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Elbow Arthroscopy

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Arthroscopy of the elbow is a technically demanding surgical procedure. Safe portals of entry into the elbow joint have been established, and this new understanding of arthroscopic portal anatomy, combined with the development of smaller instruments, has made elbow arthroscopy a viable alternative to open arthrotomy in the treatment of elbow disorders. Although technical advances and development of various arthroscopic techniques have enabled elbow arthroscopy to be performed on a reasonably routine basis, attention to detail is particularly important for a safe and reproducible arthroscopic procedure.

Indications & Contraindications

The indications for elbow arthroscopy continue to evolve. At the present time the following indications for elbow arthroscopy have been well accepted :

1. Loose body removal.
2. Evaluation and treatment of capitellum osteochondritis dissecans.
3. Evaluation and debridement of chondral or osteochondral lesions of the radial head.
4. Debridement and lysis of adhesions.
5. Debridement of posttraumatic or certain degenerative processes about the elbow.
6. Partial synovectomy.
7. Partial excision of humeral or olecranon osteophytes.
8. Flexion contracture release.
9. Valgus extension overload syndrome.
10. Irrigation and debridement for septic arthritis.
11. Evaluation of instability especially ulnar collateral ligament.
12. Adjunctive treatment of intraarticular elbow fractures.
13. Diagnosis of chronic elbow pain.

The potential advantages of arthroscopy over open arthrotomy for the treatment of these conditions relate to the relative diminished morbidity associated with arthroscopic intervention compared with that of open incisions. In addition, arthroscopy provides a magnified view that is otherwise impossible without wide exposure of the joint.

Contraindications include any condition where the normal bony or soft tissue anatomy has been distorted in such a manner that the neurovascular structures are placed at risk or the intraarticular space precludes distention, visualization, and instrumentation. Conditions such as bony ankylosis or severe fibrous ankylosis are possibly contraindicated because of the difficulty in introducing instrumentation into the elbow. In addition, previous surgical procedures such as anterior transposition of the ulnar nerve or osteotomies may alter the normal portal anatomy and place neurovascular structures at risk. As with any arthroscopic procedure, certain skin conditions such as cellulitis of the overlying skin that interferes with portal placement and risks intraarticular infection are also contraindicated.

Arthroscopic Setup

Elbow arthroscopy may be performed in either the supine or prone/ lateral position. Although the supine position was initially advocated, it requires arm suspension with an overhead device and limits

visualization of the posterior compartment. The prone position, allows the use of arthroscopic techniques that are standard in other joints, and it eliminates the need for traction devices, thus facilitating portal access and mobility of the joint. Generally, a tourniquet is used along with an arthropump. A 2.7mm 30 degree small joint arthroscope is preferable, however a standard 4 mm arthroscope may suffice for many situations.

The cutaneous landmarks are outlined for the olecranon, radial head, humeral epicondyle, and medial intermuscular septum. An 18-gauge needle is inserted into the anconeus triangle between the olecranon, radial head, and lateral epicondyle. 20 ml of normal saline is injected into the joint and the needle is withdrawn.

Portals

Although numerous portals have been described and are used for specific techniques, three standard portals are commonly used: the proximal medial, the anterolateral, and the posterolateral. The proximal medial portal is used to visualize the anterior joint, including the trochlea, coronoid, medial condyle, radial head, and capitellum [Fig. 1]. The anterolateral portal is used most often for instrumentation and operative intervention. The posterolateral portal is used primarily for visualization of the posterior joint including the olecranon fossa and the tip of the olecranon.

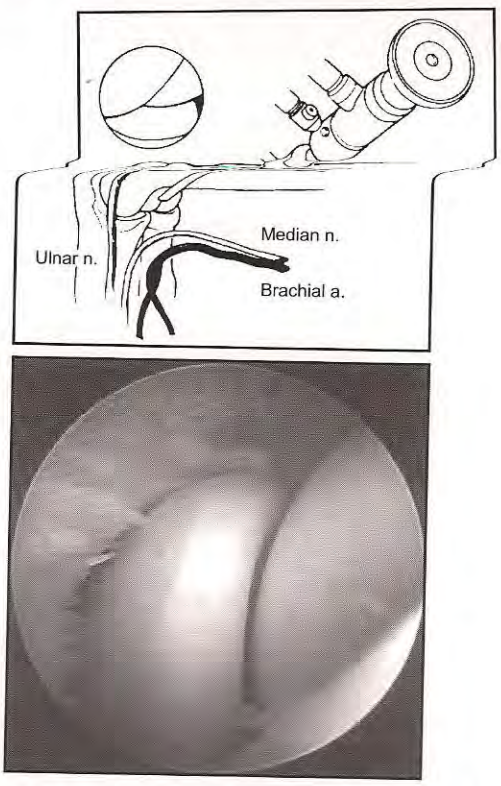

Fig. 1 : The proximal medial portal is located 2 cm proximal to the medial epicondyle and immediately anterior to the medial intermuscular septum. When viewing from this portal, the surgeon can see the radial head and the radiocapitellar articulation.

The proximal medial portal is located 2 cm proximal to the medial epicondyle and immediately anterior to the medial intermuscular septum [Fig. 1]. To avoid injury to the medial brachial cutaneous and medial antebrachial cutaneous nerves, a longitudinal incision is made through the skin only. The sheath and blunt trocar of the arthroscope are inserted along the anterior aspect of the medial intermuscular septum and the anterior surface of the distal humerus in direct contact with the bone, directing the tip toward the radial head. The anterior elbow joint can be clearly visualized from this portal.

The anterolateral portal is established immediately anterior to the radial head, 1 cm distal to the [illegible] second, after the proximal medial portal is established. The telescope is removed from the proximal medial portal and a blunt rod is inserted through the sheath and directed anterolateral to the radial head. It is important that the cannula be more lateral than anterior to the radial head to avoid injury to the posterior interosseous nerve. The blunt rod is pushed through the anterolateral capsule into the subcutaneous tissue, and the skin is incised over the tip of the rod. A separate cannula is then inserted over the rod into the anterolateral aspect of the elbow joint.

The spot in the anconeus triangle when used for telescope introduction becomes the posterolateral portal. Visualization of the posterior joint is accomplished through this portal.

In addition to the three described standard portals, a direct posterior triceps tendon-splitting approach may be used for inserting instruments in

the olecranon fossa. A 5-mm incision is made 2 cm proximal to the tip of the olecranon process with the elbow flexed 90°. A blunt cannula and trocar are inserted into the olecranon fossa under direct visualization through a telescope in the posterolateral portal.

Arthroscopic Anatomy

The medial portal is best for observing the radial head and its articulation with the capitellum, and the lateral portals are best for viewing the coronoid process and the medial capsule. The lateral portals can be used to view the posterior articulation of the olecranon and the humerus and the articulation of the posterior portion of the capitellum and radial head.

Proximal Medial Portal : When viewing from the medial portal, the surgeon can see the radial head and the radiocapitellar articulation [Fig. 1]. Because the forearm is free in the gravity-dependent, prone position, it can be pronated and supinated allowing the surgeon to see nearly three-fourths of the surface of the radial head. With varus pressure on the forearm, the joint may be opened a little farther allowing more of the radial head's articular surface to be seen. The annular ligament can be seen coursing across the neck of the radius. As the arthroscope is retracted and rotated, most of the trochlea can be seen, and, superiorly, the attachment of the capsule to the humerus is visible. The coronoid process articulation can be seen as the arthroscope is retracted farther, although it is seen best from a lateral portal.

Anterolateral Portal : When viewing through the anterolateral portal, the most obvious structure is the coronoid process and its articulation with the trochlea [Fig.2]. Flexion and extension of the elbow allows the surgeon to inspect this articulation.

Midlateral Portal : The midlateral portal is used to view the posterior compartment. The articulation of the olecranon with the humerus in the posteromedial compartment and osteophytes, or spurs, in this area can be easily seen through this portal [Fig. 3]. If the arthroscope penetrates farther and is rotated, the medial articulation of the olecranon and humerus can be seen. A portion of the posterior bundle of the ulnar collateral ligament can also be seen through this portal.

Fig. 2 : When viewing through the anterolateral portal, the most obvious structure is the coronoid process, its articulation with the trochlea, and the medial capsule.

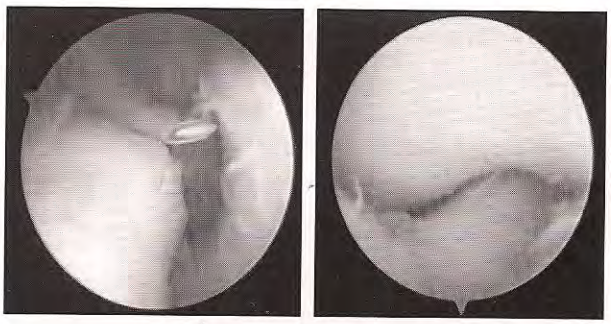

Fig. 3 : The midlateral portal is used to view the posterior compartment. The articulation of the olecranon with the humerus in the posteromedial compartment and osteophytes, or spurs, in this area can be easily seen through this portal. If the arthroscope penetrates farther and is rotated, the medial articulation of the olecranon and humerus can be seen.

Straight Posterior Portal : Visualization of the posterior compartment can be accomplished through the straight posterior portal, which penetrates the tendon of the triceps and looks directly on the articulation of the olecranon and the humerus [Fig. 4]. Turning the arthroscope both medially and laterally allows the surgeon to see the entire articulation of the olecranon. If normal elbow flexion is possible, the olecranon fossa can be seen from this portal. With the arthroscope in the midlateral portal, flexion and extension of the elbow affords a

complete view of the entire articulation from the tip of the olecranon to the coronoid process anteriorly. As the arthroscope is rotated and retracted, it can be brought into the anterior compartment to view the radioulnar joint and the inferior surface of the radial head. This portal also allows a different view of the articulation of the capitellum and may be best for visualizing articular damage and osteochondritis dissecans of the capitellum.

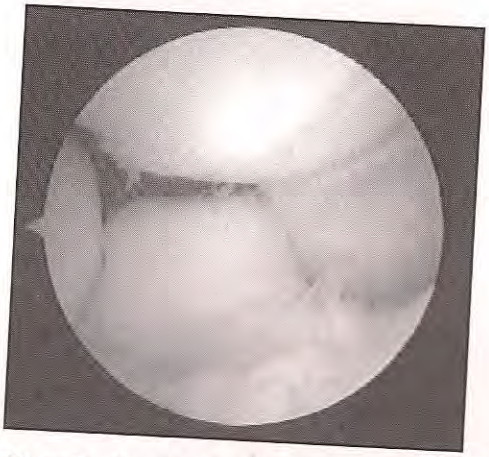

Fig. 4 : Visualization of the posterior compartment can be accomplished through the straight posterior portal. Turning the arthroscope both medially and laterally allows the surgeon to see the entire articulation of the olecranon from the tip of the olecranon to the coronoid process anteriorly. As the arthroscope is rotated and retracted, it can view the radioulnar joint and the inferior surface of the radial head.

Applications

Synovectomy: Systemic inflammatory diseases such as rheumatoid arthritis often affect the elbow joint. These inflammatory arthritides produce both mechanical and biomechanical problems within the elbow joint. Mechanically, the expanse of synovitis associated with rheumatoid arthritis can stretch the capsuloligamentous structures around the joint. With the loss of ligamentous integrity about the elbow, the biomechanics of the joint articulations are altered, and areas of uneven wear are produced resulting in erosion and destruction of the articular surfaces. The goal of synovectomy in rheumatoid arthritis and other inflammatory arthritides is to remove synovial tissues within the joint that cause expansive synovitis leading to mechanical destruction of the joint and the deposition of antigen antibody complexes that initiate the biochemical destruction of the articular surfaces.

Anterior synovectomy is accomplished with a telescope initially in the proximal medial portal and the shaver initially in the anterolateral portal. These are then interchanged for complete anterior synovectomy. Posterior synovectomy is accomplished with the shaver in the posterior portal and the telescope in the posterolateral portal. Postoperatively, motion is initiated early.

Loose Bodies : Removal of loose bodies is one of the most common indications for elbow arthroscopy. Loose bodies within the elbow may be composed of osteocartilaginous tissue, cartilaginous tissue, or fibrous tissue. The osteocartilaginous loose bodies are most often the result of osteochondritic lesions of the capitellum, osteochondral fractures from lateral compression injuries, and synovial diseases such as synovial chondromatosis. Cartilaginous loose bodies are usually the result of traumatic shearing off of the articular cartilage surface with the resulting free fragment of cartilage becoming a loose body. Fibrous loose bodies are usually the result of hypertrophied synovial villi and become fibrotic and detached and float free within the elbow joint.

Loose bodies within the elbow joint are a concern for several reasons. First of all, they may cause mechanical symptoms such as catching or locking of the elbow joint with range of motion. They may also cause wear and destruction of the chondral surfaces if they become caught between these surfaces. Loose bodies may be found in many locations within the elbow joint. Because many of

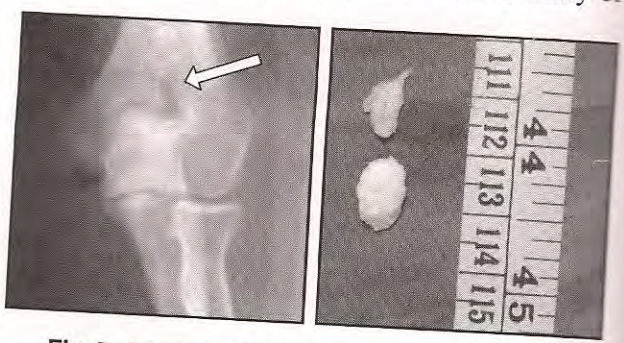

Fig. 5 : Loose bodies will often be found in the posterior compartment of the elbow.

rope over a pulley to the weight or when adhesive tapes are used to the fingers, it traverses through the spaced out holes in the small wooden 12 inch ruler, to the nylon rope and then through a pulley to the traction weight. Some surgeons keep the thumb free from the traction system. The weight used for traction is around 4 kg, the counterweight being 4 kg on the portion of the arm between the tourniquet and the elbow. It is imperative that the portion of the arm used for counter traction is well padded. The traction tower devised by W.Terry can also be used but I don't have experience with the same.

JESS System : Earlier about 10 years back, I used to use the adhesive tape traction system. It is quite cumbersome and sometimes slips off during surgery due to soaking of the adhesive tape at the time of the preparation and with all these adhesive around, space during for surgery gets reduced. Therefore in the last 5 years, I regularly use the JESS fixator distraction assembly that one uses for fixation of # distal end radius. Instead of the hinge at the wrist joint, one uses a distraction apparatus, which can safely and securely distract the wrist joint to optimum level without causing neurovascular damage. The assistant stabilizes the hand with JESS fixator with one hand and allowed to hold the camera with the other. Thus the surgeon's both hands are free to work and manipulate the instruments for the necessary procedure. I find this system very versatile for this procedure and offers many advantages.

Arthroscope System : The arthroscope used is 2.7 mm. The trolley with the monitor, video, shaver, camera console and the light source is kept opposite to the extremity. Wrist arthroscopy is commonly done through the dorsal portal but a semi-invasive volar portal has been described, often because of the danger of damage to the principle neurovascular bundles on the volar aspect, it is not done regularly.

Portals : Before making the portals a thorough knowledge of the six compartments on the dorsum through which the tendons run is absolutely necessary. In the first compartment abductor pollicis longus(APL)and extensor pollicis brevis (EPB), the second extensor carpi radialis longus(ECRL) and extensor carpi radialis brevis (ECRB).The third is extensor pollicis longus (EPL), the fourth extensor digitorum longus (EDL)and extensor indicis (EI),the fifth extensor digitorum minimi (EDM) and the sixth, the extensor carpi ulnaris (ECU). The portals are made in such a way to avoid damage to the dorsal vessels and nerves and the portals are made according to the compartments.

Portal 1-2 is between compartment 1 and 2 and helps to directly approach to the radial area of the radiocarpal joint and can visualize the radial prestyloid recess, radioscaphoid ligament and the scaphoid surface of the radius. It is very much in proximity to the radial artery and the three terminal branches of the superficial radial sensory nerve and the EPL. This portal is not very frequently used.

Portal 3-4 is made between the 3 and 4 compartments. It is the main portal for introducing the telescope, as it not only allows better visualization of the scaphoid and lunate bones but also corresponding surfaces of the radius, radioscapholunate and scapholunate ligament and the triangular fibrocartilage complex. It is on the radial side of the EDL and 3rd metacarpal.

Portal 4-5 is made on the ulnar side of the 3rd metacarpal and medial side of EDL. This portal allows us to visualize the TFCC and scapholunate ligaments, ulnar capsule, ulnar prestyloid recess and the radial and lunate surfaces of the radius, scaphoid, lunate, the triquetrum and occasionally the pisiform. This portal is commonly used for introduction of the probe and instrumentation.

Portals 6R and 6RU are made on the radial and ulnar side of the 6th compartment. It is often used for inflow portal and can help to visualize the TFCC, lunotriquetral and ulnotriquetral ligaments, ulnar prestyloid recess.

RMC (radiomidcarpal) portal is made on the radial edge of the 3rd metacarpal and 4th dorsal compartment approximately 1cm distal to the 3-4 portal. It is for better visualization of the distal row of carpal bones and distal surface of proximal row of carpus.

UMC(ulnar midcarpal)portal is located on the medial side of 3rd metacarpal and between EDL and EDM. It is often used for instrumentation for the ulnar side of the midcarpal.

Procedure

It is important to surface mark the distal radius, ulnar styloid and the various tendons of the dorsal compartments. The portals are marked with sterile marker pen. Most often, one uses the 3-4 portal and the 4-5 portal on either side of the 3rd metacarpal. The joint is infiltrated with 10cc saline entry and the skin perforated only up to the subcutaneous with a vertical 3mm incision with a stab knife, parallel to the tendons and further deepened with the help of the mosquito. The feeling of giving way signals the entry into the joint. The sheath with the blunt trochar is introduced through the 3-4 portal, the trochar is replaced with 2.7mm telescope with camera. The inflow may be through the sheath or another separate 6R or 6U portal, through a 16 gauze needle attached to the inflow system. A thorough diagnostic round is taken examining the radial stylois recess, the scaphoid, lunate, ligaments and the radius surface and TFCC and palpating the surfaces through a probe introduced through the 4-5 portal. The portals can be exchanged for the telescope and instrumentation, depending upon which side the pathology exists either on ulnar or radial side. Portals 1-2 are used for pathology in the 1 and 2 compartment. Similarly RMC and UMC portals for the midcarpal pathology.

Post-operative Care

The portals are kept open and the wrist is immobilized with a below elbow plaster slab and the hand is to be elevated for 48 hours. The slab used for immobilisation is kept for 1 to 6 weeks, whether the scopy is done only for diagnosis or as a therapeutic procedure.

Finally, the functional return of the wrist after the procedure also depends upon good rehabilitation.

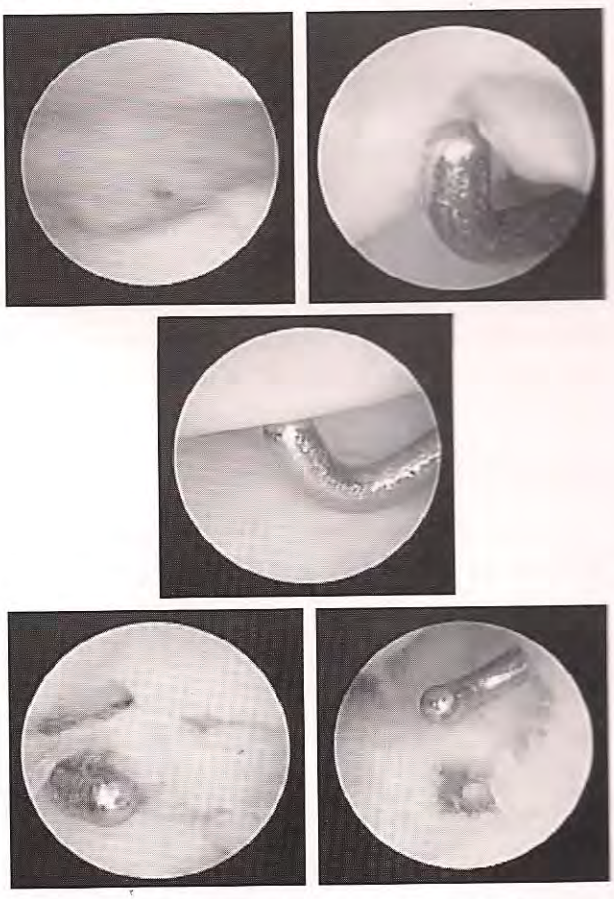

Fig. 1 : Wrist arthroscopic images of different facets of wrist joint and TFCC.

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