Arthroscopy of the elbow is now a well established technique since increasing in popularity during the 1980s. Improved surgical instrumentation and the acquisition of arthroscopic skills have each contributed to the rise in popularity of the arthroscopic approach. It is technically demanding and requires precise knowledge of elbow anatomy, as there are several neurovascular structures in close proximity. Advances in arthroscopic surgery have allowed many experienced surgeons to treat a variety of conditions. The success and outcome largely depends on the underlying condition and the skill of the surgeon.

Indications

Arthroscopy of the elbow is now being used with increased frequency to both treat and diagnose elbow disorders. It is indicated in patients that have failed conservative management where the symptoms are usually severe enough to have interfered with work, activities of daily living or sleep for at least six months. It is also useful as a diagnostic tool, particularly when the diagnosis is in doubt or therapeutic intervention may be anticipated.

Removal of loose bodies and/or debridement of the arthritic elbow is perhaps the commonest indication for elbow arthroscopy. Patients usually present with restricted motion and pain, often at the extremes of flexion and extension. Arthroscopic aims are to remove all loose bodies, debride the joint, and remove impinging osteophytes, whilst in some cases the capsule can also be released to improve range of movement. Other indications for elbow arthroscopy include the treatment of osteochondral lesions, diagnostic arthroscopy, valgus extension overload syndrome, elbow instability, tennis elbow release and...
the management of arthrofibrosis and post-traumatic contracture. It may also be used for washout of septic arthritis, and synovectomy for persistent synovitis. Less common procedures include ulnar nerve decompression and assisted fixation of coronoid process fractures.5,6

Contraindications to elbow arthroscopy include abnormal anatomy, such as patients with previous ulnar nerve transposition, congenital or post-traumatic conditions, rheumatoid deformities and severe ankylosis. Relative contraindications include uncooperative patients that may be unable to complete a rehabilitation regime following capsular release.

Instrumentation and patient position

Elbow arthroscopy is usually performed under general anaesthesia with a tourniquet. Most surgeons avoid using a brachial plexus block so that assessment of the neurological status can be made following surgery. After pre-operative evaluation we identify the bony landmarks (lateral and medial epicondyles, the olecranon tip and radial head) using a sterile marker pen on the ward with the patient positioned as they would be for surgery (Fig. 1). This not only helps the surgeon with orientation and planning but also helps with the consent process. A 4 mm 30 degree arthroscope is used predominantly, but a 2.7 mm arthroscope can also be used in tight spaces, such as the lateral compartment, or in small patients. An arthroscopic pump or gravity inflow system is commonly used to help with visualisation. The ideal position for elbow arthroscopy allows maximal visualization of the joint and also allows flexion and extension of the elbow with ease of access to the anterior and posterior aspects of the elbow in case open intervention is required. There are three main positions suitable for elbow arthroscopy. These are supine, prone and the lateral decubitus.

Supine

The supine position was first described by Andrews and Carson.7 In the supine position the patient’s shoulder is abducted to 90 degrees and the elbow flexed to 90 degrees with the arm suspended by an overhead traction device. The advantages of the supine position are that it allows access to the anterior elbow joint and the elbow remains in an anatomic position providing the inexperienced surgeon with familiarity and ease of orientation. The disadvantages are that access to the posterior compartment is awkward, the neurovascular structures are closer to the working area, and an assistant may be required to stabilise the arm whilst in the traction device. A modification of this technique has been described with the shoulder flexed to 90 degrees so the forearm is suspended over the chest and held in position to provide stability.8 Access to the posterior aspect of the elbow is much easier and gravity allows the anterior neurovascular structures to fall away, making portal entry safer. However, a mechanical arm holder or assistant is required to maintain this position.

Prone

The prone position was first described by Poehling et al.9 The patient is intubated and positioned prone with the shoulder abducted 90 degrees and the elbow flexed at 90 degrees. The arm hangs with the aid of gravity allowing the anterior structures to drop away from the anterior elbow joint. The other advantages include ready access to the whole elbow especially the posterior structures if an open procedure is required. The main disadvantage is the requirement for airway protection by intubation.

Lateral decubitus

In our centre, we use the lateral decubitus position as reported by O’Driscoll and Morrey.10 This represents a modification of the prone position. The patient is positioned and a tourniquet applied. The arm is rested on a padded support, which provides stability and allows the elbow to be flexed and extended. The main advantage of this position is the ease of access to both the anterior and posterior aspects of the elbow without impingement of the arthroscope. The main disadvantage of this position is the limited access to the medial aspect of the elbow.

Portal placement and surgical technique

Portal placement depends on surgeon preference and the surgical indication. The soft spot, or direct lateral portal, is
located at the centre of a triangle between the lateral epicondyle, subcutaneous olecranon tip and the radial head (Fig. 1). It is used primarily to inject the joint with 20 to 30 ml of normal saline. This distends the joint, pushing neurovascular structures away thereby reducing the chances of nerve or vascular injury. It can also be used to visualise the olecranon fossa, the olecranon/trochlear articulation and the posterior aspect of the radio-capitellar joint. Instrumentation may also be performed from this portal.

An entry portal is then made and the site of this again depends on surgical preference and the particular indication for surgery. We use the anterolateral portal, but other options include the proximal medial or proximal lateral portals. Careful surgical technique again is necessary to reduce risk to neurovascular structures. The skin is incised with an ‘11’ blade, ensuring that only the skin and not the underlying subcutaneous tissue is divided, so as not to injure the subcutaneous nerves. Blunt dissection is performed with a haemostat, followed by arthroscopic trochar and cannula insertion. Switching sticks may also be used to establish the portals using an inside out technique.

Anterolateral portals

The anterolateral portal is located 3 cm distal and 2 cm anterior to the lateral epicondyle (Fig. 1). The trochar is aimed towards the centre of the elbow joint and is passed through the extensor carpi radialis brevis and supinator muscles. It provides excellent visualisation of the lateral and medial aspect of the elbow with access to the coronoid process, radial head, trochlea and medial capsule. The main disadvantage is the close proximity of the radial nerve. Lynch et al. found that the cannula passes within 3 mm of the radial nerve and the posterior antebrachial cutaneous nerve is located within 2 mm of the portal. For this reason some surgeons prefer to use the proximal anterolateral portal. This is located 2 cm proximal and 1 cm anterior to the lateral epicondyle (Fig. 1). Studies have shown that the radial nerve is almost twice as far from this portal when compared to the more distal portal, and still provides good visualisation of the joint.

Proximal medial portal

The proximal medial portal is a good alternative as an entry portal. It is located 2 cm proximal to the medial epicondyle and just anterior to the medial intermuscular septum (Fig. 2). The ulnar nerve is situated 12 mm posterior to this portal and can be avoided by introducing the trochar anterior to the intermuscular septum. Whilst palpating the septum, the trochar is aimed towards the radial head, sliding across the anterior aspect of the distal humerus. This portal provides good visualisation of the anterior aspect of the elbow joint, particularly the radial head, coronoid and lateral capsule and gutter. The median nerve is 12 mm and the brachial artery 18 mm anterior to the portal, but the structure most at risk is the medial antebrachial cutaneous nerve, located at an average of 2.3 mm from the cannula. This portal is contraindicated when the anatomy of the ulnar nerve is unknown or there has been an ulnar nerve transposition.

Posterior portals

Posterior elbow arthroscopy is safer as the neurovascular structures lie further away than they do with the anterior portals. The two main portals are the posterolateral and direct posterior. The posterolateral portal is used primarily for visualisation of the olecranon fossa, olecranon tip, medial and lateral gutters and the posterior radio-capitellar joint. The posterior radio-capitellar joint is a frequent site for loose bodies that are missed. An accessory lateral...
portal may be required to retrieve loose bodies, or debride the capitellum as in osteochondritis dissecans. The portal is located 3 cm proximal to the olecranon tip and lateral to the triceps muscle. The posterocentral portal is located 3 cm proximal to the olecranon tip in the midline (Fig. 3). It can be used to debride the olecranon, the triceps bursa and to aid in visualisation of the olecranon fossa. For both posterior portals the trochar is aimed towards the olecranon fossa at 45 degrees with the elbow flexed at 90 degrees.

Another posterior portal described is the posterior retractor portal, located 2 cm proximal to the midline posterior portal. This is not frequently required but a Howarth elevator or similar retractor can be used to elevate the joint capsule, making it easier to visualise the olecranon fossa.

Results

Treatment of the arthritic elbow

Elbow arthroscopy offers the surgeon an intermediate step between nonoperative management and elbow arthroplasty for the management of osteoarthritis. Patients may present with pain, stiffness or mechanical symptoms secondary to loose bodies. Arthroscopic procedures include removal of loose bodies, debridement of the joint as well as partial resection of the coronoid along with the radial and coronoid fossae (Fig. 4). Anterior capsule release can also be used to improve elbow extension if necessary. Debridement of the radial head or excision may also be achieved quite effectively. Redden and Stanley described an arthroscopic technique of fenestration of the olecranon fossa which is essentially the same as an OK procedure, and this may also improve function and pain relief. Cohen et al. compared the results of open and arthroscopic debridement in their non-randomised controlled study. They found an arthroscopic procedure was significantly more effective in achieving pain relief than an open procedure, but more flexion could be obtained with the open procedure with a more generous debridement of the posterior compartment and release of the posterior capsule.

Several other studies have reported good results with arthroscopic techniques for osteoarthritis, with low complication rates. Savoie and Field reviewed 24 patients (18 had radial head excision) with osteoarthritis treated by debridement and fenestration with good results. They achieved a reduction in pain and an average increase in the arc of movement of 81 degrees. Other studies have looked at the combined results of osteoarthritis and post-traumatic contractures achieving good results with an improved range of movement of more than 40 degrees. Some authors have also demonstrated good results without the need for radial head excision even in severe radiocapitellar chondral loss.

Thrower’s elbow

Posterior and posteromedial olecranon osteophytes may form as a result of valgus extension overload identified in the throwing athlete. Arthroscopic surgery can be successful in relieving symptoms and returning the throwing athlete to competition. Arthroscopy is most successful when loose bodies are removed, although good results can also be achieved by debridement of the posterior osteophytes, with a high return to the same level of sporting participation (85%). Care should be taken when removing the olecranon osteophyte as the results of cadaveric studies have shown that taking native bone may place added stress on the medial collateral ligament (MCL) hence contributing...
to the patient’s symptoms. Chronic MCL insufficiency is a common finding with posteromedial olecranon osteophytes. It can be assessed by applying a valgus stress test at 70 degrees of flexion. Medial opening of the radio-capitellar joint of more than 1–2 mm suggests MCL insufficiency and reconstruction is indicated in this group of patients.

Contractures/arthrofibrosis

Contractures of any joint may result from a number of factors. Commonly in the elbow this occurs following trauma, osteoarthritis or a combination of the two. Intrinsic causes are loose bodies, joint incongruity, bony spurs and synovitis. Extrinsic causes include capsular contractures and ligament injuries. Peripheral causes include neuromuscular disorders, such as cerebral palsy, head injury etc.

Usually, elbow arthroscopy will address the anterior compartment first using a combination of anterior, lateral and medial portals. Loose bodies are removed first then any bony spurs are debrided, followed by release of the anterior capsule. The capsule is released from the proximal aspect as it attaches to the anterior humerus and a bridge of tissue is resected to avoid further contracture. The brachialis muscle provides anterior protection to the neurovascular structures, namely the median nerve and brachial artery, but the radial nerve is particularly at risk anterior to the radial head.

Posterior arthroscopy is performed next. Fibrotic scarring is frequently found, which impedes visualisation of the olecranon fossa. This must be removed first followed by loose bodies, bony spurs and release of the posterior capsule. Usually this is found to be scarred against the posterior triceps muscle. Care must be taken with debridement near the medial gutter as the ulnar nerve lies in close proximity. Some surgeons recommend a small open incision for identification and protection of the nerve, with direct open release of the postero-medial capsule.

There have been few reports of arthroscopic arthrolysis. Many surgeons are concerned about the risk of catastrophic nerve injury, particularly of the radial nerve with anterior capsule release and the ulnar nerve with postero-medial release. Jones and Savoie reported on 12 patients treated by arthroscopic capsular release with good results. However, one patient had a permanent posterior interosseous nerve palsy. Savoie et al. also reported impressive results in 53 patients with an increased range of flexion arc of 41 degrees and extension of 42 degrees. In addition Byrd reported good results with an increase in flexion of 14 degrees and extension of 30 degrees. Other studies have included a combination of patients with post-traumatic contracture and osteoarthritis with similar results, less morbidity and earlier rehabilitation as compared to open techniques.

Radial head excision

Traditionally, radial head excision is performed using open methods for radio-capitellar arthritis. However, recent advances in arthroscopic instrumentation have led some surgeons to perform radial head excision arthroscopically. The main advantages over open surgery are that the whole elbow can be addressed removing all loose bodies, debris, synovium and bony spurs as well as allowing earlier rehabilitation. There have been several series reporting good results of arthroscopic radial head excision with no complications. So far studies have reported better range of movement when compared to open procedures. This most likely is a result of reduced tissue trauma and therefore less postoperative contracture.

Rheumatoid arthritis and synovectomy

With the introduction of improved disease modifying medications, synovectomy of the elbow in rheumatoid arthritis is uncommon. Theoretically a more complete synovectomy is possible arthroscopically due to better visualisation. Indeed, studies have shown good early results with improved pain scores, but they have also shown that the range of motion deteriorates more rapidly with time, when compared to open synovectomy. Lee and Morrey reported good short term results in 11 patients (14 elbows) with reduced pain (93% good to excellent) but their results deteriorated rapidly. Horii et al. also reported good early results, mainly in patients with only early radiographic changes. They found recurrence rates comparable to open procedures. The short term benefits of this procedure must be balanced against the risks, particularly neurovascular injury.

Tennis elbow

Arthroscopic tennis elbow release is one of many techniques reported for the management of tennis elbow following failure of conservative management. Usually an undersurface tear or abnormality of the capsule adjacent to the ECRB tendon insertion can be identified. The capsule is removed with a shaver or radiofrequency probe, then a small radial resector is used to remove the undersurface of the ECRB tendon from the lateral epicondyle from proximal to distal. In a third of patients complete rupture of this tendon has been reported and therefore, in this situation, debridement alone is required. Arthroscopic release has produced similar results to open, percutaneous or endoscopic techniques.

Others

There have been few studies on elbow arthroscopy for osteochondritis dissecans of the capitellum. A prospective cohort examined the clinical outcome and functional results in 15 patients. 80% of patients were able to return to their pre-injury level of sport activity with good pain relief and improved function. However, it still remains unclear whether microfracture is of benefit in the management of these patients. Porcelini et al. have reported good results with arthroscopic techniques for ulnar nerve decompression, but few surgeons will attempt this risky procedure when good, reliable results can be obtained using open techniques. Joint lavage and washout may also be performed arthroscopically for septic arthritis, as for any other joint, with equally good results.
Complications

The overall rate of major and minor complications in elbow arthroscopy has been reported to be 10%, which is much higher than seen after knee and shoulder arthroscopy at 1–2%. This has led some surgeons to avoid using this technique. However, reports of devastating nerve injury are rare. In a review of 473 elbow arthroscopies Kelly et al. reported a major complication in 0.8% of patients, all of which were septic arthritis. Other major complications reported have been compartment syndrome and permanent nerve injury. Minor complications (11%) include superficial wound infection, transient nerve damage, prolonged portal drainage, contracture, haematoma and complex regional pain syndrome. The most frequent minor complication in Kelly et al. series was prolonged portal drainage in 5% of cases, all of which were from lateral portals. They recommended the use of locked horizontal mattress sutures to minimise the risk of this complication.

The majority of nerve injuries are transient nerve palsies but some permanent nerve injuries have been reported. The cause may be direct nerve injury from a scalpel, trochar or local anaesthetic infiltration, or from external compression either due to tourniquet use or fluid extravasation. Patients with rheumatoid arthritis and contractures of the elbow are most at risk of this complication. Careful selection of patients, pre-operative marking of bony landmarks and the use of fluid to distend the joint, all help to reduce the risk of neurological injury. Other techniques of reducing nerve injury include the use of arthroscopic retractors and, when necessary, formal identification of the nerve either arthroscopically or via a small open incision. Experience of the surgeon is an important factor, especially with the more complex procedures.

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