Wrist arthroscopy

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Abstract

Wrist arthroscopy has continued to develop as both a diagnostic and therapeutic tool since its introduction over 40 years ago. The anatomy of the wrist is complex with important neurovascular structures. Specific portals are utilized to allow for safe entry to the wrist joint. Wet arthroscopy and dry arthroscopy are used to treat a variety of pathology including triangular fibrocartilage complex (TFCC) pathology, carpal instability, distal radius fractures, scaphoid fractures, wrist arthritis, to name but a few. Indications are continually increasing with the support of the ever expanding evidence base. As with any new procedure, wrist arthroscopy has its own set of complications.

Keywords arthroscopy; complications; portal (s); review; wrist

Background

With the evolution of laparoscopic surgery, significant leaps have been made in the use of similar instruments and techniques to treat pathology of the wrist. Instruments used for cystoscopy and laparoscopy were initially used for the inspection of joints. The knee was the obvious initial choice as this was the largest joint in the body and access was relatively simple. Arthroscopy of the wrist was first attempted in cadavers in 1932 and first described in detail by Chen in 1979 as a mainly diagnostic tool. Entry portals to the wrist developed by Whipple in 1986 allowed safe entry. Wrist arthroscopy is used diagnostically and therapeutically. It remains the 'gold standard' for the diagnosis and triangular fibrocartilage complex (TFCC) lesions and scapholunate ligament (SLL) injuries. In terms of diagnosis, arthroscopy in the hands of an expert gives far fewer false positive and negatives compared to other investigations. Ongoing development of instrumentation has encouraged the acquisition of new skills and techniques allowing more and more pathology to be treated arthroscopically.

Anatomy

The wrist joint consists of eight carpal bones, numerous articular surfaces with intrinsic and extrinsic ligaments and the TFCC all within a compact 5 cm space. Wrist arthroscopy allows direct visualization of cartilage, synovial tissue and ligaments under bright illuminations and magnification. An understanding of the dorsal anatomy of the wrist is essential as most arthroscopic approaches to the wrist are dorsal. The dorsum of the wrist comprises of six extensor compartments. The portals are created by localizing the contents of the compartment and carefully negotiating the spaces between them to gain safe passage into the joint.

The first compartment contains abductor pollicis longus and extensor pollicis brevis tendons. The second compartment contains extensor carpi radialis brevis and longus tendons. The third compartment contains only extensor pollicis longus. The fourth compartment is made up of extensor digitorum communis with extensor indicis and the fifth compartment contains extensor digiti minimi. The sixth compartment contains extensor carpi ulnaris. The spaces between these compartments are used to avoid injury to the tendons at the level of the joint. The major neurovascular trunks are located on the volar surface and are thus mostly avoided. Superficial cutaneous branches however, like the superficial branch of the radial nerve (SBRN) or dorsal sensory branch of the ulnar nerve (DSBUN) and the distal articular branch of the posterior interosseous nerve (PIN), are potentially at risk during portal placement.

Another important dorsal structure in addition to the tendons and cutaneous nerves is the deep branch of the radial artery (RA) which enters the anatomical snuffbox under the tendons of the first dorsal compartment and crosses the base of the thumb metacarpal to enter the palm of the hand. The SBRN traverses beside the RA deep to brachioradialis in the forearm and turns across the snuffbox at the crossing of the second and third extensor compartments travelling superficially to supply sensation to the thumb, index and middle fingers. The DSBUN location is highly variable. It arises from the ulnar nerve deep to flexor carpi ulnaris tendon, runs across the border of the forearm and courses around the distal ulna approximately 5 cm proximal to its tip. On approaching the ulnar styloid it gives off up to five branches. The distal posterior interosseous nerve travels along the floor of the fourth compartment and ends at a variable position to supply the joint capsule.

The TFCC is composed of five parts:

- The articular disc
- The dorsal and volar radioulnar ligaments
- The ulnar collateral ligament
- The sheath of the extensor carpi ulnaris
- The meniscal homologue

It acts as an extension of the articular surface of the radius to support the proximal carpal row while also providing stability to the distal radioulnar joint. The volar carpal ligaments assist in limiting wrist extension and radial deviation while also stabilizing the volar-ulnar side of the carpus. Roughly twenty per cent of the entire load of the forearm is transferred through the ulnar side of the wrist and the TFCC. The articular disc has thickening of the volar and dorsal margins forming the volar and dorsal radioulnar ligaments which provide stability to the distal radioulnar joint.

Set up for procedure

The patient is positioned supine with the elbow flexed at 90°. The availability of modern sterile traction towers allow for the safe application of traction combined with counter-traction *via* the upper arm, which significantly improves access and control for

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the arthroscopist. The limb can be positioned in space and also wrist flexion can be achieved whilst maintaining traction of 2–3 kg *via* the index and middle finger. The elbow also can be extended if needed to allow the wrist to be positioned horizontal, which can facilitate open surgical exposure without removal of traction. Important landmarks include Lister's tubercle, the scaphoid, the lunate, the DRUJ and the ECU. The most common scope used in wrist arthroscopy is a 2.7 mm 30° arthroscope.

Portals

The anatomical joint space available for wrist arthroscopy is substantially smaller than the shoulder and knee. It is imperative to have knowledge of the normal wrist anatomy for accurate port placement (Table 1).

The standard arthroscopic portals used are dorsally located so as to avoid neurovascular structures. There are eight generally accepted arthroscopic portals. Five radiocarpal and two midcarpal. The 3–4 and 4–5 portals are the primary portals used to perform diagnostic arthroscopy and instrumentation of the radiocarpal joint. The radiocarpal joint can be insufflated with 10 ml of normal saline prior to portal placement to aid safe passage of the initial portal and prevent iatrogenic injury to cartilage. (Figures 1 and 2). Figure 3 shows the location of the dorsal and volar portals. It is important to take note of the neurovascular structures and their relationship to the portals.

Indications

The indications for wrist arthroscopy are ever-increasing as it is used as both a diagnostic and therapeutic tool. The ability to perform therapeutic intervention for wrist pathology arthroscopically is ever-increasing due to the evolution of new techniques and also joint-specific instrumentation which significantly aids the surgeon. Some indications include treatment of intra-articular fractures of the distal radius and scaphoid, wrist lavage, synovectomy, ganglionectomy, distal ulnar shortening, detection and removal of loose bodies, debridement of degenerative arthritis, debridement and repair of TFCC pathology, resection arthroplasty, management of septic arthritis and stabilization of interosseous ligaments.

Figure 1 The limb is placed in vertical traction using a sterile tower and finger traps after exsanguination and tourniquet inflation.

Figure 2 Insufflation of the radiocarpal joint with normal saline is performed to aid passage of the initial 3–4 portal.

Arthroscopy allows for the accurate assessment of interosseous ligament tears, whether they are partial or complete, evaluating the TFCC and evaluating chronic wrist pain of unknown aetiology.

Most acute sprains for the wrist with radiographic normal findings usually resolve with conservative treatment. This conservative treatment includes wrist immobilization, oral NSAIDs and/or corticosteroid injection. The investigation of patients who do not improve after conservative treatment can be investigated with tricompartmental wrist arthrography, wrist arthroscopy and MRI. Adolfsson used wrist arthroscopy to examine 144 patients with chronic wrist pain but normal findings on standard radiographs. Ligamentous changes were found in 75 patients, TFCC lesions in 61 patients and degrees of scapholunate instability in 14 patients.[1]

Tadjerbashi et al showed that despite increasing use of wrist arthroscopy in the treatment of various wrist disorders, the efficacy of arthroscopically performed interventions was only studied in four Randomized Control Trials (RCTs). This was compared to 50 RCTs for shoulder arthroscopy. The four RCTs included Keinbock's disease (arthroscopic *versus* open surgery), dorsal wrist ganglions (arthroscopic *versus* open excision), volar wrist ganglia (arthroscopic *versus* open excision), and distal radius fracture (arthroscopically and fluoroscopically assisted *versus* fluoroscopically-assisted reduction followed by fixation). The number of participants in the four studies was 16, 50, 72 and 40 respectively.[2]

Edwards et al. showed that in 55 patients who underwent arthroscopic resection of dorsal wrist ganglion cysts, all patients had a significant increase in function and decrease in pain at 6 weeks. At 2 years after surgery all patients had wrist motion that was within five degrees of their preoperative range of motion with no recurrences of the ganglions.[3] They suggested that contraindications to arthroscopy include compartment syndrome, median nerve compromise, open joint and severe soft tissue injury.