Normal Wrist Arthroscopy

G. Dautel

The appearance of wrist arthroscopy as a diagnostic tool in the armamentarium of wrist investigations and treatment is relatively recent [1, 2], probably due to the technical constraints imposed by such a small joint interval involved. However, this technique has become inevitable today for diagnosis as well as management of wrist pathology [3], even as noninvasive imaging has continued to progress in performance as well as in definition. Arthroscopy remains the gold standard for evaluation of wrist ligament lesions by the direct vision it provides as well as the dynamic testing which makes it possible to detect even very early stages of dissociative instability [4, 5].

1 Performing a Wrist Arthroscopy

1.1 Anaesthesia

Wrist arthroscopy is performed under locoregional anaesthesia as a day case procedure. The patient may follow the procedure on screen if he/she wishes.

1.2 Setup

Arthroscopy necessitates joint distraction which is obtained by setting up the hand on a traction tower with the forearm vertical and a counter traction support applied to the arm above the elbow. The Chinese finger traps are placed on the index and middle fingers (Fig. 1).

G. Dautel
Service de Chirurgie Plastique et Reconstructrice de l'Appareil Locomoteur,
Centre Chirurgical Emile Gallé, 49 rue Hermite, 54000 Nancy, France
e-mail: gilles.dautel@wanadoo.fr

E. Camus, L. Van Overstraeten (eds.), *Carpal Ligament Surgery*,
DOI 10.1007/978-2-8178-0379-1_7, © Springer-Verlag France 2013

Fig. 1 Arthroscopy tower. This type of tower provides distraction whilst allowing repositioning and wrist orientation as required

The scope used is 2.7-mm calibre oriented at 30°. This scope is adequate for exploration of the radiocarpal and midcarpal joints. The 'needle' 1.9-mm scope is only rarely used for exploration of the distal radioulnar joint. The trocar is smooth-tipped to avoid cartilaginous lesions during introduction. It bears the connection for the light source, and the irrigation. Once in place, the light connects to the video camera where the joint is visualized on a monitor screen and not by direct vision. The probe is an indispensable instrument in this set. Its size and the smoothness of its tip must be adapted to the size of the joint explored. A set of two graspers (straight and curved) as well as a single-use knife are useful for debridement of the TFCC when necessary. The use of powered instruments (shavers and burrs) for arthroscopic surgery for the TFCC is quite common practice now [6].

1.3 Access Portals

The portals of access are designated by the corresponding dorsal extensor compartments (Fig. 2). We recommend defining all the portals that will be needed at the beginning of the operation. The development of a 'hydroma' due to diffusion of the irrigation fluid renders it difficult to identify bone and tendon landmarks later throughout the course of the procedure. For all portals, a small calibre needle is used for identification. If elastic resistance is encountered at the point of entry, it is easy to reposition the needle to avoid tendons. A hard resistance is characteristic of bone. Correct penetration into the joint interval is denoted by a suction sound due to the

Fig. 2 Portals for exploration of the wrist. The current portals for wrist exploration are identified in relation to the extensor compartments. Portal 3/4 is on the radial border of the extensor communis EDC (*1*) and portal 4/5 on the ulnar border of EDC (*2*). Portals for the midcarpal joint are RMC (*3*) and UMC (*4*). Portal 6U (*5*) is commonly used as drainage outlet for the irrigation

intra-articular negative pressure resulting from the distraction. Once the interval is marked by the needle, portal access can be established using an N°15 blade perpendicular to the surface. The scope or probe can then be introduced.

To explore the radiocarpal joint, three portals are usually sufficient.

Portal 3/4 is the first point of introduction of the scope. This portal is situated at the radial border of extensor communis tendon. The tubercle of Lister is the bony landmark for this portal. It is found by palpating with the thumb along the posterior border of the radial glenoid.

The depression indicating the joint interval can be palpated about 1 cm above (distal) this point. The needle should be introduced obliquely on account of the radial slope in the sagittal plane. The knife should be held sharp facing downward to avoid iatrogenic lesion of the scapholunate interosseous ligament.

Portal 4/5 is between the EDC and EDM and serves for probe introduction for exploration of the radiocarpal joint. The depression between the two tendons is readily palpable and introduction is more proximal than the previous portal on account of the radial slope in the frontal plane. These portals 3/4 and 4/5 are the least risky for sensory nerve branches [7].

Portal 6U is situated on the ulnar border of the ECU. This is the site for the needle for drainage of the irrigation fluid.

Other portals. The 6U portal is seldom used. It is useful for arthroscopic surgery of the TFCC. Palmar portals are only used for arthroscopically assisted reduction of distal radius fractures. Introduction of the scope through the FCR has been proposed as a secure method of exploring the most palmar portion of the scapholunate ligament [8, 9].

1.3.1 Portals for Exploration of the Midcarpal Joint

The radial midcarpal RMC is situated on the radial border of the EDC, about 1 cm distal to the 3/4 portal (Fig. 2). This corresponds to the scaphocapitate interval more difficult to palpate than the radiocarpal interval. The ulnar midcarpal portal UMC is situated on the ulnar border of EDC about 15 mm from 4/5 and corresponds to the triquetrohamate interval.

2 Performing a Diagnostic Arthroscopy

2.1 Analysis of Radiocarpal Chondral Lesions

Simple inspection of the articular surfaces is followed by probing any cartilage defect or lesion. The topography, extent and severity of the lesion is appreciated and noted. Healthy cartilage feels firm and elastic when palpated using the probe. The probe does not leave an imprint on healthy cartilage, and a full-thickness cartilaginous lesion is hard on probing.

This exposure of subchondral bone is synonymous to arthritis even if the lesion is of limited extent and does not show on X-ray. All other chondral lesions without bone exposure are grouped under the generic term ‘chondritis’. A precise description of the lesion must specify if it is simple cartilage oedema (the cartilage bears the imprint of the probe), a fibrillary chondritis (associated with cartilaginous flaps) or a partial defect not exposing the underlying bone (without arthritis).

2.2 Study of the Radiocarpal Articular Surfaces

Diagnostic arthroscopy begins by visualization of the scaphoid and lunate fossae of the radius, separated by a blunt anteroposterior ridge (Fig. 3). Through the same portal, the scope is oriented ulnar to explore the horizontal portion of the TFCC.

The radial insertion, central portion and the anterior border of the TFCC must be systematically palpated as they are often the site of traumatic or degenerative lesions. An intact healthy TFCC gives a firm elastic resistance to probing – described as the ‘trampoline effect’. When pushed to the ulnar side of the radiocarpal interval, the probe may access the prestyloid recess and penetrate it. This is a physiologic extension of the radioscaphoid joint. A radial traction motion must be applied as if to pull the full thickness of the TFCC laterally. This can depict a peripheral (ulnar) disinsertion of the TFCC. If no lesion, the peripheral TFCC insertion stays taut resisting probing and no wave effect is elicited. Examination of the carpal surfaces follows. Scaphoid convexity is examined until the styloscaphoid space and then the lunate dome is inspected. The 3/4 portal does not allow easy access to the triquetrum; thus, the scope must be reintroduced through the 4/5 portal to complete the radiocarpal examination.

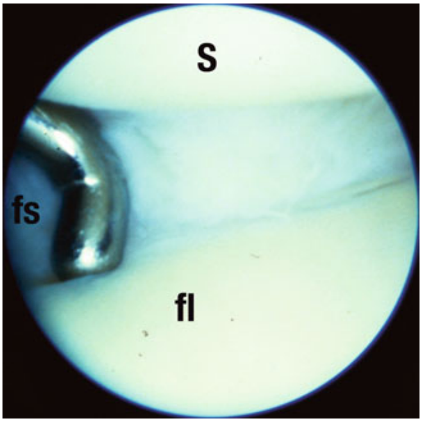

Fig. 3 Exploration of the radiocarpal joint. Scaphoid (S), Scaphoid fossa (*fs*) and Lunate fossa of the radius (*fl*) separated by a blunt ridge

2.3 Study of Ligamentous Structures in the Radiocarpal Joint

Extrinsic ligaments: Due to the dorsal entry point of the scope, the only extrinsic ligaments accessible are those of the anterior plane. The posterior plane cannot be studied – a minor inconvenience since they have a minor role in intracarpal stability. Arthroscopy gives quite a clear intra-articular view of these ligaments [10]. Heated controversy exists as to the nomenclature of these ligaments. We have adopted those best suited to this arthroscopic intra-articular view.

- *The most radial is the radioscaphocapitate ligament* (Fig. 4):
  This ligament arises from the anterior border of the radial glenoid and wraps around the waist of the scaphoid to reach the waist of the capitate. There is a distinct space between it and the radiolunotriquetral which the probe can penetrate and which Berger and Landsmeer named the *interligamentary sulcus* [11]. Thus positioned, the probe can be used to test the tension of the radioscaphocapitate ligament.
- *The second ligament of the anterior extrinsic plane is the radiolunotriquetral ligament*:
  It is distinguished from the previous ligament by the obliquity of its fibres. This ligament arises from the anterior border of the radius facing the scaphoid fossa and directing obliquely towards the triquetrum, to insert on the anterior horn of the lunate and onto the anterior portion of the scapholunate interosseous ligament. As above it can be inspected and tested during the radiocarpal examination.
- *The radioscapholunate ligament* (*ligament of Testut*):
  This ligament is easily identified in arthroscopic examination; its fibres are strictly vertical, inserting onto the radius at the level of the anteroposterior ridge separating the scaphoid and lunate fossae of the radius. The previous two ligaments had oblique fibres. From its radial insertion, this ligament diverges in a T shape where each limb inserts into either part of the interosseous ligament. On palpation, it seems less tense than the other two ligaments whatever the degree of articular

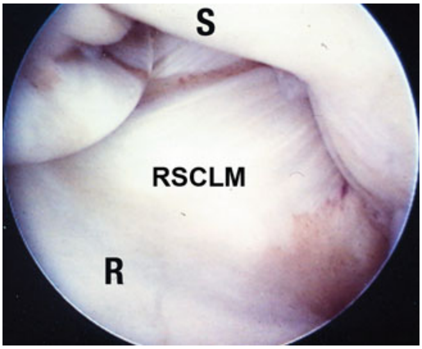

Fig. 4 The anterior plane of extrinsic ligaments seen on exploration of the radiocarpal joint. *S* scaphoid, *R* radius, *RSCLM* radioscaphocapitate ligament

distraction. These arthroscopic findings confirm the accessory biomechanical role played by this ligament, which is otherwise considered as a vessel bearing matrix – an intra-articular extension of the anterior interosseous pedicle [11].

- The radial half of the radiocarpal joint is thus lined at its palmar aspect by three easily distinguished ligaments; the ulnar half is sealed palmarly by a continuous sheet of ligament consolidating with the anterior border of the TFCC. Classic descriptions report two principal ligaments (ulnolunate and ulnotriquetral). Both arise from the ulnar styloid but their respective limits cannot be distinguished by arthroscopy. It is still possible to test this ligament curtain using the probe to appreciate its tension and verify continuity with the anterior border of the TFCC.

3 Intrinsic Ligaments

The scapholunate and lunotriquetral interosseous ligaments must be assessed.

Their posterior two-thirds are accessible to inspection and palpation due to the posterior entry points of the scope.

3.1 The Scapholunate Interosseous Ligament

It is identified at the ‘ceiling’ of the carpus through the 3/4 portal. Covered by a layer of articular cartilage continuous with that of the scaphoid and the lunate, it may be difficult to identify when healthy; it is palpated as a zone of attenuated tension vertically above the anteroposterior ridge separating the scaphoid and lunate fossae and the deep radioscapholunate ligament (of Testut) (Fig. 5). The entire extent of the ligament should be assessed in search of lesions of the middle or anterior thirds. Traumatic lesions affect the insertion onto the scaphoid, the body of the ligament or less frequently, the lunate insertion.

Fig. 5 The scapholunate interosseous ligament. It is identified by the probe as an area of attenuated tone between scaphoid (*S*) and lunate (*L*). It is entirely covered by cartilage

3.2 The Lunotriquetral Interosseous Ligament

It is more difficult to localize due to the absence of anatomical landmark. The scope should be reintroduced through the 4/5 portal, and often probe palpation is necessary.

4 Midcarpal Examination

4.1 Examination of Articular Surfaces

The scope is introduced through the RMC which is generally sufficient for complete exploration of the midcarpal joint including its ulnar corners. The use of a probe is indispensable through the UMC portal. During introduction, the first image seen is the scaphocapitate space. The distal scaphoid fossa and the scapholunate interval are examined at this point. With no ligament lesion, these fossae are perfectly congruent (Fig. 6) and the space between the two bones admits only the tip of the probe.

The slope of this interval is then followed apically and radially to reach the distal pole of the scaphoid and the STT joint. The scope is then pushed ulnarly assessing the capitate head on the way as well as the tip of the hamate and the capitohamate junction. The lunotriquetral interval is also hereby assessed with the same criteria of congruency and cohesion as for the scapholunate interval.

In most cases, it is possible to extend the examination following the helicoidal slope of the hamate to the ulnar corner of the midcarpal joint.

Different morphological types of the midcarpal joint have been described; we have adopted the terminology of Viegas [12] who described type I lunate with a single midcarpal facet and type II when a second facet is present, separated from the

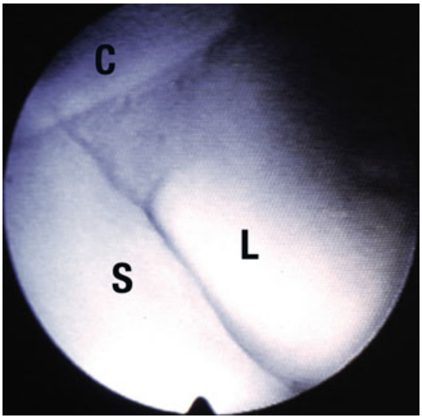

Fig. 6 Assessment of the midcarpal joint. Assessment of the congruency of distal articular surfaces of the scaphoid (*S*) and lunate (*L*). If no instability, the congruency is perfect at rest. *C* capitate

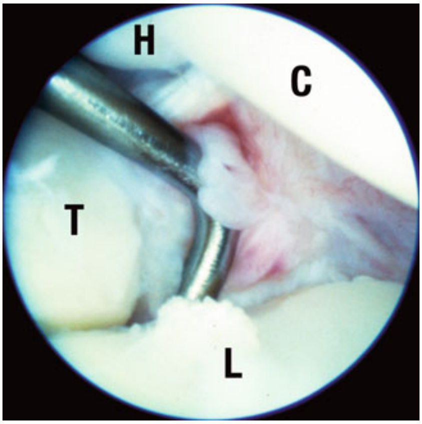

Fig. 7 Examination of the midcarpal interval. Junction of the four bones. The four internal bones are seen on this midcarpal view: *L* lunate, *T* triquetrum, *C* capitate, *H* hamate. The medial branch of the deltoid V is also seen (V)

first by an anteroposterior ridge. The second type appears to predispose to late degenerative midcarpal lesions [12, 13]. As will be further discussed, arthroscopy has a decisive role in the diagnosis and management of these lesions in the ulnar confines of the midcarpal joint which are not detected by X-ray (Fig. 7).

4.2 Examination of Ligamentous Structures in the Midcarpal Joint

Only two extrinsic ligamentous structures are accessible during midcarpal examination.

The first is the midcarpal segment of the radioscaphocapitate ligament. It is sometimes seen as a ligamentous structure barring the scaphocapitate space. In fact, this tough ligament firmly closes this space, preventing access to the anterior capsule and ligaments. The second is the medial branch of the deltoid V, a ligament stretching between the hamate and capitate. Lesions of this ligament are incriminated in the development of midcarpal instability.

5 Dynamic Tests During Arthroscopy

In diagnostic arthroscopy, it is possible to mobilize the bones in the carpal range to detect instability. These dynamic tests are adapted to the diagnosis of the so-called dissociative instability which is denoted by a modification of spatial coherence (or dissociation) between two adjacent bones. Practically, these dynamic tests are most relevant for the scapholunate and lunotriquetral instability, with the first being by far the most commonly encountered.

It is established that the generation of this type of instability does not follow an 'all or none' law but comes in a wide spectrum of lesions. During the early stages of scapholunate instability, static and dynamic radiography may not detect any lesions. The clinical suspicion evoked is thus confirmed by arthroscopy [4]. The next chapter is dedicated to the use of arthroscopy for the diagnosis of dissociative instability.

References

1. Chen YC (1979) Arthroscopy of the wrist and finger joints. Orthop Clin North Am 10:723–733
2. Whipple TL, Marotta J, Powell J (1986) Techniques of wrist arthroscopy. Arthroscopy 2:244–252
3. Slutsky DJ, Nagle DJ (2008) Wrist arthroscopy: current concepts. J Hand Surg Am 33(7):1228–1244
4. Dautel G, Goudot B, Merle M (1993) Arthroscopic diagnosis of scapholunate instability in the absence of X-ray abnormalities. J Hand Surg 18B:213–218
5. Dautel G, Merle M (1993) Tests dynamiques arthroscopiques pour le diagnostic des instabilités scapholunaires – note de technique. Ann Chir Main 12:206–209
6. Whipple L (1988) Powered instruments for wrist arthroscopy. Arthroscopy 4(4):290–294
7. Abrams RA, Petersen M, Botte MJ (1994) Arthroscopic portals of the wrist: an anatomic study. J Hand Surg Am 19(6):940–944
8. Abe Y, Doi K, Hattori Y, Ikeda K, Dhawan V (2003) Arthroscopic assessment of the volar region of the scapholunate interosseous ligament through a volar portal. J Hand Surg Am 28(1):69–73
9. Abe Y, Doi K, Hattori Y, Ikeda K, Dhawan V (2003) A benefit of the volar approach for wrist arthroscopy. Arthroscopy 19(4):440–445
10. North ER, Thomas S (1988) An anatomic guide for arthroscopic visualisation of the wrist capsular ligaments. J Hand Surg 13A:815–822
11. Berger RA, Landsmeer JMF (1990) The palmar radiocarpal ligaments/a study of adult and fetal human wrist joints. J Hand Surg 15A:847–850
12. Viegas SF (1990) The lunato-hamate articulation of the midcarpal joint. Arthroscopy 6(1):5–10
13. Viegas SF, Wagner K, Patterson R, Peterson P (1990) Medial (hamate) facet of the lunate. J Hand Surg 15A:564–571