WRIST ARTHROSCOPY

– Written by Jonny K Andersson, Qatar

Wrist arthroscopy was initially used for diagnostic purposes when it was first introduced in 1979. Yung-Cheng Chen then reported on 90 arthroscopic examinations of the wrist and finger joints in 43 patients. F J Bora described the wrist arthroscope in a brief article in 1985[1]. The techniques of wrist arthroscopy were refined throughout the early 1980s and it became fully accepted as a diagnostic tool around the mid-1980s. At that time, arthroscopy of the wrist was an innovative technique to determine whether a patient`s problems and symptoms could be explained by pathological findings inside the wrist, but, a few years later, wrist arthroscopy became increasingly used also as a therapeutic tool.

Now wrist arthroscopy is the gold standard and the preferred diagnostic technique with sufficient conclusive properties when it comes to wrist ligament injuries, as magnetic resonance imaging (MRI) is unable to rule out the possibility of a clinically relevant injury to the triangular fibrocartilage complex (TFCC), the scapholunate (SL) ligament, or the lunotriquetral (LT) ligament of the wrist[2]. Wrist arthroscopy is now used as assistance during the treatment of distal radius fractures, scaphoid non-unions and different types of ligament reconstructions.

Wrist arthroscopy is used to an increased extent in athletes, as we have the possibility to treat and adjust small injuries with a rapid recovery and then postpone the need for further open surgery to in between the seasons or even to after their career. For example, I recently operated on a professional goalkeeper with a total one year old SL injury, with wrist pain and locking symptoms and treated a small chondral injury with shaving and debridement, but at the same time used my finger-tip feeling, and did not went further on with an open SL ligament reconstruction, which could be a career-ending operation, as only approximately 70% of range of motion (ROM) and grip strength could be expected (see the article about SL injuries later on in this Journal).

I now follow this athlete, who returned to training and match in four weeks with a specific splint preventing from to much forced dorsal extension, on a regular basis, to decide when the open surgery is necessary – probably necessary in 3-5 years (Figure 1a, and b). Treating professional elite football players, handball players and other athletes, especially goalkeepers, requires an experienced touch.

INDICATIONS AND CONTRA-INDICATIONS

The indications for wrist arthroscopy are wide and vary considerably from performing just a diagnostic procedure for chronic wrist pain to ligament reconstructive surgery and fracture reduction. Radiocarpal (RC) arthroscopy should always be accompanied by midcarpal (MC) arthroscopy, which is essential when making the diagnosis and grading of SL and LT instabilities (Figure 2a and b). An arthroscopy performed only in the RC joint is not a proper arthroscopy procedure. The cartilage, ligaments and joint capsule can be assessed and the injuries can be evaluated in terms of dynamic instability, degree of injury (partial, total), quality of the tissue, reparability and healing capacity. The grading scale reported by Geissler et al[3] (see the coming two articles in this Journal) provides a means of staging the degree of injury to the intrinsic ligaments and instability in order to choose the best type of treatment. After diagnostics, direct arthroscopic repair of ligaments, microfracture of chondral injuries, shaving of synovitis or excision of bone spikes and cysts etc. can be performed at the same surgical procedure.

Marked swelling, open wounds and large capsular tears that might lead to the

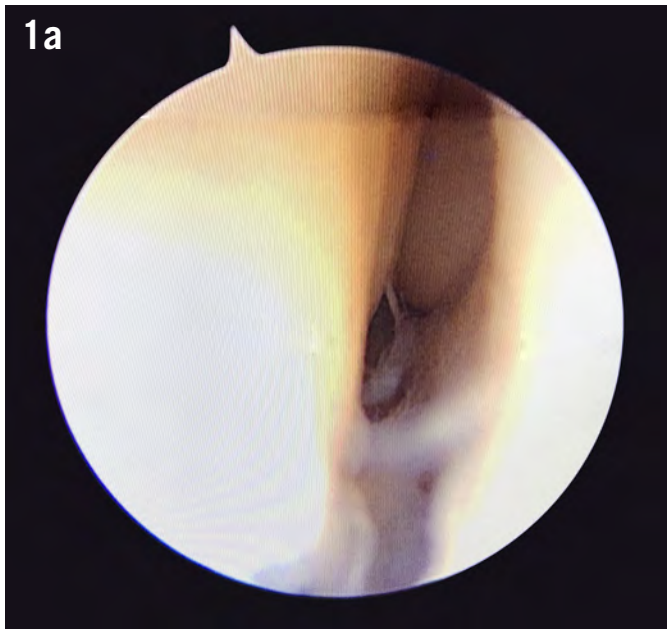
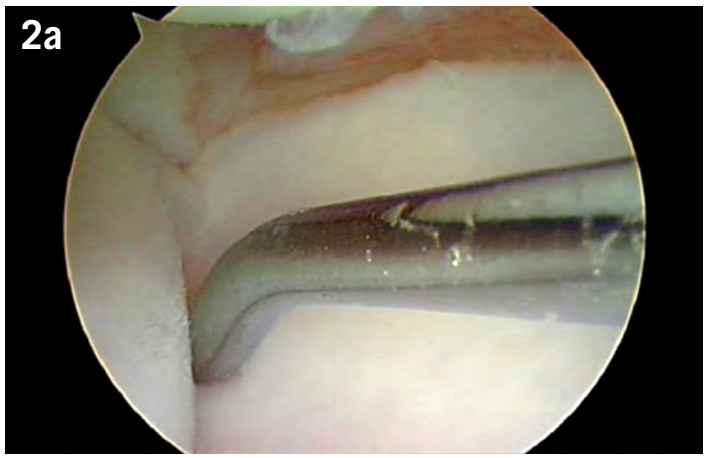


Figure 1a and b: Total scapholunate (SL) ligament injury with a so called drive through (Geissler IV) in a Swedish first division goalkeeper and his special protecting divice, used inside his glove.

Figure 2a and b: No instability in the lunotriquetral (LT) space, seen from the midcarpal view and a so called Geissler III out of IV instability (can rotate the probe totally around) where the probe can be rotated in the LT space. Photo: Jonny K Andersson.



extravasation of irrigation fluid are relative contra-indications to wrist arthroscopy and are also technical limitations. Dry arthroscopy according to del Pinal et al is then preferable[4]. In their experience, this technique is as effective as the standard procedure, but without the disadvantages of fluid extravasation, which minimises the risk of acute compartment syndrome, especially during the arthroscopically assisted treatment of intra-articular radius fractures. In terms of arthroscopy-assisted surgery of distal radius fractures, is it also advantageous to wait 5-7 days, as for the consolidation of the fracture hematoma prevent fluid extravasation and the fracture fragments are easier to move to the right positions.

Bleeding disorders, neurovascular compromise and infection are contra-indications for wrist arthroscopy, as well as not enough knowledge about the procedure by the surgeon.

Wrist arthroscopy has the benefit of providing the surgeon with a tool for therapeutic intervention. Unlike MRI, it does, however, suffer from the limitation of being a surgical procedure - with associated risks of complications, however small, 2-5% in all[5-7] - and the need for regional or general anaesthesia.

Complications in wrist arthroscopy are rare. Severe complications such as deep infection and acute compartment syndrome are almost anecdotal. Dysesthesia and nerve damage (sensory branches of the radial and ulnar nerves) in the area of the portals are, however, reported in approximately 2-3% of the patients

A systematic review in 2012 of studies related to complications of wrist arthroscopy yielded a complication rate of 4.7%[8], which is higher than the previously reported 2%. A variety of complications have been reported, including nerve injuries, tendon injuries, tendon sheath fistulae, arterial injury, cyst development, development of carpal tunnel syndrome, de Quervain tenosynovitis, chronic loss of mobility (arthrofibrosis), hematoma development, equipment-related burn injuries and local infections. It is possible that this rate may be an underestimation because of the small number of documented studies of wrist arthroscopy. In my hands, I have seen one case of postoperative acute carpal tunnel syndrome and one case of deep infection during over 15 years and approximately 2000 procedures. Taken together, the complication rate is very low, if the surgeon is well experienced.

EQUIPMENT, PORTALS AND SETTINGS

Regional or general anaesthesia is needed. The RC and MC joints, together with the portals subcutaneously and the posterior interosseous nerve (PIN), are also pre-operatively injected with local anaesthesia. In general, a 2.4-2.7 mm 30°-angled scope

Figure 3a, b and c: Wrist arthroscopy technique. The portals are marked and local anaesthesia is injected into the RC joint. A gentle blunt dissection is performed before introducing the 2.4 - 2.7 mm arthroscope in the 3-4 portal and the 2-3 mm probe in the 6R portal, followed by a small joint punch. Photo: Tommy Holl, with permission.

attached to a fibreoptic light source and a digital camera system and monitor is used. In small wrists, a 1.9-mm arthroscope is sometimes necessary; the 1.9-mm arthroscope can also be used in thumb base arthroscopy.

Traction (5-10 pounds) is needed, preferably using the ARC® tower, which greatly facilitates the instrumentation process, by various degrees of freedom in rotation and flexion/extension of the wrist and elbow, under controlled conditions. A 2-mm hook probe is needed to palpate the intercarpal ligaments, TFCC, extrinsic ligaments, secondary stabilisers, capsule and cartilage (Figure 3a, b and c). A motorised 2.9-3.5 mm shaver is used for debridement and a burr is needed for bony resection. VAPR for thermal shrinkage (partial SLL)[9] and suture repair kits (TFCC ulnar tunnel repair kit, Arthrex®)[10] are also very useful for different treatment procedures. The arm is exsanguinated and a tourniquet is inflated (80 mmHg over the patient's pre-operative systolic blood pressure). The RC and MC joints are identified with a 22-gauge needle, inserted first in the RC joint sloped 100 palmar (normal volar inclination of a normal radius), and the joint is normally injected with 4-6 cc saline, which in the standard setting also flushes continuously through a pump.

The arthroscopic procedure described by Whipple et al[11] is used. The standard portals for wrist arthroscopy are mostly dorsal (Figure 4), due partly to the good view of the important intercarpal ligaments (SL, and LT) and important volar structures and the relative lack of neurovascular structures on the dorsum of the wrist. The dorsal portals, which allow access to the RC joint, are named after their relationship to the ambient tendon sheaths (see text below and Figure 4). The first portal to be established is the 3-4 portal, located at the soft spot in the interval between the third dorsal extensor compartment (extensor pollicis longus, EPL) and the fourth extensor compartment (extensor digitorum communis, EDC, and extensor indicis proprius, EIP). The 4-5 portal (between the EDC and the fifth compartment; extensor digiti quinti, EDQ) or the 6R portal (radial to the sixth compartment, ECU) is initially the "working portal" used for the hook and other instruments. Anatomic cadaver dissections have been performed, in order to measure the distances between the standard dorsal portals and neurovascular structures. The 1-2 portal (between the first extensor compartment, including the extensor pollicis brevis, EPB, and the abductor pollicis longus, APL, and the second extensor compartment, including the extensor carpi radialis brevis and longus, ECRB/L) was found to be the most dangerous, as branches of the superficial radial sensory nerve were located within a mean of 3 mm from that portal[12]. The MC joint is assessed through the midcarpal radial portal (RMC) and the often somewhat more available and accessible midcarpal ulnar portal (UMC). DRU portals, located 1-1.5 cm proximal to the 6R portal, are difficult to establish and to get a good view, but can be useful in assessing and estimating the quality of the DRUJ cartilage and the foveal insertion of the TFCC. An accessory 6R portal, located 1 cm distal to the 6R portal, is needed if all-arthroscopic re-insertion of the TFCC is planned. There is also a 6U portal (very useful in arthroscopic Wafer osteotomy and in evaluation of dorso-ulnar structures – but located in a risky area in terms of the dorsal sensory branch of the ulnar nerve), located ulnar to the ECU, and a specific portal for the STT joint.

All the dorsal portals should always be established through a small transverse 4-5 mm long incision, just through the skin, followed by blunt dissection with a small pair of scissors and a haemostat, to force other structures gently apart and to avoid unnecessary injury to sensory nerves and tendons.

Volar radial (VR) and volar ulnar (VU) portals can also be used, with an inside-out-technique through "safe zones" in the volar joint capsule, to assess the palmar aspects of the SLL and LTL and to repair dorsal capsular

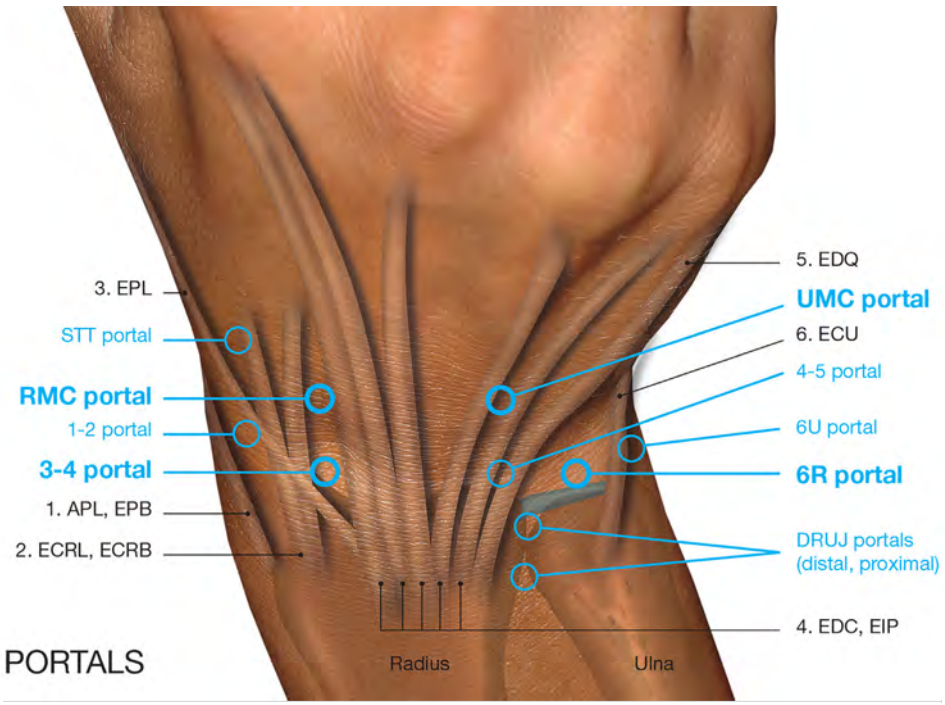


Figure 4: The most used wrist arthroscopic dorsal portals. 3-4 portal (between the EPL and EDC, EIP), 4-5 portal (between the EDC, EIP and EDQ), 6R portal (radial of ECU), 6U portal (ulnar of ECU), RMC =radial midcarpal, UMC =ulnar midcarpal. The DRUJ portals and the STT portal are also shown. Copyright © Jonny K Andersson.

ligaments. Slutsky[13] determined the safe landmarks for volar portals and showed that the median nerve is located within a mean of 8 mm ulnar to the VR portal, while the palmar cutaneous branch is located within a mean of 4 mm ulnar to that portal.

Dynamic assessment through careful provocation tests could be made through the whole arthroscopic procedure, if needed, together with laxity assessments in the MC joint (Geissler classification)[3] of the SL and LT and estimations of steps and associated cartilage injuries. The TFCC is classified, according to Palmer and Atzei[14-16]. The classifications of the wrist ligament injuries will be presented in the articles about scapholunate ligament injuries and injuries to the triangular fibrocartilage complex in this issue of the Journal.

In summary wrist arthroscopy is the only tool available for determine the dynamic instability of the different parts of the wrist and for determine the healing capacity if the different injuries. Wrist arthroscopy is preferably used as a diagnostic tool together with the proper treatment during the same procedure as a one-stage surgery. Wrist arthroscopy is still the gold standard of diagnostics of wrist ligament injuries, as MRI is unable to rule out the possibility of the different clinically relevant injuries. For sure, MRI is usable when it comes to differential diagnostics, in terms of extra-articular conditions (i.e. synovitis and ganglion cysts) and intra-osseous pathology (i.e. bony cysts and Kienboeck´s disease).

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