20

Small-Joint Arthroscopy in the Hand and Wrist

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Ten years ago, small-joint arthroscopy in the hand and wrist was tantamount to a technique searching for a purpose. Today, small-joint arthroscopy has found its way into virtually every arthroscopist's armamentarium. Reductions in the dimensions of arthroscopic equipment and improvements in our understanding of the internal anatomy of small joints have made it possible to arthroscopically evaluate and treat a number of conditions involving the carpometacarpal (CMC) and metacarpophalangeal joints of the hand.[1–3] Recently, it has even been proposed that arthroscopy of the proximal interphalangeal joint may have indications. This chapter provides an overview of relevant joint anatomy, portal placement, arthroscopic techniques, and indications for those techniques.

FIRST CMC JOINT

Arthroscopy of the first carpometacarpal joint was developed and described nearly 7 years ago.[1,2] The first carpometacarpal joint was a natural starting point for small-joint arthroscopy due to its relative depth, highly curved articular surfaces, and the nearly circumferential nature of the stabilizing ligaments. Each of these factors makes complete viewing of the joint difficult with arthrotomy, unless capsulotomies are carried out through these vital ligaments. Found to be useful for diagnosis, arthroscopy of the first CMC joint was soon applied to help visualize the adequacy of reduction of fractures involving the articular surfaces of the trapezium or first metacarpal, such as a Bennett's fracture, as well as to treat established arthritis. With miniaturization of thermocouple probes, arthroscopy can now guide shrinkage of the joint capsule in conditions of joint capsule laxity as well as arthroplasty for the treatment of end-stage arthrosis.

Indications

The principal indications for arthroscopy of the first carpometacarpal joint are, in general, the same as for other joints. Included in this list are staging evaluation of arthrosis, identification of a ligament injury, treatment of two-part fractures of the base of the first metacarpal, retrieval of floating loose bodies or foreign objects, and the irrigation of a septic joint.

Contraindications

The contraindications for arthroscopy of the first carpometacarpal joint are the same as for other joints, including poor soft tissue coverage, active cellulitis, and joint injury that is obviously beyond the capability of the arthroscope to address (Rolando fracture).

Regional Anatomy

The skin overlying the first CMC joint is glabrous only on the palmar surface. Immediately deep to the skin and superficial to the deep fascia are numerous veins, including the principal tributaries forming the cephalic vein system. Within the periadventitial tissue of these tributaries are the S1 and S2 divisions of the superficial radial nerve, found just deep to the veins (Figure 20.1).

Several muscles and tendons cross the joint, beginning anteriorly with the abductor pollicis brevis, which originates from the anterior surface of the trapezium (Figure 20.1). Just lateral to this is the tendon of the abductor pollicis longus, which inserts into the posterior base of the first metacarpal. The tendon of the extensor pollicis brevis passes distally just posterior to the abductor pollicis longus. Just superficial to the posterior joint capsule of the first CMC joint is the deep division of the radial artery, crossing the first CMC joint deep to the extensor pollicis longus tendon before coursing anteriorly between the proximal metaphyses of the first and second metacarpals. Between the proximal epiphyses of the first and second metacarpals is the intermetacarpal ligament, which is entirely extracapsular.

Joint Anatomy

The first CMC joint is a double saddle joint formed by the distal articular surface of the trapezium and the

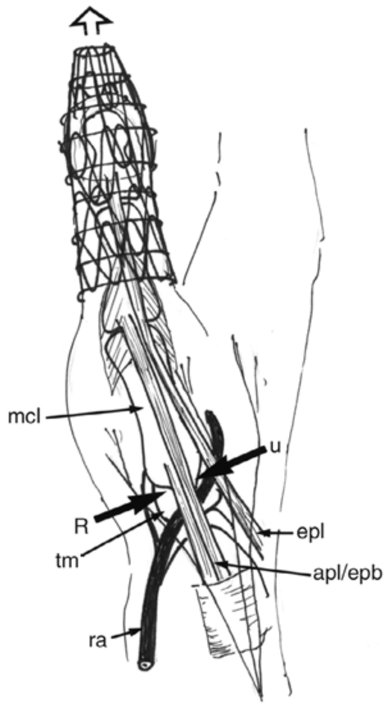


FIGURE 20.1. Drawing of the regional anatomy of the first carpometacarpal joint. mcI = first metacarpal, tm = trapezium, ra = radial artery, epl = tendon of extensor pollicis longus, apl/epb = tendons of abductor pollicis longus and extensor pollicis brevis, R and U = radial and ulnar arthroscopic portals, respectively. (Reprinted with permission, Atlas of the Hand Clinics, Sept 2001, Berger RA: Arthroscopy of the Small Joints of the Hand.)

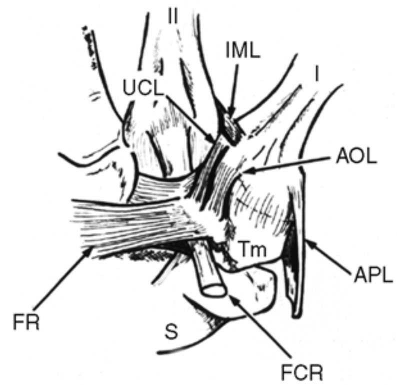


FIGURE 20.2. Drawing of the anterior surface of the first carpometacarpal joint capsule. I = first metacarpal, II = second metacarpal, Tm = trapezium, S = scaphoid, APL = tendon of abductor pollicis longus, FCR = tendon of flexor carpi radialis, FR = flexor retinaculum, AOL = anterior oblique ligament, UCL = ulnar collateral ligament, IML = intermetacarpal ligament. (Reprinted with permission, Atlas of the Hand Clinics, Sept 2001, Berger RA: Arthroscopy of the Small Joints of the Hand.)

base of the first metacarpal. The articular surface along the major axis of the trapezium is concave in the medial-lateral direction, and the articular surface along the minor axis is concave in the anteroposterior direction. The converse relationship is found with the base of the first metacarpal, where the articular surface is concave in the anteroposterior direction and convex in the medial-lateral direction. Although a joint capsule surrounds the entire joint, only three-fourths is reinforced by capsular ligaments.[4,5]

The anterior edge of the first CMC joint is reinforced by the anterior oblique ligament complex (AOL), which is composed of superficial and deep divisions (Figures 20.2, 20.3, and 20.4). The superficial division (AOLs) spans nearly the entire anterior edge of the joint and attaches to the anterior surface of the trapezium just proximal to the articular surface and just distal to the articular surface of the base of the first metacarpal. The deep division (AOLd) is a well-demarcated thickening of the superficial band found just medial to the midline of the superficial division. Often, there is a distant medial edge separating the AOLd from the AOLs (Figures 20.3 and 20.4). The deep division of the AOL is often referred to as the *beak ligament*. The orientation of the fibers of the AOLs is slightly oblique, passing proximal to distal from lateral to medial. The fiber orientation of the AOLs is essentially proximal to distal. The extreme lateral (ulnar) surface of the joint is reinforced by the ulnar collateral ligament (UCL), which has fibers oriented in a proximal to distal direction (Figures 20.2 and 20.5). The lateral 30% of the posterior surface of the joint capsule is reinforced by the posterior oblique ligament (POL) (Figures 20.5, 20.6, and 20.7). The fiber orientation of the POL is slightly oblique, passing from proximal and medial to distal and lateral. The remaining posterior joint capsule is reinforced by the dorsoradial ligament (DRL) (Figures 20.5, 20.6, and 20.7). The fiber orientation of the DRL is generally proximal to distal. The joint capsule immediately deep to the tendon of the abductor pollicis longus is not reinforced by a ligament. Although there is a distinct border between

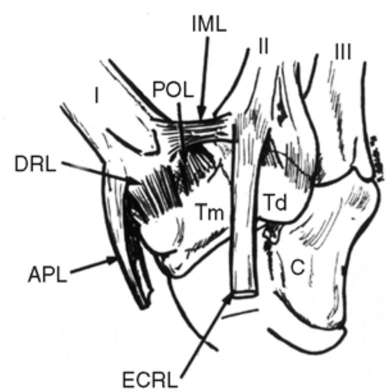
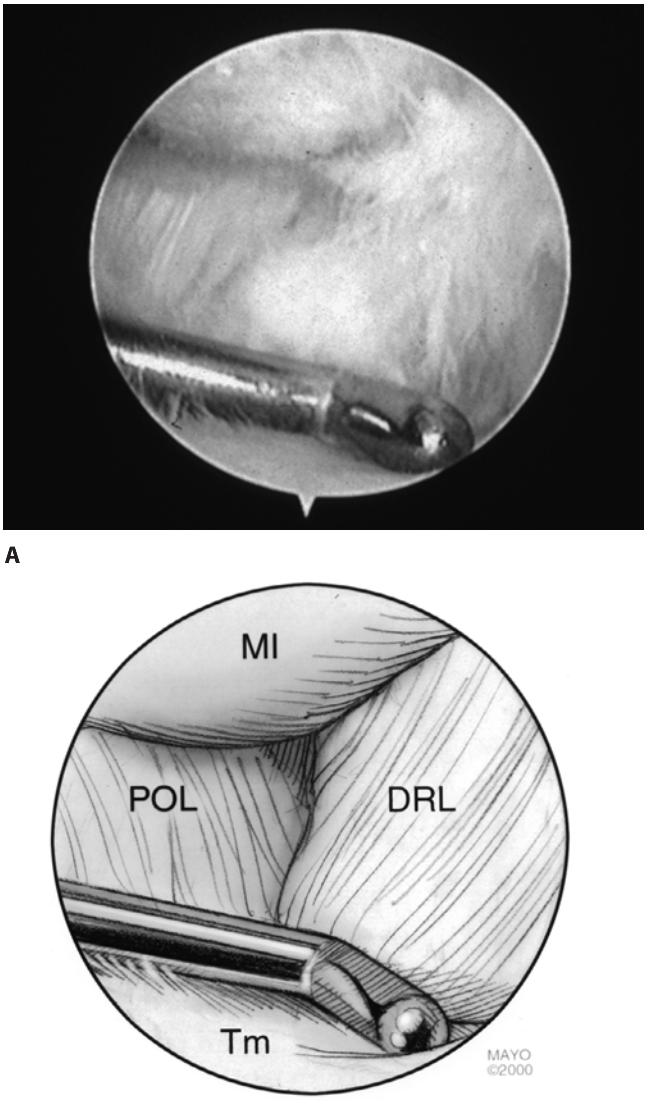


FIGURE 20.3. Drawing of the posterior surface of the first carpometacarpal joint capsule. I = first metacarpal, II = second metacarpal, III = third metacarpal, Tm = trapezium, Td = trapezoid, C = capitate, ECRL = tendon of extensor carpi radialis longus, APL = tendon of abductor pollicis longus, IML = intermetacarpal ligament, POL = posterior oblique ligament, DRL = dorsoradial ligament. (Reprinted with permission, Atlas of the Hand Clinics, Sept 2001, Berger RA: Arthroscopy of the Small Joints of the Hand.)



A

B

FIGURE 20.4. Arthroscopic photograph (**A**) and corresponding drawing (**B**) of the posterior joint capsule viewed from the 1-R portal. MI = first metacarpal, Tm = trapezium, DRL = dorsoradial ligament, POL = posterior oblique ligament. (Reprinted with permission, Atlas of the Hand Clinics, Sept 2001, Berger RA: Arthroscopy of the Small Joints of the Hand.)

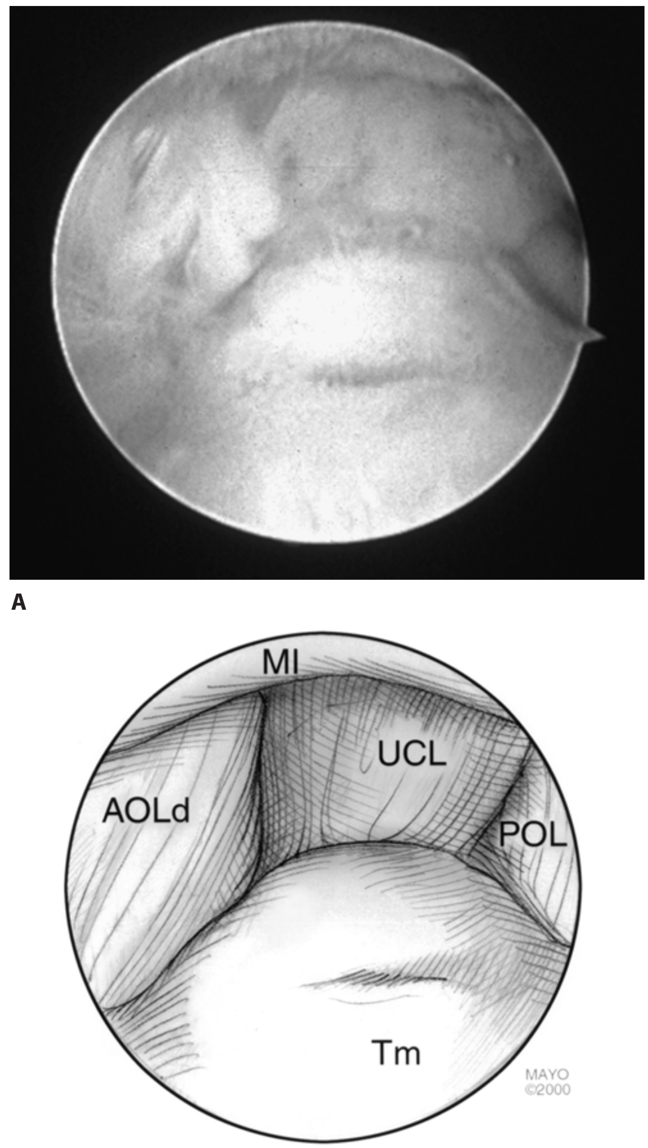
the AOLs and AOLd, there are no reliable demarcations between the remaining ligaments.

Portals

The two recognized portals for arthroscopy of the first carpometacarpal joint are named according to their relationship with the extensor pollicis brevis and abductor pollicis longus tendons (Figure 20.8). The I-R portal is established at the joint line just radial to the abductor pollicis longus tendon (Figures 20.1 and 20.8). The 1-U portal is established at the joint line just ulnar to the extensor pollicis brevis tendon (Figures 20.1 and 20.8).

Surgical Technique

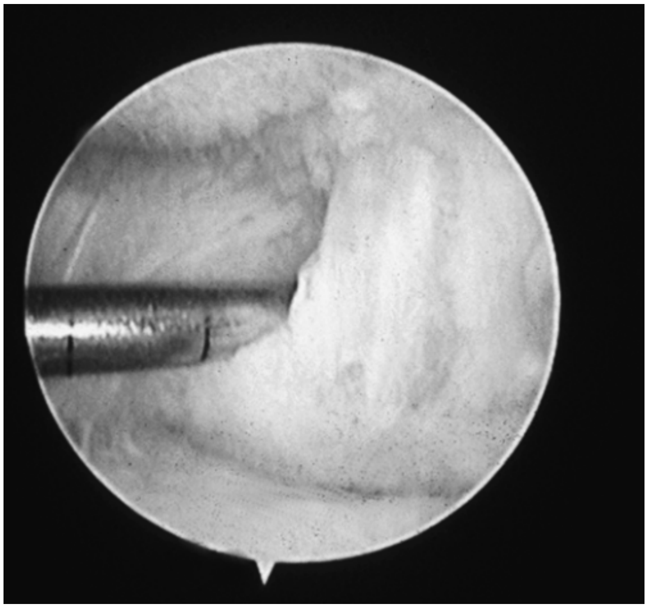
The patient is positioned supine on the operating table with either regional or general anesthesia. Parenteral antibiotics may be administered, and a pneumatic tourniquet is typically applied to their arm. A single finger trap is secured to the thumb, and 5 to 8 pounds of longitudinal traction is applied (Figure 20.9). Using a 22-gauge hypodermic needle, the location of either the 1-R or 1-U portal is scouted by advancing the needle directly ulnarly. The needle should be angled approximately 20 to 30 degrees distally due to the curved nature of the joint surface. If there is any difficulty in



A

B

FIGURE 20.5. Arthroscopic photograph (**A**) and corresponding drawing (**B**) of the ulnar joint capsule viewed from the 1-R portal. MI = first metacarpal, Tm = trapezium, POL = posterior oblique ligament, UCL = ulnar collateral ligament, AOLd = deep portion of the anterior oblique ligament. (Reprinted with permission, Atlas of the Hand Clinics, Sept 2001, Berger RA: Arthroscopy of the Small Joints of the Hand.)



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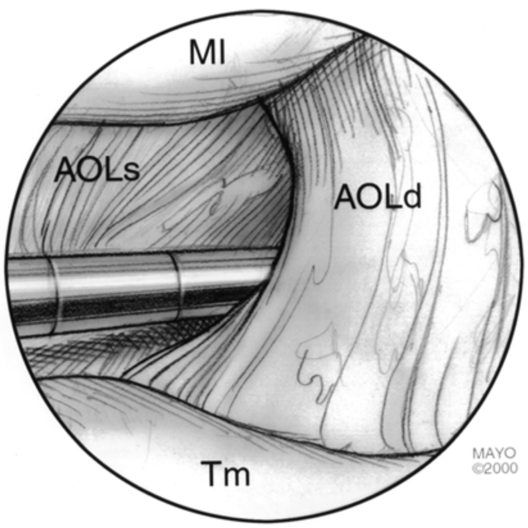
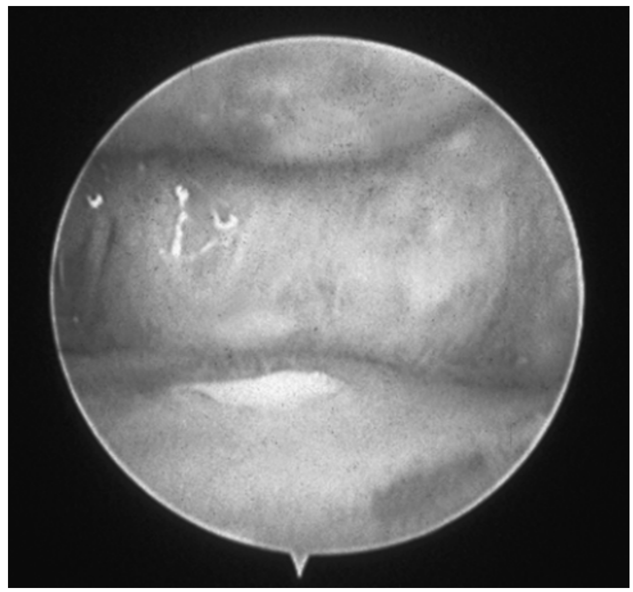


B

FIGURE 20.6. Arthroscopic photograph (**A**) and corresponding drawing (**B**) of the anterior joint capsule viewed from the 1-U portal. MI = first metacarpal, Tm = trapezium, AOLd = deep portion of the anterior oblique ligament, AOLs = superficial portion of the anterior oblique ligament. (Reprinted with permission, Atlas of the Hand Clinics, Sept 2001, Berger RA: Arthroscopy of the Small Joints of the Hand.)

passing the needle into the joint or if there is any concern about the proper identification of the joint, intraoperative radiographs or fluoroscopy may be used to verify the level of the needle prior to proceeding.

Once the proper level of the joint portals has been identified, small stab wounds are created with a scalpel, either transversely or longitudinally. I would advocate making the incisions for both portals at the beginning of the procedure. This facilitates switching portals during the operation without disturbing the cadence of the procedure. Subcutaneous tissues are dissected bluntly to the joint capsule level to be certain that underlying neurovascular tissues are displaced from harm's way. Depending upon the surgeon's preference, a 1.5 to 2.4 mm diameter arthroscope may be utilized (Figure 20.10). The arthroscope sheath is then introduced with a tapered trocar in one portal, and a small probe is introduced in the other portal. It is rare that an outflow device is needed, particularly with judicious control of inflow fluid volume and rate. If an outflow tract is necessary, however, a large-bore hypodermic needle may be introduced, or a shaver may be used to evacuate excess or cloudy fluid. It may also



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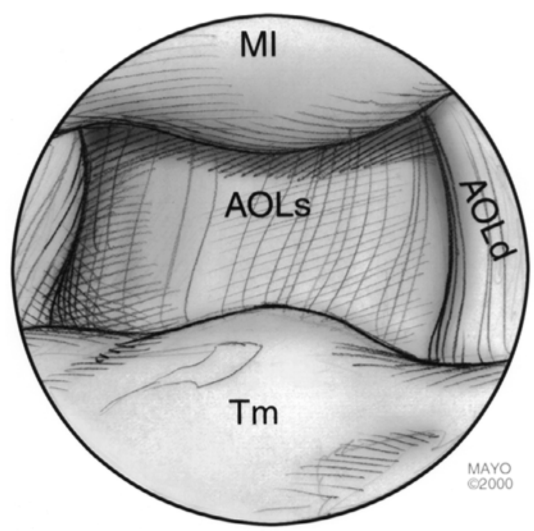

B

FIGURE 20.7. Arthroscopic photograph (**A**) and corresponding drawing (**B**) of the anterior joint capsule viewed from the 1-U portal. MI = first metacarpal, Tm = trapezium, AOLd = deep portion of the anterior oblique ligament, AOLs = superficial portion of the anterior oblique ligament. (Reprinted with permission, Atlas of the Hand Clinics, Sept 2001, Berger RA: Arthroscopy of the Small Joints of the Hand.)

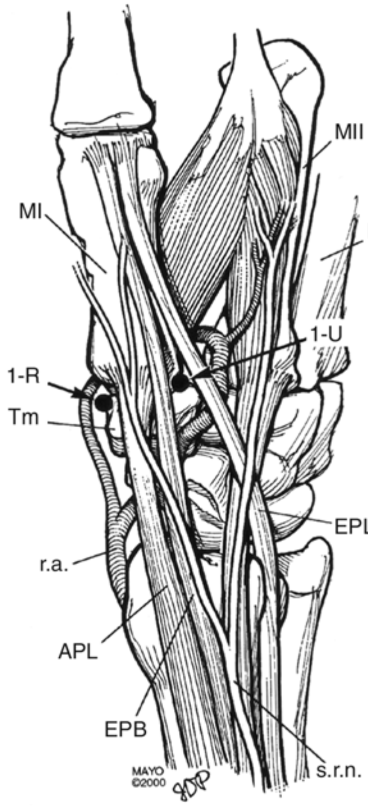

FIGURE 20.8. Landmarks used to establish the portals for the first carpometacarpal joint arthroscopy. IMC = first metacarpal, MII = second metacarpal, MIII = third metacarpal, Tm = trapezium, APL = tendon of abductor pollicis longus, EPB = tendon of extensor pollicis brevis, 1-R = radial CMC portal.

be necessary to debride excess synovial tissue in order to visualize the joint surfaces and the ligaments. This may be accomplished with either a small shaver or a suction punch.

I typically orient the camera and orient the lens of the arthroscope in a manner that places the image of the base of the first metacarpal at the top and the trapezium at the bottom. A comprehensive inspection of the articular surfaces is carried out. Next, an inspection of the intra-articular appearance of the capsular ligaments may be completed. It is best to use the probe to validate the integrity of these structures, rather than simply relying on their visual appearance.

The dorsoradial ligament, posterior oblique ligament, ulnar collateral ligament, and deep portion of the anterior oblique ligament can typically be visualized from the 1-R portal (Figures 20.3, 20.4, 20.5, and 20.7). The superficial and deep portions of the anterior oblique ligament, ulnar collateral ligament, and posterior oblique ligament can be visualized through the 1-U portal (Figures 20.3, 20.4, 20.5, and 20.7).

Procedures

The following procedures have been proposed, although this list is largely based upon personal communications and anecdotal experiences and is by no means meant to be all-inclusive.

Synovectomy

A partial or radical synovectomy can be carried out arthroscopically using a shaver less than 3 mm in diameter and a thermocouple probe system or a small suction punch device. Care should be exercised when using the shaver or a punch to avoid iatrogenic compromise of the capsular ligaments themselves. Because of the small diameter of the shaver, the suction sheath frequently becomes clogged with debrided tissue. This requires frequent cleaning, which may frustrate some surgeons.

Capsular Shrinkage

It may be advantageous in some circumstances to be able to shrink, hence stiffen, the joint capsule, such as in a substantially lax individual with early arthrosis of the first CMC joint. Commercially available thermocouple probe systems, in a diameter suitable for this joint, are available, but little experience has been gained in this specific joint at this time.

FIGURE 20.9. Standard operating room setup for first CMC joint arthroscopy. The thumb is suspended with 5 to 8 lbs. of traction. (Reprinted with permission, Atlas of the Hand Clinics, Sept 2001, Berger RA: Arthroscopy of the Small Joints of the Hand.)

FIGURE 20.10. Arthroscopy of the first CMC joint. The arthroscope is in the 1-U portal and a shaver is in the 1-R portal. Provisional K-wires have been placed for fixation of a Bennett fracture reduced arthroscopically. (Reprinted with permission, Atlas of the Hand Clinics, Sept 2001, Berger RA: Arthroscopy of the Small Joints of the Hand.)

Staging Arthritis

The precise staging of arthritic involvement of the articular surfaces of the first CMC joint is easily accomplished with the arthroscope.[6] This is important in those patients with painful instability of the first CMC joint on whom one is considering performing an extra-articular ligament reconstruction.[7] If substantial arthrosis is present, but not radiographically evident yet, a ligament reconstruction would be considered contraindicated. The most common locations for initial involvement of articular cartilage destruction in degenerative arthritis are the central aspect of the trapezial surface and the ulnar third of the metacarpal surface.

Resection/Interposition Arthroplasty

There may some indication for partially resecting wither the base of the first metacarpal or the distal surface of the trapezium, although one would think that this would need to be accompanied by another procedure to either stabilize the joint or interpose some material, such as a section of tendon or fascia.[6,8] This was advocated by Menon, where a strip of flexor carpi radialis was interposed arthroscopically after arthroscopic resection of the arthritic joint surfaces.[2]

Septic Arthritis

Although rarely encountered, the irrigation and debridement of a septic first CMC joint is easily accomplished with the arthroscope and a shaver. A large volume of normal saline can be passed through the joint by simply running the shaver in the middle of the joint space while connecting the inflow to a wide-open source of fluid. Cultures can be obtained by sampling the initial aspirate.

Reduction of Intra-Articular Fracture

The arthroscope may be a valuable adjunct to the treatment of simple intra-articular fractures involving the base of the first metacarpal. Bennett's fractures involve an intra-articular fracture through the ulnar condyle of the base of the first metacarpal. They may produce problems due to intra-articular stepoff or instability. The instability is generated by the uncompromised pull of the abductor pollicis longus on the large fragment with loss of contact with the ulnar collateral ligament. Since the first CMC joint is nearly circumferentially covered with stabilizing ligaments, any attempt to visualize the fracture line in a Bennett's fracture will necessarily compromise these ligaments. Accurate visualization of the adequacy of reduction by closed means using radiographic imaging is difficult due to the highly curved nature of the articular surfaces of the joint.

When contemplating an arthroscopically assisted fixation of a Bennett's fracture, it must first be determined that the fracture is mobile. It is important to remember that the arthroscope is not a reduction device per se. It is merely a means of visualizing the reduction carried out by other means. Regional or general anesthesia is required, and the patient should be prepared for the possibility that the procedure may be converted to an open reduction or aborted altogether if the arthroscopic procedure is not possible. The easiest way to assess whether the fracture is mobile, and potentially amenable to closed reduction under arthroscopic assessment, is to distract the thumb on the operating table. Under fluoroscopy, the distal fragment is manipulated while observing the fracture. Typical manipulation maneuvers include axial rotation, with the goal of reducing the large fragment (in the surgeon's grasp) to the small fragment (the ulnar condyle of the first metacarpal base). If the fracture moves close to what is considered an adequate reduction, one may proceed with arthroscopy.

Next, a 0.045 K-wire is advanced into the base of the first metacarpal under fluoroscopic guidance in a line that will either skewer the small fragment upon reduction or will penetrate an adjacent bone to stabilize the reduction (Figure 20.10). The arthroscope is introduced in the standard fashion, as is a small shaver. The shaver is used to evacuate the intra-articular hematoma universally present. A careful assessment of the articular surfaces and the capsular ligaments is made. Once clear visualization is possible, the fracture is manipulated into an acceptable reduction under arthroscopic guidance. Once an acceptable reduction is achieved, the assistant advances the previously placed K-wire for secure fixation of the fracture. Final radiographs are obtained, and external dressings with reinforcement are applied, just as in an open reduction procedure.

Because of the severe comminution and soft tissue disruption in a Rolando fracture, this fracture pattern should be viewed as a relative contraindication for arthroscopic reduction. Logically, there is no advantage to using an arthroscope for an extraarticular fracture pattern. It should be possible to use the arthroscope for intra-articular fractures of the trapezium, but the author has had no experience with this approach.

METACARPOPHALANGEAL JOINTS

Arthroscopy of the metacarpophalangeal (MCP) joints of the hand is rarely performed, but may have limited applications.[2,9] One must remember the advantages versus limitations of open versus arthroscopic procedures before deciding which technique to use. The advantage of open procedures is typically in the access to regions for procedural tasks, while the disadvantages are surgical scars, potential soft tissue destabilization, and limitation of visualization in deep recesses. Arthroscopy offers the advantages of superior visualization of most regions of a joint otherwise difficult to access in an open procedure through very small incisions with minimal impact on the status of contiguous tissues. The major disadvantages of arthroscopic procedures lie in the limits of procedural maneuvers allowed through the very small incisions. This dilemma is most evident in the MCP joint. Although a lengthy skin incision may be needed for an open exposure of the MCP joint, leaving largely a cosmetic effect, the disturbance of the soft tissues (extensor mechanism and joint capsule) probably has a minimal effect, especially with the proper postoperative rehabilitation protocol. However, there may be an occasion when arthroscopy of the MCP joint may be an attractive option.

Indications

Indications for arthroscopy of the MCP joints are poorly worked out at this time, but may include assessment of arthritis,[10,11] synovectomy,[10,12,13] irrigation of a septic joint, retrieval of foreign bodies, and the identification and possible reapproximation of collateral ligaments avulsed from either the proximal phalanx or the metacarpal.[2]

Contraindications

The contraindications for arthroscopy of the MCP joints are the same as for other joints, including poor soft tissue coverage, active cellulitis, and joint injury that is obviously beyond the capability of the arthroscope to address. To date, the techniques of arthroscopic reduction and fixation of intra-articular fractures of the metacarpal head or proximal phalanx base have not been determined for general application.

Regional Anatomy

The skin over the dorsal surfaces of the MCP joints is typically held loosely to subcutaneous incisions, so care must be exercised when marking palpated landmarks so that stretching the skin prior to committing to an incision location does not displace the marks. Immediately deep to the skin are cutaneous sensory nerves (superficial radial and lateral antebrachial cutaneous nerves for the thumb, index and long fingers, and the dorsal sensory branches of the ulnar nerve for the ring and small fingers). The major veins draining the fingers are typically found in the intermetacarpal valleys, well away from most arthroscopic approaches.

The tendons on the dorsal surfaces of the MCP joints share a common feature: the extensor hood (Figure 20.11). At the level of the joint, the extensor hood is composed of the extrinsic extensor tendon(s) and the sagittal fibers passing toward the volar plate. The extensor tendons for the thumb include the extensor pollicis brevis (radially) and longus (ulnarly). For the index through small fingers, the extensor digitorum communis tendon passes across the MCP joint as the radial-most tendon. Each finger also has an independent proprius tendon, although the extensor indicis proprius and extensor digiti minimi (quinti) tendons are the most widely

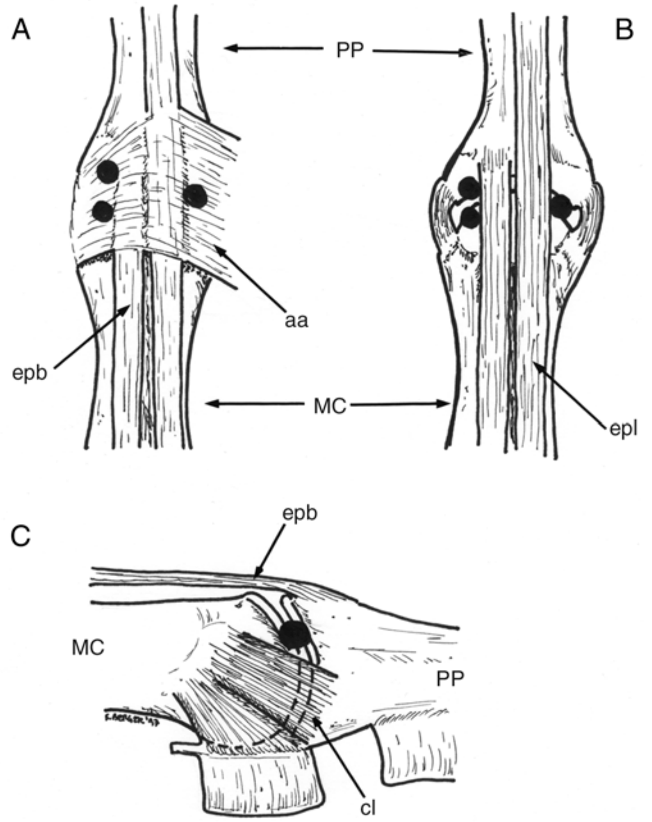

FIGURE 20.11. Drawings of the relevant anatomy for metacarpophalangeal (MP) joint arthroscopy. **A.** Thumb MP joint showing the extensor hood formed in part by the adductor aponeurosis (aa) and the extrinsic extensor tendons (epb = extensor pollicis brevis). **B.** Thumb MP anatomy after removal of the extensor hood, revealing the tendon of extensor pollicis longus (epl). **C.** Lateral view of the MP joint demonstrating the relationships between the metacarpal (MC), proximal phalanx (PP), tendon of extensor pollicis brevis (epb), and the collateral ligament system (cl). The black dots represent the location of recommended arthroscopic portals. (Reprinted with permission, Atlas of the Hand Clinics, Sept 2001, Berger RA: Arthroscopy of the Small Joints of the Hand.)

recognized. These tendons do not insert directly into the proximal phalanx, but are connected to the dorsal joint capsule and, hence, indirectly insert into the phalanx.

Intra-Articular Anatomy

The intra-articular anatomy of the first through fifth MCP joints is similar. The joint is described as a shallow glenoid-type joint. The articular surface of the second through fifth metacarpal heads is largely spherical, but widens palmarly in the transverse plane. The first metacarpal has little medial-lateral variance. The bases of the proximal phalanges have a shallow glenoid shape for articulation with the metacarpal head.

The lateral joint capsule is reinforced by the collateral ligament system. The true collateral ligaments span the distance from a depression on the lateral and medial surfaces of the head of the metacarpal to the palmar half of the proximal rim of the proximal phalanx. The accessory collateral ligaments are fan-shaped extensions of the true collateral ligaments that attach to the lateral edges of the volar plate.

The volar plate forms the palmar surface of the MCP joint capsule. It has a poorly defined proximal attachment to the metacarpal, but has a definite attachment along the palmar rim of the base of the proximal phalanx. Often, there is a meniscal rim of the volar plate protruding into the joint space, biased toward the distal end of the volar plate.

The dorsal joint capsule is thick and redundant, extending proximally to a line that is proximal to the level of collateral ligament attachment to the metacarpal head.

Portals

The two recognized portals for arthroscopy of the metacarpophalangeal joints (Figure 20.11) are named according to their relationships with the extensor tendons. The radial portal is established at the joint line just radial to the extrinsic extensor tendons. The ulnar portal is established at the joint line just ulnar to the extrinsic extensor tendons.

Surgical Technique

The patient is positioned supine on the operating table; either regional or general anesthesia is administered. Parenteral antibiotics may be administered, and a pneumatic tourniquet is typically applied to the arm. A single finger trap is secured to the thumb or finger to be evaluated, and 5 to 8 pounds of longitudinal traction is applied (Figure 20.12). Using a 22-gauge hypodermic needle, the location of either the I-R or I-U portal is scouted by advancing the needle directly palmarly. If there is any difficulty in passing the needle into the joint or if there is any concern about the proper identification of the joint, intraoperative radiographs or fluoroscopy may be used to verify the level of the needle prior to proceeding.

Once the proper level of the joint portals has been identified, small stab wounds are created with a scalpel, either transversely or longitudinally. I would advocate making the incisions for both portals at the beginning of the procedure. This facilitates switching portals during the operation without disturbing the cadence of the procedure. Subcutaneous tissues are dissected bluntly to the joint capsule level to be certain that underlying neurovascular tissues are displaced from harm's way. The arthroscope sheath is then introduced with a tapered trocar in one portal; a small probe is introduced in the other portal. It is rare that

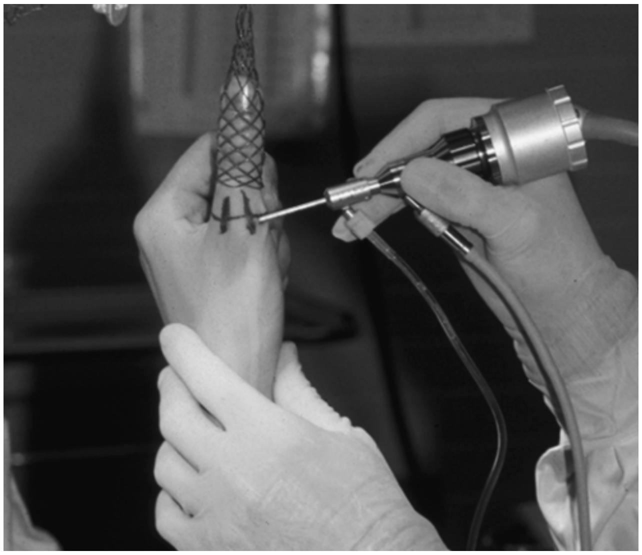

FIGURE 20.12. Standard operating room setup for thumb MCP joint arthroscopy. Longitudinal traction of 5 lbs. is applied through a finger trap. The arthroscope is in the radial portal. Note the definition of the extensor tendons defining the landmarks used to establish the portals. Arthroscopy of the first CMC joint. The arthroscope is in the 1-U portal and a shaver is in the 1-R portal. Provisional K-wires have been placed for fixation of a Bennett fracture reduced arthroscopically. (Reprinted with permission, Atlas of the Hand Clinics, Sept 2001, Berger RA: Arthroscopy of the Small Joints of the Hand.)

an outflow device is needed, particularly with judicious control of inflow fluid volume and rate. If an outflow tract is necessary, however, a large-bore hypodermic needle may be introduced, or a shaver may be used to evacuate excess or cloudy fluid. It may also be necessary to debride excess synovial tissue in order to visualize the joint surfaces and the ligaments. This may be accomplished with either a small shaver or a suction punch.

A comprehensive inspection of the articular surfaces is carried out. Next, an inspection of the intra-articular appearance of the collateral ligaments and volar plate may be completed. It is best to use the probe to validate the integrity of these structures, rather than simply relying on their visual appearance.

Procedures

The following procedures have been proposed, although largely based upon personal communications and anecdotal experiences. This is by no means meant to be an all-inclusive list.

Synovitis

Synovial biopsy is easily performed through standard portals with a 2-mm shaver or arthroscopic grabber. Similarly, a radical synovectomy can be carried out with a shaver in all joint regions.

Septic Arthritis

Irrigation and debridement of a septic MCP joint are easily accomplished with the arthroscope and a shaver. This may be considered particularly useful in so-called "fight bites" in which an open intrusion of the joint has occurred during an altercation where contact with an opponent's teeth creates a septic hazard for the joint. A large volume of normal saline can be passed through the joint simply by running the shaver in the middle of the joint space while connecting the inflow to a wide-open source of fluid. Cultures can be obtained by sampling the initial aspirate.

Diagnosis of Collateral Ligament Injury

Most ligament injuries about the MCP joints are treated well with closed means. However, the Stener-type lesion creates a situation that is less likely to result in successful closed management. In the Stener lesion, the distally avulsed collateral ligament is displaced and trapped under the free proximal edge of the extensor hood.[14] Although injury to the ulnar collateral ligament of the thumb is the most common avulsion injury associated with a Stener lesion, it is possible in the fingers.[3,8,14] This is particularly so with the ulnar collateral ligament of the index finger MCP joint and the radial collateral ligament of the small finger MCP joint. The arthroscope provides a minimally invasive means of readily identifying the presence of a Stener-type lesion in any of the digits.

Additionally, in a subacute setting of instability following injury, it may prove to be a difficult task to know if the injury has occurred from the proximal or distal attachment of a finger MCP collateral ligament. Because scar tissue has likely developed, the surgeon will have a difficult time knowing where the injury occurred, leading to potential complications of elevating the wrong end of the ligament during open repair. Again, the arthroscope offers a ready means of identifying the level of the injury prior to converting to an open procedure.

Reapproximation of Collateral Ligament Avulsion Injury

Ryu has advocated the use of the arthroscope as the definitive treatment for thumb Stener lesion injuries of the ulnar collateral ligament.[3] After verifying the presence of the Stener lesion, the ligament is "hooked" by the probe and drawn back deep to the adductor aponeurosis, where it comes to rest adjacent to the normal attachment point on the ulnar rim of the base of the proximal phalanx. From here, it is treated as a nondisplaced collateral ligament injury.

Foreign Body Retrieval

Depending upon its size, type, and location, it may be possible to retrieve a foreign body in the PIP joint arthroscopically through standard portals using an arthroscopic grabber.

PROXIMAL INTERPHALANGEAL JOINT

Arthroscopy of the proximal interphalangeal (PIP) joint has not been widely accepted as a useful technique at this time. This is no doubt due in large part to the relatively restricted number of indications due to the technical limitations.

Indications

The indications for PIP joint arthroscopy are essentially the same as those for metacarpophalangeal joint arthroscopy, and would include assessment or staging of arthritis,[11] synovial biopsy,[11] irrigation of a septic joint, and retrieval of foreign bodies.[15]

Contraindications

The contraindications for arthroscopy of the PIP joints are the same as for other joints, including poor soft tissue coverage, active cellulitis, and joint injury which is obviously beyond the capability of the arthroscope. To this date, the techniques of arthroscopic reduction and fixation of intra-articular fractures of the proximal phalangeal head or middle phalanx base have not been reported.

Regional Anatomy

The proximal interphalangeal joint is formed by the articulation of the head of the proximal phalanx and the base of the middle phalanx. The skin overlying the joint is a distal reflection of the skin over the main part of the hand, with relatively thin, mobile skin dorsally and thick, glabrous palmar skin. The palmar skin displays several colinear transverse creases at the level of the joint, while the dorsal skin is redundant and displays concentric elliptical creases. The dorsal skin is separated from the extensor mechanism by a layer of loose aponeurotic tissue. The extensor mechanism at the level of the PIP joint undergoes a transition from the discrete intrinsic and extrinsic systems proximally to the combined extensor mechanism distally. Identifiable elements at this level include the central slip, radial and ulnar lateral bands, the transverse retinacular ligament, and, although difficult to define discretely, the proximal fibers of the oblique retinacular ligament (Figure 20.13). The radial and ulnar proper neurovascular bundles are seen coursing distally just anterior to the midlateral plane of the finger, channeled by Grayson's and Cleland's ligaments. The flexor digitorum superficialis and profundus tendons are encased within the flexor tendon sheath system. At the level of the PIP joint, this system is composed of the PIP joint volar plate, the A3 pulley, and the tenosynovial sheath. The volar plate stabilizes the PIP joint from excessive hyperextension due to stout insertions of the check rein ligaments into the neck of the proximal phalanx and distal attachments to the medial and lateral ridges of the base of the middle phalanx. The volar plate is further stabilized through the accessory collateral liga-

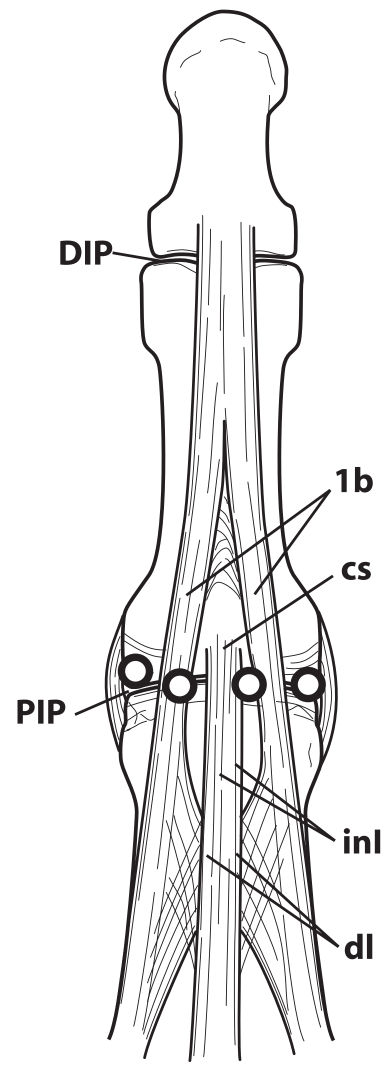

FIGURE 20.13. Drawings of the relevant anatomy for proximal interphalangeal (PIP) joint arthroscopy. Left: dorsal view of a finger. Right: lateral view of a finger. DIP = distal interphalangeal joint, PIP = proximal interphalangeal joint, lb = lateral band, cs = central slip, dl = dorsolateral portal, between a lateral band and the central slip.

ments that attach to the lateral recesses of the head of the proximal phalanx, confluent with the proximal attachments of the proper collateral ligaments. From these recesses, the proper collateral ligaments course distally to attach to the lateral ridges of the base of the middle phalanx. Finally, the palmar skin is richly invested with a venous network. The dorsal skin is innervated by terminal fibers of either the superficial radial nerve for the radial digits or the dorsal sensory branch of the ulnar nerve for the ulnar digits. The palmar and lateral skin are innervated by the underlying proper digital nerve.

Intra-Articular Anatomy

The PIP joint is a bicondylar joint. As such, a medial and lateral condyle form the head of the proximal phalanx, and corresponding medial and lateral fossae form the base of the middle phalanx. The condyles are separated by a sagittal groove called the intercondylar groove, while the fossae on the base of the middle phalanx are separated by a corresponding interfossal ridge. All of these regions are covered in articular cartilage. The dorsal aspect of the middle phalanx base forms a rim where the central slip of the extensor mechanism inserts. The volar plate often has a mensicuslike, wedge-shaped prominence intruding into the palmar aspect of the joint.

Portals

Several portals have been described for arthroscopy of the PIP joint. On either the radial or ulnar surface of the digit (or both surfaces), portals have been described in the intervals between the central slip and the lateral bands,[15] or between the lateral bands and the collateral ligaments (Figure 20.13).[11,15] Although a dorsal portal has been described, it has not been recommended for general use because of difficulty in obtaining useful imaging and the possibility of damage to the central slip.[15] Similarly, a volar portal has been described and abandoned, due to the difficulty of traversing the flexor tendons, volar plate, and neurovascular bundles.[15]

Surgical Technique

Most authors have advocated using a horizontal position of the extremity to maximize mobility of the arthroscope and equipment in multiple planes about the finger. Regional or general anesthesia has been reported most often, although there does not seem to be a strong reason not to do this procedure with a digital block and finger tourniquet. The use of parenteral antibiotics is at the surgeon's discretion. The finger is supported in slight flexion with a towel, and manual distraction is applied if necessary.

The joint is distended by inserting a 25-gauge needle into the joint either dorsally or transversely deep to the extensor mechanism and introducing 2 cc of normal saline. Small longitudinal incisions are made in the skin over the designated portal sites, and subcutaneous tissues are bluntly separated to the level of the extensor mechanism.

A 1.5-mm arthroscopic needle system is advocated, and 2-mm shavers may be used. A tapered trocar for the arthroscopic sheath is advanced into the distended joint through the desired portal interval, and the sheath is then advanced over the trocar. A probe or shaver may be introduced into the remaining portal. Inflow is maintained through an indwelling needle through the dorsal capsule while an assistant intermittently infuses the joint with normal saline. It is best to exchange the arthroscope between portals in order to ensure maximum joint visualization.

Once the procedure is completed, the skin is closed with simple sutures, and a soft sterile dressing is applied after removal of the tourniquet and confirmation of reperfusion has been made. The use of a splint is at the surgeon's discretion, dependent upon what condition is present and what procedure was performed. Sutures are removed 10 to 14 days postoperatively.

Procedures

The following procedures may have applications similar to the metacarpophalangeal joint. As for the MCP joint, this is by no means meant to be an all-inclusive list.

Synovitis

Synovial biopsy is easily performed through standard portals with a 2-mm shaver or arthroscopic grabber. Similarly, a radical synovectomy can be carried out with a shaver in all joint regions except the volar 50%.

Septic Arthritis

Irrigation and debridement of a septic PIP joint are easily accomplished with the arthroscope and a shaver. A large volume of normal saline can be passed through the joint simply by running the shaver in the middle of the joint space while connecting the inflow to a wide-open source of fluid. Cultures can be obtained by sampling the initial aspirate.

Foreign Body Retrieval

Depending upon the size, type, and location of the foreign body in the PIP joint, it may be possible to retrieve such a structure arthroscopically through standard portals using an arthroscopic grabber.

Complications

Few complications should be encountered with careful application of standard arthroscopic principles. The most serious complications are potential injury to cutaneous nerves, which can be avoided with careful dissection techniques based upon a sound understanding of the underlying anatomy. Iatrogenic injury to the articular surfaces is easily encountered unless a very gentle approach to the use of instruments is maintained. It is important to remember that the arthroscope typically moves only a few millimeters in a telescoping fashion to cover the entire joint. Do not force the arthroscope where it doesn't want to go. Infection remains a risk, regardless of surgical procedure. Many surgeons prefer to administer a prophylactic dose of parenteral antibiotics prior to initiating a joint-related procedure.

CONCLUSION

Arthroscopy of the small joints of the hand has become a reliable clinical tool, although somewhat limited in diagnostic applications. Therapeutic options are becoming increasingly available but must be balanced against the efficacy of open procedures. The arthroscopy of these joints is safe, but only if the relevant anatomy is thoroughly understood by the surgeon.

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