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Wrist Arthroscopy – Setup, Indications, and Complications

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Abstract

Wrist Arthroscopy, a minimally invasive, outpatient procedure, is a valuable tool in the diagnosis and treatment of most disorders of the wrist. In this article Arthroscopy set up, equipments are described, and operative indications and complications are discussed. Anatomy of Portal is described in details. Portals allow direct visualization of articular surfaces of radio-carpal and mid-carpal joints, triangular fibrocartilage, interosseous and extrinsic ligaments. It offers direct visualization of the structures of the joint anatomy and existing disease processes while causing minimal damage to surrounding soft tissue.

Keywords: Wrist arthroscopy, indications, portals, complications.

Introduction

Arthroscopic examination of wrist joint had been first attempted on cadavers in 1932 [1]. Furthermore, in 1986 Whipple described safe entry portals to wrist joint. In the same year, first wrist arthroscopy workshop was organized [2]. Over the past 30 years, this technique has been refined to become a valuable tool for both diagnosis and treatment of wrist problems. The magnified view of arthroscope has provided a new understanding of carpal anatomy and disease[3]. It provides a technical capability to examine and treat intra-articular abnormalities directly under bright illumination and magnification.

Indications for Wrist Arthroscopy:

Current indications for wrist arthroscopy can either be diagnostic, evaluation (staging), or therapeutic [4].

1) Diagnostic arthroscopy [5]: When other investigations are nonconclusive,

- Dynamic assessment of carpal instabilities,
- Osteochondral fractures,
- Certain synovial pathologies,
- Chronic wrist pain of unknown origin.

2) Therapeutic arthroscopy [6]: Therapeutic applications have continued to expand and include,

- Arthroscopic-assisted fracture reductions (intra-articular radius fractures, scaphoid fractures),
- Treatment of radiocarpal synovitis and arthritis, (osteoarthritis, rheumatoid arthritis),
- Triangular fibrocartilage complex (TFCC) and other ligament injuries,
- Resection arthroplasty (proximal row carpectomy),
- Management of septic arthritis [7] and,
- Arthroscopic management of soft tissue pathologies such as ganglion excisions and release of contractures.
- Radial styloidectomy,
- Partial wrist fusion.

Contraindications

- Marked swelling that distorts the topographic anatomy,
- Large capsular tears that might lead to extravasation of irrigation fluid,
- Neurovascular compromise,
- Bleeding disorders,
- Unfamiliarity with regional anatomy (relative contraindication) [8].

Arthroscopic Setup

- Wrist distraction is key element to enhance surgeon's ability in performing arthroscopic procedures in confined wrist joint. For distraction of wrist joint sterile or unsterile Traction Tower is commonly used system [9].
- We prefer sterile traction tower with finger traps and /or wooden handle. This allows us to adjust distraction force and wrist position and permits easy conversion to open procedure if required.
- Patient position is supine on operating table with regional anesthesia to upper limb. Shoulder is in 90° abduction and elbow at 90° flexion and attached to traction tower with the help of finger traps and/or wooden handle. Most procedures require 5 -10 pounds of traction (Fig. 1, 2).
- Upper arm tourniquet with pressure set at 250 mmHg is used. Once painting and sterile drepping done, tourniquet is inflated after exsanguination.

Equipments

Small Joint instrumentation is absolutely essential for wrist arthroscopy [10,13]. In general, small joint arthroscope (2.7 mm or 1.9 mm) is used with 30° or 70° visualization angle (Fig. 3) [11].

A 3 mm hook probe is needed for palpation

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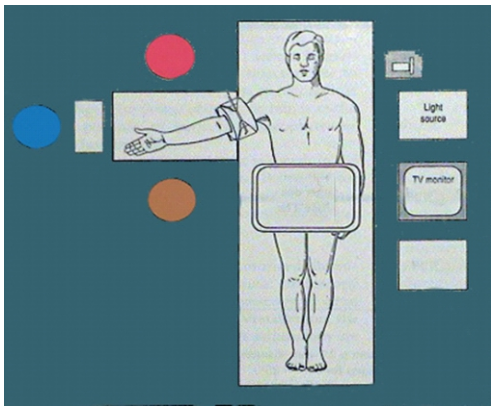

Figure 1: The Schöttle point [19] located with a microfracture awl intraoperatively using fluoroscopic guidance. The point lies 1.3 mm anterior to the posterior cortex extension line, 2.5 mm distal to the posterior origin of the medial femoral condyle, and proximal to the level of the posterior point of the blumensaatline. A true lateral view with posterior condyles over-lapping is absolutely essential.

Figure 2: wooden handle used for traction, with dorsal portals marking. Saline injected to distend the joint.)

Figure 3: Arthroscope ; diameter 2.7 mm, Visual Angle 300.

of intracarpal structures (Fig. 4).
Motorized shaver of 2.7 mm is needed for debridement (Fig. 5). RF probe is used for thermal shrinkage and also probably for debridement (Fig. 6). Bony resection can be done by 2.9 mm Burr.
Various suture materials are required for ligament repair (PDS 2-0, ethibond 3-0). We used ethibond 3-0 in few TFCC repair with good outcomes.
Fine curved Halstead forceps, Basket forceps, Grasping forceps (Fig. 7).

Portal Anatomy

The standard wrist arthroscopy portals are dorsal. This is in part due to the relative lack of neurovascular structures on the dorsum of the wrist as well as the initial emphasis on assessing the volar wrist ligaments [11].

Dorsal portals (Fig. 8, 9)

The dorsal radiocarpal portals are named for the dorsal extensor compartments they are between. For example, the 1-2 portal lies between the 1st and 2nd extensor compartments, the 3-4 portal lies between the 3rd and 4th extensor compartments and the 4-5 portal lies between the 4th and 5th compartments. The 6R portal is located on the radial side of the extensor carpi ulnaris (ECU) tendon, and the 6U portal is located on the ulnar side of the ECU.
The 3-4 and 4-5 portals are the main portals used for radiocarpal arthroscopy and used interchangeably for visualization and instrumentation. The 6R portal is providing further access to the ulnar aspect of this joint. The 6U portal is typically used for outflow through an 18-gauge needle [12].
Two portals are used to assess the midcarpal joint [20]. Midcarpal radial portal (MCR) located 1 cm distal to 3-4 portal and is bounded radially by ECRB and ulnarly by EDC. Midcarpal ulnar portal located 1 cm distal to 4-5 portal, 1.5 cm ulnar and slightly proximal to MCR portal, in line with ring metacarpal axis.
Volar Portals :
Volar radial portal (VR)
A 2 cm transverse or longitudinal incision is made in the proximal wrist crease overlying the flexor carpi radialis (FCR) tendon. The tendon sheath is entered and the FCR tendon is retracted ulnarly to protect the palmar cutaneous branch of the median nerve. The radiocarpal joint space is identified with a 22-gauge needle and distended with 5 cc of saline. Blunt tenotomy scissors or forceps are used to pierce the volar capsule, usually between the radioscaphocapitate ligament and the long radiolunate ligament. A blunt trocar is then introduced, followed by arthroscope. There is a safe zone comprising the width of the FCR tendon plus at least 3 mm or more in all directions that is free of neurovascular structures.

Volar radial midcarpal portal [20]

The midcarpal joint is identified with a 22-gauge needle through the same skin incision as used for the VR portal, by angling it approximately 1 cm distally and 5° ulnarly. A blunt trocar is then inserted. The trocar passes deep to the superficial palmar branch of the radial artery, which courses more superficially over the scaphoid tuberosity at that level. The distance between the volar radiocarpal and volar midcarpal entry sites averages 11 mm (7-12 mm).

Volar ulnar portal (VU) [14]

The VU portal is established through a 2 cm longitudinal incision centered over the proximal wrist crease along the ulnar edge of the finger flexor tendons. Careful dissection and wound spread technique should be observed to avoid injuring cutaneous nerves. The tendons are retracted to the radial side and the radiocarpal joint space is identified with a 22-gauge needle.

Volar central portal (VC)

Corella et al. [16] established a VC portal through 1.5 cm incision starting at distal wrist flexion crease and extending proximally, in line with third metacarpal space. Flexor digitorum superficialis tendons retracted radially, and interval between 3rd and 4th flexor digitorum profundus tendons was developed to reach the capsule. Needles were placed in radiocarpal and midcarpal joints [16].

Radioulanar Portals [14] :

Dorsal radioulnar portal
These portals lie between the ECU and the EDM tendons. Distal radioulnar joint (DRUJ) portals may be used to assess the status of the articular cartilage of the DRUJ, as well as the deep surface and foveal attachment of the TFC, identify loose bodies and synovial hypertrophy.
The proximal portal (proximal-distal

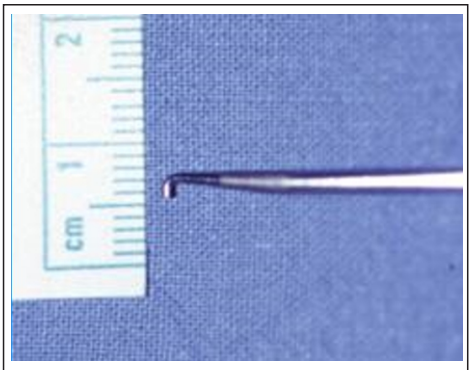

Figure 4: Hook probe (1 mm curved tip)

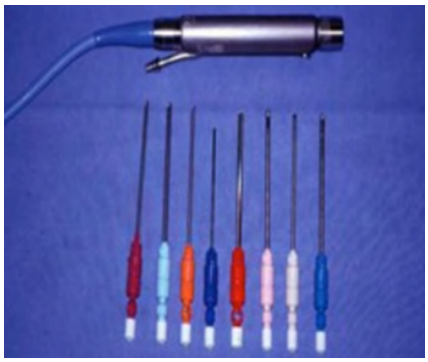

Figure 5: Shaver with Various shaver blades.

Figure 6: RF Probe

radioulnar joint [PDRUJ]) is located just proximal to the sigmoid notch and the flare of the ulnar metaphysis.

The distal portal (DDRUJ) is identified with 22-gauge needle 6-8 mm distal to PDRUJ portal and just proximal to 6R portal. This portal can be used for outflow drainage or instrumentation.

Volar distal radioulnar (VDRU) portal

The VDRU portal is accessed through the same skin incision used for the VU portal. The joint is first identified by angling a 22-gauge needle 45° proximally, and then, injecting the DRUJ with saline. It is useful to leave a needle or cannula in the ulnocarpal joint for reference during this step; the capsular entry point for the VDRU lies 5 mm to 1 cm proximal to the ulnocarpal joint.

All portals should be drawn on the skin before the skin incision is made and after traction has been applied. The bases of the index, long, and ring-finger metacarpals are palpated and marked. The ECU tendon becomes prominent with traction, which makes it easy to palpate and identify. The tip of the surgeon's thumbnail can be used to roll over and mark the dorsal lip of the radius.

The 3-4 portal is located by palpating Lister's tubercle and moving the finger approximately one centimeter distally until a soft spot is noted between the third and fourth compartments (Fig. 9). The 3-4 portal also is in line with the radial border of the long finger. The 3-4 portal is the workhorse and is the initial site for examination of the radiocarpal joint. It is just radial to the extensor digitorum communis tendon but ulnar to the extensor pollicis longus tendon. As the distal aspect of the radius has a volar and radial tilt (approximately 11 and 22 degrees, respectively), the needle used to distend the joint with fluid and the arthroscope should enter the wrist at this angle.

The 4-5 portal is located by the surgeon rolling his or her finger over the palpable fourth compartment and identifying the soft spot opposite the 3-4 portal on the ulnar aspect of the fourth compartment. As a general rule, the 4-5 portal lies slightly more proximally than 3-4 portal because of radial inclination. The 4-5 portal is located just ulnar to the extensor digitorum communis tendon, but radial to the extensor digiti minimi. An instrument enters the radiocarpal joint through this portal over the insertion of the TFCC into the ulnar margin of the radius.

An ulnar portal is necessary to visualize the triquetrum and the lunotriquetral (LT) interosseous ligament [17]. One can readily visualize the TFCC and the ulnolunate, ulnotriquetral, and interosseous LT ligaments from the 6R portal. It is also the ideal portal to assess the scapholunate (SL) ligament and to identify the ganglion stalk that can arise from its dorsal aspect.

The 6R and 6U portals are named according to their positions relative to the ECU tendon, with the 6R portal being radial and the 6U portal, ulnar to the tendon. Although the 6U portal is useful for joint distention and outflow, it is not routinely used, because of the proximity of the dorsal ulnar sensory nerve.

The 1-2 portal provide a radial side view similar to that of the 3-4 portal and is ideally suited for radial styloid ectomy. The 1-2

Figure 7: Halstead forceps (hemostat), Hook probe, Basket forceps, grasping forceps

Figure 8: Surface marking of landmarks for dorsal portals

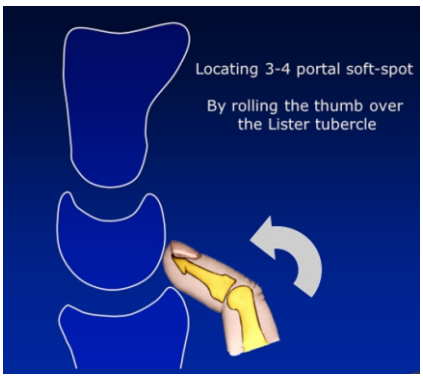

Figure 9: Locating dorsal 3-4 portal

portal is located radial to the extensor carpi radialis longus tendon, ulnar to the extensor pollicis brevis tendon, and distal to the radial styloid. Care must be taken when making this portal to avoid injuring the superficial radial nerve and the dorsal radial artery.

Midcarpal arthroscopy should be done as a routine part of wrist arthroscopy [18]. The midcarpal portals are essentially made one centimeter distal to the 3-4 and 4-5 portals. The midcarpal space is somewhat tighter than radiocarpal space, so extra care must be taken while entering it with the blunt trocar. The most commonly used is the radial midcarpal portal, which is located 1 cm distal to the 3-4 radiocarpal portal, in line with the radial margin of the third metacarpal and just radial to the extensor digitorum communis tendon to the index finger. As the arthroscope enters the wrist between the capitate and the scaphoid, the midcarpal space can be examined, as well as the SL, LT, and scaphotrapeziotrapezoid articulations. The ulnar midcarpal portal is located in line with the shaft of the fourth metacarpal and is useful for visualizing the LT, SL, and triquetrohamate articulations.

Complications

Wrist arthroscopy is safe procedure with low rate of complications [23]. They may include infection, nerve injuries, excessive swelling, bleeding, scarring, or tendon tearing. Diagnostic wrist arthroscopy and simple debridement procedures have lower rates of morbidity than open stabilization procedures for fractures and ligaments [24]. Four case reports were also found, identifying injury to the dorsal sensory branch of the ulnar nerve, injury to the posterior interosseous nerve, and extensor tendon sheath fistula formation [24].

To avoid many potential complications with portal creation, blunt dissection to the level of the wrist capsule with a hemostat should be used to limit injury to sensory nerves and extensor tendons. Instruments should not be forced into a joint, as this increases the potential for iatrogenic chondral lesions

Conclusions

Restoration of stability and a full, painless arc of rotation are the goals of treatment for the post-traumatic unstable DRUJ. Both surgeon and patient however must recognize the limitations of a ligament reconstruction, especially following complex injuries of the wrist. Alternative causes of ulnar-sided wrist pain must be carefully considered before instability is attributed as the primary cause of symptoms. In addition, adequate restoration of the skeletal architecture and soft tissues must be restored to achieve a satisfactory long-term outcome. Careful examination of the articular surfaces at the time of surgery may reveal underlying arthritis or un-reconstructable deficiencies indicating alternative procedures should be performed

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