They include synovial space infections, such as infectious tenosynovitis, deep subfascial space infections, septic arthritis, necrotizing fasciitis, and osteomyelitis.¹ Infections of the deep subfascial spaces of the hand and wrist are relatively uncommon but well recognized.² These spaces include the interdigital web space, dorsal subaponeurotic space, Parona's space, thenar space, midpalmar space, and hypothenar space.² Typically, infections are secondary to suppurative flexor tenosynovitis. Suppurative conditions of the hand-wrist compartments result in a vicious circle of infection and an increase in compartmental pressure that reduces perfusion of soft tissues and facilitates the spread of infection.² Besides suppurative infection, tuberculous tenosynovitis and bursitis can also occur in the flexor tendon sheaths and the deep subfascial spaces and are 2

of the major causes for chronic tendon sheath infection in developing countries.³

There are various patterns of communication among the finger flexor tendon sheath, ulnar and radial bursae, thenar and midpalmar spaces, and space of Parona.^{2,4,5} The midpalmar space of the hand communicates with the space of Parona in the forearm through the carpal tunnel.² The first flexor digitorum tendon sheath usually communicates with the radial bursa, whereas the fifth flexor digitorum tendon sheath communicates with the ulnar bursa in 50% to 80% of cases.⁴ The flexor digitorum tendon sheaths of the other fingers usually do not communicate with the radial or ulnar bursa.⁴ Occasionally, there are communications among the wrist joint, ulnar bursa, and fifth flexor digitorum tendon sheath.^{4,6,7} These communications are of clinical importance in explaining the spread of inflammatory, infectious, and even neoplastic processes that involve this region.⁸

Infection of these deep spaces can be difficult to diagnose and can present as compartment syndrome of the hand and forearm, which is a limb-threatening condition.^{2,9} Blunt trauma, fractures, or dislocations of the hand and wrist may cause hematoma or effusion in the thenar and midpalmar spaces, which may result in compartment syndrome^{9,10} or carpal tunnel syndrome.^{8,11}

Suppurative deep-space infection is treated primarily with surgical drainage in association with rest, elevation, and appropriate systemic antibiotic therapy.^{2,12} Selection of surgical approaches should be based on the extent and precise location of the infection. The planning and placement of the surgical incision

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Table 1. Indications and Contraindications of Little Finger Flexor Tendoscopy, Endoscopy of the Ulnar Bursa and Midpalmar Space

Indications	Contraindications
<ol style="list-style-type: none"> 1. Suppurative or chronic infections of the fifth flexor digitorum tendon sheath, the ulnar bursa, or the midpalmar space. 2. Hematoma collection of the midpalmar and thenar spaces. 3. Chronic tenosynovitis or bursitis of these spaces associated with inflammatory diseases that are resistant to conservative treatment. 	<ol style="list-style-type: none"> 1. Compartment syndrome of myofascial spaces including the hypothenar space, adductor pollicis, and first dorsal interosseous muscles.

should be undertaken carefully to avoid damage or leaving the flexor tendons and median nerve without adequate soft tissue coverage.² Aggressive hand therapy is usually required in the postoperative period to avoid the complication of tendon adhesions, joint contractures, and hand stiffness.^{2,12} There is demand for endoscopic approaches to these deep spaces to reduce the risk of exposed tendons or nerves associated with the open approaches. Moreover, aggressive hand therapy can be started in the early postoperative period because of the minimal surgical trauma and small surgical wounds. The endoscopic approach to the radial bursa and thenar space has been described.¹³ The purpose of this Technical Note is to describe the technical details of little finger flexor tendoscopy, endoscopy of the ulnar bursa and midpalmar space. It is indicated for suppurative or chronic infections or hematoma collection of these spaces. It is also indicated for chronic tenosynovitis or bursitis associated with inflammatory diseases that is resistant to conservative treatment. It is contraindicated if there is clinical presentation of compartment syndrome of myofascial spaces including the hypothenar space, adductor pollicis, and first dorsal interosseous muscles. Subcompartmentalization of the enclosed myofascial spaces of the hand has been demonstrated.¹⁴ Open release is a more appropriate treatment option because thorough inspection within anatomic areas or generous release of the muscular origin along the metacarpal at the time of fasciotomy can be ensured (Table 1).

Technique

Preoperative Planning and Patient Positioning

Most hand infections are surgical emergencies, and imaging investigations may not be available in these emergency situations.¹ Clinical assessment should determine which compartment is involved, although most of the time it is a difficult task. In the subacute or chronic condition, the pathology can be located with magnetic resonance imaging (Fig 1). Multidetector computed tomography, with its multiplanar reformation and 3-dimensional capabilities, can also be used for the evaluation of acute hand and wrist pathology. The clinical and imaging features of hand and

wrist infections as evidenced on multidetector computed tomography are reviewed with emphasis on contiguous and closed synovial and deep fascial spaces.¹ Knowledge of hand compartmental anatomy enables accurate characterization of the infectious process and localizes the extent of disease in the acute setting.¹

The patient is in the supine position with the hand on the side table. An arm tourniquet is applied to provide a bloodless surgical field. Fluid inflow is by gravity, and no arthropump is used. A 2.7-mm 30° arthroscope (Henke Sass Wolf GmbH, Tuttlingen, Germany) is used for this procedure.

Portal Placement

Three portals are used for this procedure. The phalangeal portal of the little finger is located just proximal to the distal volar skin crease of the little finger. The ulnar palmar portal is over the flexor tendons to the little finger at the level of the fifth

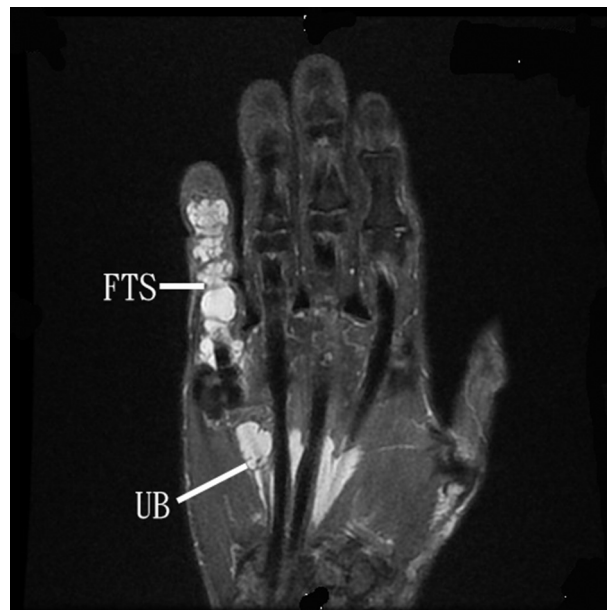
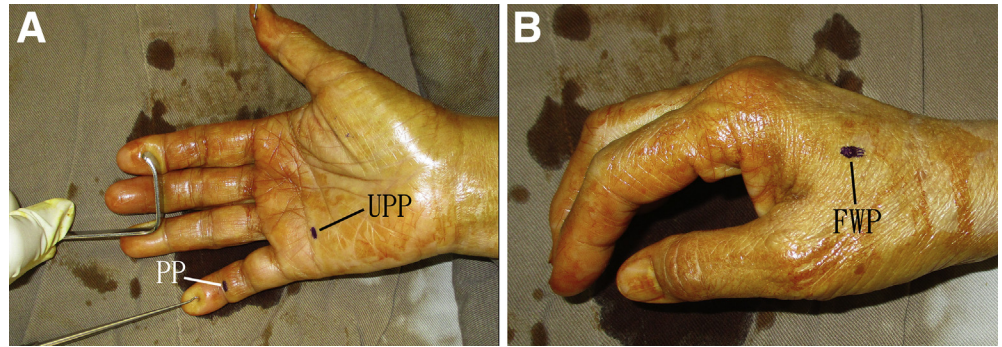


Fig 1. Preoperative magnetic resonance imaging of the illustrated case. Coronal T2 weighted image shows tenosynovitis of the fifth flexor digitorum tendon sheath (FTS) and bursitis of the ulnar bursa (UB).

Fig 2. Little finger flexor tendoscopy, endoscopy of the ulnar bursa and midpalmar space of the right hand. The patient is in the supine position with the hand on the side table. (A) Locations of the phalangeal portal of the little finger (PP) and the ulnar palmar portal (UPP). (B) Location of the first web portal (FWP).



metacarpal neck. The first web portal is at the dorsum of the first hand web and is created with an inside-out technique (Fig 2). The flexor tendoscopy of the little finger is performed through the phalangeal portal of the little finger and the ulnar palmar portal. The ulnar bursa endoscopy and endoscopy of the midpalmar space are performed through the ulnar palmar and first web portals.

Flexor Tendoscopy of the Little Finger

A 3- to 4-mm transverse skin incision is made just distal to the distal volar skin crease of the little finger. The subcutaneous tissue is bluntly dissected down to the flexor tendon sheath by a hemostat. The tendon sheath is penetrated by the hemostat. This creates the phalangeal portal of the little finger. A trocar cannula is inserted into the tendon sheath and advanced proximally. Some resistance may be experienced when the trocar passes through the pulleys. This can be overcome by consistent force of push. Excessive force should be avoided, and the trocar should not be pointed toward the phalangeal bones to reduce the risk of flexor tendon injury. When the tip of the trocar can be felt at the planned ulnar palmar portal site,

another 3- to 4-mm transverse incision is made at this point and the subcutaneous tissue is bluntly dissected until the trocar tip can be seen. This creates the ulnar palmar portal. The phalangeal portal of the little finger and the ulnar palmar portal are interchangeable as the viewing and working portals for flexor tendoscopy of the little finger.

With the phalangeal portal as the viewing portal, the proximal half of the flexor tendon sheath and the flexor tendons can be examined for any pathology. With the arthroscope withdrawn distally, the flexor digitorum superficialis tendon, the tendinous hiatus of flexor digitorum superficialis tendon, and the flexor digitorum profundus tendon can be seen in sequence (Fig 3). Any inflamed synovium can be debrided with an arthroscopic shaver (Dyonics; Smith & Nephew, Andover, MA) via the ulnar palmar portal. After completing assessment and debridement of the proximal half of the flexor tendon sheath, the arthroscope is switched to the ulnar midpalmar portal. The distal half of the flexor tendon sheath and the flexor tendons can be examined. Synovectomy can be performed with the shaver via the phalangeal portal.

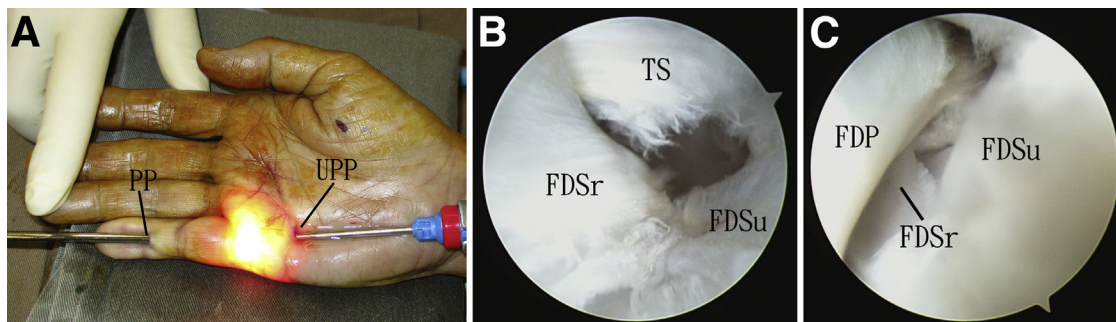


Fig 3. Little finger flexor tendoscopy, endoscopy of the ulnar bursa and midpalmar space of the right hand. The patient is in the supine position with the hand on the side table. (A) Little finger flexor tendoscopy is performed with the phalangeal portal (PP) of the little finger as the viewing portal and the ulnar palmar portal (UPP) as the working portal. (B) Tendoscopic view of the proximal half of the tendinous hiatus of the flexor digitorum superficialis tendon. (C) Tendoscopic view shows that the flexor digitorum profundus tendon passes the tendinous hiatus of the flexor digitorum superficialis tendon. (FDP, flexor digitorum profundus tendon; FDSr, radial band of the tendinous hiatus of the flexor digitorum superficialis tendon; FDSu, ulnar band of the tendinous hiatus of the flexor digitorum superficialis tendon; TS, tendon sheath.)

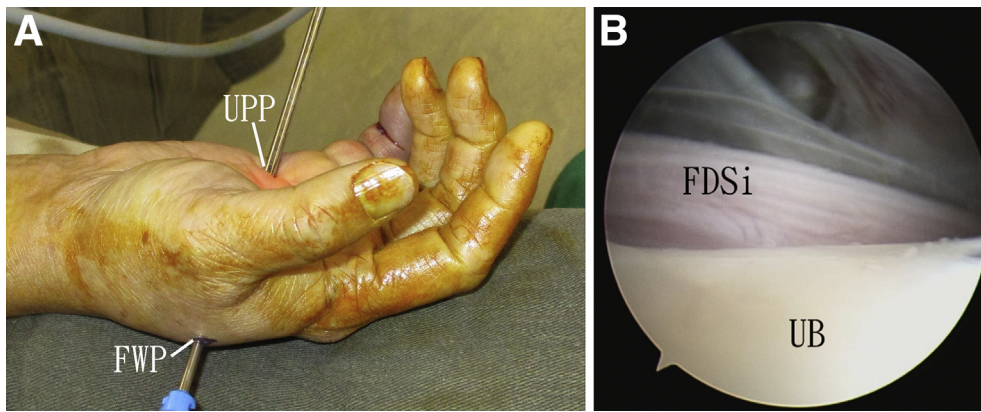


Fig 4. Little finger flexor tendoscopy, endoscopy of the ulnar bursa and midpalmar space of the right hand. The patient is in the supine position with the hand on the side table. (A) Endoscopy of the ulnar bursa is performed with the ulnar palmar portal (UPP) as the viewing portal and the first web portal (FWP) as the working portal. (B) Endoscopic view shows the ulnar bursa (UB) and flexor digitorum superficialis tendon to the index finger (FDSi).

Endoscopy of the Ulnar Bursa

The trocar cannula is introduced through the ulnar midpalmar portal along the palmar surface of the flexor tendons to the first hand web with the thumb abducted. Skin incision is made at the tip of the trocar to create the first web portal. The passage of the trocar should be kept as distal as possible, and excessive force should be avoided. This can reduce the risk of injury to the superficial palmar arch. Moreover, the distally placed first web portal reduces the risk of injury to the branches of superficial radial nerve and allows access to the most proximal part of the subfascial spaces, which are funnel shaped.⁸ The ulnar palmar portal and the first web portal are interchangeable as the viewing and working portals.

With the ulnar palmar portal as the viewing portal and the arthroscope withdrawn from the first web portal, the thenar muscles and the thenar bursa (if distended) can be seen. By further withdrawal of the arthroscope, the flexor tendons and the ulnar bursa can be examined. At this level, the flexor tendon to the index finger is usually outside the ulnar bursa and can be seen at the radial side of the bursa (Fig 4).¹⁵ This can be confirmed by passive mobilization of the index finger. The flexor tendons to the middle and ring fingers can be seen through the ulnar bursa by moving the respective finger. Synovectomy and bursectomy, if indicated, can be performed with a shaver via the first web portal. The surgeon should be cautious not to debride toward the palmar aponeurosis to avoid injury to the superficial palmar arch and the digital nerves. Withdrawn further, the arthroscope will enter the flexor tendon sheath of the little finger. The palmar portion of the tendon sheath can then be examined through the ulnar palmar portal.

Endoscopy of the Midpalmar Space

Endoscopy of the midpalmar space can be performed through the ulnar palmar and first web portals. They are interchangeable as the viewing and working portals.

The trocar and cannula are introduced through the ulnar palmar portal, along the metacarpal bones and deep to the flexor tendons, to the first web portal. The trocar is then replaced by the arthroscope. By withdrawal of the arthroscope, the thenar muscles and the thenar space (if distended) are in view before the midpalmar space is visualized. Sometimes, the flexor pollicis tendon can be seen within the thenar muscles. Next the midpalmar space is entered (Fig 5). The space can be drained and debrided, if indicated, by a shaver via the first web portal (Video 1). The surgeon should

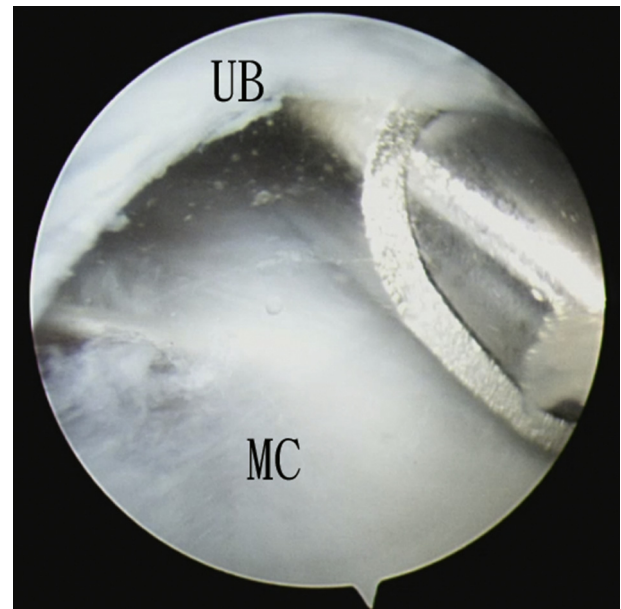


Fig 5. Little finger flexor tendoscopy, endoscopy of the ulnar bursa and midpalmar space of the right hand. The patient is in the supine position with the hand on the side table. Endoscopy of the midpalmar space is performed with the ulnar palmar portal as the viewing portal and the first web portal as the working portal. The space is bounded anteriorly by the ulnar bursa (UB) and posteriorly by the fascia covering the metacarpals and interossei (MC).

Table 2. Pearls and Pitfalls of Little Finger Flexor Tendoscopy, Endoscopy of the Ulnar Bursa and Midpalmar Space

Pearls	Pitfalls
<ol style="list-style-type: none"> 1. Passage of instrument along the fifth flexor digitorum tendon sheath should be gentle and should not point toward the phalangeal bones. 2. The first web portal is created by an inside-out technique. 3. The first web portal should be made as distal as possible. 	<ol style="list-style-type: none"> 1. The fascia covering the metacarpals and interossei should not be breached. 2. Debridement of the ulnar bursa should not continue toward the palmar aponeurosis.

be cautious not to breach the fascia covering the metacarpals and interossei to avoid injury to the deep palmar arch and deep branch of the ulnar nerve (Table 2). Further withdrawal of the arthroscope will enter the flexor tendon sheath of the little finger again. After the procedure, drains can be inserted into the spaces via the corresponding portals.

Discussion

There is no communication between the flexor sheath of the little finger and the ulnar bursa in 25% of cases. In cases with communication, it is small and valve-like in more than 50% of cases.¹⁵ Therefore, the phalangeal portal of the little finger is not a good viewing portal for the ulnar bursa. The wrist portion of the ulnar bursa can be approached with the longitudinally aligned portals of endoscopic carpal tunnel syndrome.¹⁶ Moreover, the midpalmar space can be approached with the wrist portal of flexor pollicis longus tendoscopy via the space of Parona.¹³ However, limited space within the carpal tunnel restricts instrumentation freedom and access to the widened palmar portion of the ulnar bursa and midpalmar space. Moreover, instrumentation within the carpal tunnel increases risk of injury to the median nerve and its motor branch. The transversely aligned ulnar palmar and first web portals allow more instrumentation freedom and access to the entire palmar portion of the ulnar bursa and midpalmar space. The thenar space, if distended, can also be reached through these portals. Therefore, all the deep subfascial spaces can be examined for pathology. This is important because the exact

locations of involvement may not be easily identified preoperatively.

The phalangeal portal of the little finger, ulnar palmar portal, and first web portals together with the portals of flexor pollicis longus tendoscopy (wrist portal, thenar portal, and phalangeal portal of the thumb)¹³ and other web portals (second, third, and fourth web portals) allow access to all the deep subfascial spaces (Fig 6). The thenar space can be approached through the wrist portal, second web portal, ulnar palmar portal, and first web portal. The midpalmar space can be approached through the ulnar palmar portal and the first, third, and fourth web portals. The second, third, and fourth web portals allow access to the midpalmar and thenar spaces via the lumbrical canals. However, these web portals should be used with caution because of the risk of injury to the interdigital neurovascular bundles. Moreover, adjacent web portals must not be used simultaneously because of the risk of complete numbness or ischemia of the central digit.

The advantages of this arthroscopic technique include better cosmesis, less soft tissue dissection, less postoperative pain, complete assessment of the subfascial spaces, avoidance of exposed tendons or nerve, and allowance of immediate postoperative vigorous hand therapy. The potential risks of this procedure include injury to the superficial and deep palmar branches, deep branch of ulnar nerve, digital nerves, branches of superficial radial nerve, and flexor tendons and spread of infection among compartments (Table 3). This is a technically demanding procedure and should be attempted only by experienced hand and wrist arthroscopists.

Fig 6. Little finger flexor tendoscopy, endoscopy of the ulnar bursa and midpalmar space of the right hand. The patient is in the supine position with the hand on the side table. (A) Locations of the wrist portal (WP), thenar portal (TP), and phalangeal portal of the thumb (TPP) of flexor pollicis longus tendoscopy. (B) Second (SWP), third (TWP), and fourth (FoWP) web portals.

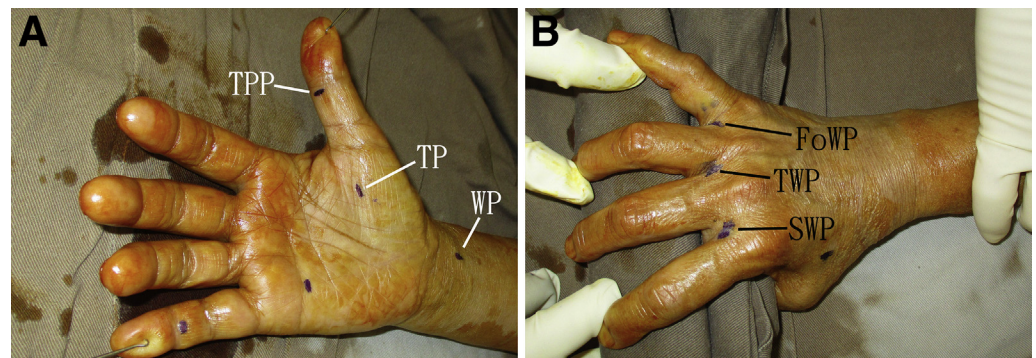


Table 3. Advantages and Risks of Little Finger Flexor Tendoscopy, Endoscopy of the Ulnar Bursa and Midpalmar Space

Advantages	Risks
1. Better cosmesis.	1. Injury to the superficial and deep palmar branches.
2. Less soft tissue dissection.	2. Injury to the deep branch of ulnar nerve, digital nerves, and branches of superficial radial nerve.
3. Less postoperative pain.	3. Injury to the flexor tendons.
4. Complete assessment of the subfascial spaces.	4. Spread of infection among compartments.
5. Avoidance of exposed tendons or nerves.	
6. Allowance of immediate postoperative vigorous hand therapy.	

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