Advances in arthroscopy during the last 30 years have specified new indications for elbow arthroscopy. Burman originally stated that the elbow was “unsuitable” for arthroscopic examination, but later retracted the statement when he was able to visualize the anterior compartment in a cadaveric study. In the 1970s, advances in arthroscopic equipment, such as smaller scopes, led to a renewed interest in elbow arthroscopy. This led to safer techniques in portal placement, technical advances in arthroscopic equipment, and an ever increasing number of elbow arthroscopies performed each year.

Regional Anatomy
Knowledge of the superficial and deep anatomy of the elbow and proper identification of the major neurovascular structures, prior to the procedure, will help guide the surgeon, not only in establishing portals, but also in protecting any neurovascular structures that could be harmed from within the joint. The bony anatomy of the lateral and medial epicondyles is palpable and serves as the origins for the mobile wad and the flexor/pronator groups, respectively. The olecranon process, the radial head, which is 3 cm to 4 cm distal to the lateral epicondyle, can be identified on pronation and supination. The antecubital fossa has three muscular borders: 1) the mobile wad, laterally, consisting of the extensor carpi radialis brevis (ECRB); the extensor carpi radialis longus (ECRL), and the brachioradialis; 2) the pronator teres, medially; and the biceps, superiorly. The triceps lies posteriorly along with the olecranon tip and the anconeus, which runs from the lateral epicondyle to the proximal ulna.

There are numerous sensory nerves in the elbow region which are at risk during portal placement. The medial brachial cutaneous nerve innervates the skin of the postero-medial arm down to the level of the olecranon. The medial antebrachial cutaneous nerve gives branches to innervate the medial elbow and forearm. The lateral antebrachial cutaneous nerve, a continuation of the musculocutaneous nerve, gives sensation to the elbow and the lateral quarter of the forearm. The posterior antebrachial cutaneous nerve, which is a branch of the radial nerve, innervates the posterolateral elbow and the posterior forearm.

The deep neurovascular structures are at risk not only during portal placement but throughout the arthroscopic procedure. The median nerve lies in the antecubital region on the medial aspect of the brachial artery and biceps. It then courses through the two heads of the pronator teres beneath the flexor digitorum superficialis (FDS) as it runs down the forearm. The radial nerve penetrates the lateral intermuscular septum in the arm, crosses anterior to the lateral epicondyle, and enters the antecubital region where it gives off two branches; the superficial sensory branch and the posterior interosseous nerve (PIN). The PIN runs around the posterolateral radial neck before it enters the supinator. The ulnar nerve penetrates the medial intermuscular septum, travels behind the medial epicondyle in the cubital tunnel, and courses distally between the flexor carpi ulnaris (FCU) and the FDS. The brachial artery descends on the anterior aspect of the brachialis just medial to the biceps and bifurcates into the radial and ulnar artery at the level of the radial head.

Portal Placement
There are a number of general principles in planning arthroscopic portals for the elbow which, when adhered to, allow safe and effective entrance into the elbow. The surgeon should be familiar with the regional anatomy, especially the
neurovascular structures at risk. The surgeon must mark all anatomical structures on the skin prior to any incisions. The elbow should be flexed to 90° before marking the skin. This increases the capacitance and compliance and moves the neurovascular structures further from the portals. Only the skin is incised with a scalpel. This protects underlying neurovascular structures and limits fluid extravasation during the procedure. To gain maximum safety, new portals are established into distended joint, moving structures at risk further away from the joint itself.

Although there have been a number of portals described in the literature, the following seven portals are the most frequently used, because they have been shown to give optimum effect with the least complications.

**Direct Lateral Portal**

Also known as the soft spot, is the middle of the triangle formed by the olecranon, radial head, and lateral epicondyle and is initially used for distension. During the procedure, it is a viewing portal for 1) working in the posterior chamber where the entrance passes between the anconeus and the triceps and 2) the radiocapitellar joint, in which it passes through the anconeus. The only neurovascular structure at risk is the posterior antebrachial cutaneous nerve.

**Proximal Medial Portal**

The proximal medial portal is located 2 cm proximal to the medial humeral epicondyle and slightly anterior to the intermuscular septum. The trochar is aimed toward the radiocapitellar joint and passes the ulnar nerve which is within the vicinity; the nerve should be protected as long as the surgeon stays anterior to the septum. This portal allows for excellent visualization of the anterior compartment and the radial head. It is a working portal when viewing through the anterolateral portal and can be used as a high flow irrigation portal when viewing through the posterolateral portal. The position of the median nerve averages 12.4 mm from the portal in the distended joint but only 7.6 mm in the nondistended joint and is protected by the brachialis muscle. The ulnar nerve is approximately 12 mm distant and is protected by the septum, unless the patient has a history of ulnar nerve transposition. The latter condition is a contraindication to using the proximal medial portal. The medial antebrachial cutaneous nerve is within 6 mm when the elbow flexed 90°.

**Anterolateral Portal**

Originally described as 3 cm distal and 1 cm anterior to the lateral epicondyle, this location has been revised to reposition the portal further from the radial nerve. It is now described as 1 cm distal and 1 cm anterior to the lateral epicondyle in a sulcus that can be felt between the radial head and capitellum. The portal passes through the ECRB and supinator and creates a view of the medial capsule, coronoid, and trochlea. The surgeon must keep in mind that with the elbow flexed, the portal can be as close as 3 mm to the radial nerve and averages only 2 mm from the posterior antebrachial cutaneous nerve. This portal has fallen into disfavor in preference to the safer proximal anterolateral portal described below.

**Proximal Lateral Portal**

The proximal lateral portal site is 2 cm proximal and 1 cm anterior to the lateral epicondyle. The trochar pierces the brachioradialis and distal brachialis before entering the capsule. This portal allows for excellent anterior visualization. It passes 6.1 mm, on average, from the lateral antebrachial cutaneous nerve. The radial nerve averages 9.9 mm with the elbow flexed and 4.9 mm in extension. This is twice as far from the radial nerve when compared to the anterolateral portal. The proximal lateral portal is, therefore, not only safer than the anterolateral portal, but allows for a more extensive examination of the joint.

**Anteromedial Portal**

The anteromedial portal may be created under direct visualization from the lateral portal. Its location is described as 2 cm anterior and 2 cm distal to the medial epicondyle. The trochar penetrates the flexor-pronator tendinous origin and brachialis and gives a view of the entire anterior compartment. The portal averages 1 mm from the medial antebrachial cutaneous nerve and 7 mm from the median nerve in a flexed elbow (only 2 mm in an extended elbow). Linfield recommends starting more proximally in order to parallel the median nerve as the approach toward the capsule.²

**Posterolateral Portal**

The posterolateral portal is located 3 cm proximal to the olecranon just superior and posterior to the lateral epicondyle. It allows visualization of the olecranon tip and fossa and the posterior trochlea. With a 4 mm, 70° scope, one can see the posterior bundle of the ulnar collateral ligament (UCL). The medial and posterior antebrachial cutaneous nerves are approximately 25 mm from the posterolateral portal. One must remember to take care in evaluating the medial gutter, as the ulnar nerve is immediately superficial to the medial capsule.

**Straight Posterior Portal**

The site for the straight posterior portal is located 3 cm medial to the posterolateral portal. Use of the portal is helpful when removing osteophytes that impinge on the olecranon. It is usually necessary to create this portal when doing a complete synovectomy of the joint. The portal averages 23 mm from the posterior antebrachial cutaneous nerve and 25 mm from the ulnar nerve.

**Preoperative Planning**

A complete history and physical should be done with a focus on a history of ulnar nerve transposition and an examination...
to test for ulnar nerve subluxation. Any history of trauma to the region may distort the anatomy and possibly preclude the patient from arthroscopic surgery. Appropriate radiographs of the elbow should be taken preoperatively, including an axial view. Of note, 25% to 30% of loose bodies are not detected on plain films. Frequently, these loose bodies are arthroscopically identified in the posterior fossa when observed with the arthroscope.

**Positioning and Instruments**

**Supine Position**

The supine position was popularized by Andrews. The arm is suspended in both 90° of shoulder abduction and elbow flexion. Advantages include excellent visualization of the posterior compartment, access to the patient’s airway, and access to the patient’s entire elbow, should the surgeon need to convert to an open procedure.

The prone position was introduced by Poehling and colleagues, in 1989, who felt it had several advantages over the supine position. These advantages include: 1) no need for arm suspension; 2) better visualization of the posterior compartment; 3) a stable arm position; and 4) displacement of the neurovascular structures anteriorly by gravity. The abducted shoulder and elbow are hung over an arm board, allowing the elbow to move freely through a complete range of motion. This position also allows for conversion to an open procedure, however, access to the anterior elbow is difficult.

**Lateral Decubitus Position**

O’Driscoll recommends the lateral decubitus position, because it has similar access when compared to the prone position but also provides better access to the patient’s airway. Takahashi recommends attaching a 3 kg to 6 kg weight to the patient’s hand to increase access to the joint. He reports as much as 1.8 mm of distraction across both the radiocapitellar joint and ulnotrochlear articulation.

The standard instrument for elbow arthroscopic procedures is the 4.0 mm, 30° scope. A 70° scope is occasionally useful in areas of limited space and decreased maneuverability. A 2.7 mm scope may also be applied in smaller spaces. A cannula system is used for interchangeability. Nonvented cannulas and a Coban around the forearm will help prevent extravasation. Blunt trochars should be used to protect neurovascular structures.

**Procedure**

A tourniquet is applied to the proximal arm and is inflated during the case. As mentioned previously. Prior to the incision, all landmarks are identified and marked. Normal saline (15 cc to 25 cc) is injected through the lateral soft spot to achieve capsular distension. To verify the needle is within the joint, one should note backflow as well as the arm favoring a position of extension and supination on capsular distension. Gallay and associates reported a stiff elbow has less than one-half the capacitance and is one-sixth as compliant, which significantly increases the risk of neurovascular compromise. Some authors recommend starting with a direct lateral portal for the initial inspection; however, many feel this portal gives a limited anterior view. Most authors now recommend starting with a medial portal. Linfield recommends the anteromedial portal rather than the anterolateral entry as described by Andrews. The advantages of Linfield’s approach are: 1) less extravasation, as the cannula passes through a tougher, more tendinous origin; 2) A better view of the lateral and anterior compartments; and 3) protection of the radial nerve.

Portal creation proceeds and is directed by the location of pathology. The number of capsular penetrations should be limited to prevent extravasation. The anterolateral portal can be created by using a ‘switching stick’ from the anteromedial portal. Entrance is made laterally, rather than anterior to the radial head. A posteromedial portal is discouraged due to its proximity to the ulnar nerve.

**Indications**

General indications for diagnostic arthroscopy of the elbow include: 1) undiagnosed pain, not relieved with nonoperative management; 2) an ambiguous clinical diagnosis, especially in an athlete; and 3) when other investigative techniques have failed, such as plain films or MRI. Frequently, the surgeon will find unexpected synovitis, loose bodies, and chondral defects. The ability to take a biopsy is an additional advantage. O’Driscoll and Morrey reported 64% of their patients benefited from a diagnostic arthroscopy; the patient outcome was positively influenced by the procedure. Indications for arthroscopy of the elbow include a variety of disorders and conditions (Table 1).

**Intra-articular Loose Body**

Loose body removal has become the most common indication for elbow arthroscopy. The causes of bodies include arthritis, osteochondritis dissecans (OCD), trauma, foreign body, and synovial chondromatosis. The location is often dictated by the underlying disorder. In the case of OCD, the loose body is usually located near the capitellum and radial head; for fractures, near the site of injury; for syno-

**Table 1** Indications for Performing Arthroscopy of the Elbow

<table>
<thead>
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<th>Indication</th>
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<td>Loose bodies</td>
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<td>Arthritis</td>
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<td>Synovitis</td>
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<td>Arthrofibrosis</td>
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<td>Osteochondritis Dissecans/Panner’s disease</td>
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<td>Valgus extension overload</td>
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<td>Lateral epicondylitis</td>
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<td>Fractures</td>
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<td>Instability</td>
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<td>Radial head resection (need for)</td>
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vial chondromatosis, loose bodies are frequently anterior. Ogilvie-Harris and Schemitsch reported successful removal in 33 of 34 patients without the need of arthrotomy. Prior to engaging in surgery, the patient should be counseled that the loose body may recur. For anterior loose bodies, the scope should be placed in the proximal medial portal, the anterolateral portal is the working portal, and the posterolateral portal is used for outflow and pressure monitoring. For posterolateral loose bodies, the scope is placed in the posterolateral portal, outflow is through the anterolateral portal, and the direct posterior portal is the working portal.

**Arthritis**

Elbow arthroscopy is used to treat patients with early to moderate osteoarthritis by osteophyte and loose body excision. This is performed most commonly in athletes, baseball pitchers, and weight lifters, who put tremendous loads on their elbows and subject them to repetitive trauma. The athlete will frequently complain of mechanical symptoms caused by impingement. Removal of loose bodies and osteophytes offers the best opportunity for relief of symptoms. In the prone and lateral decubitus positions, the arm can be brought through a full range of motion to examine for impingement. If extension is limited, the marginal osteophytes and tip of the olecranon are removed with a burr using the portals that were described earlier to remove posterolateral loose bodies. Redden and Stanley recommended an arthroscopic version of the Outerbridge-Kashiwagi technique, also known as ulnohumeral arthroplasty, with fenestration of the olecranon fossa to gain access to the anterior compartment.

**Synovitis**

There are multiple causes of synovitis in the elbow, including repetitive trauma, synovial osteochondromatosis, and rheumatoid arthritis. For anterior synovectomy, the arthroscope is placed in the proximal medial portal, the shaver in the anterolateral portal, and a pressure monitor/outflow in the posterolateral portal. For a posterior synovectomy, the pressure monitor/outflow is in the anterolateral portal, the arthroscope is in the posterolateral portal, and the shaver is directly posterior.

**Arthrofibrosis**

The major clinical sign of arthrofibrosis is a painful contracture of 30° or more that is refractory to nonoperative management, resulting in a functional limitation. Elbow arthroscopy can only be helpful with contractures of intrinsic origin: the capsule, collaterals, and joint pathology. The proximal medial and lateral portals are used. First, 1 cm of anterior capsule is removed to expose the brachialis. The median nerve and brachial artery are anterior and should be protected. However, O’Driscoll recommends periosteal elevation for anterior capsular release, as the anatomy may be distorted and the PIN is vulnerable near the anterolateral capsule. The next step is to move posteriorly for debride-ment of the medial and lateral gutters. In the posterior compartment, the surgeon may find extensive scarring and osteophytes in the olecranon fossa, which should be resected. Care must be taken in the medial compartment, as the ulnar nerve is in close proximity. Postoperatively, the patient should be placed initially in extension and supination, with early and active assisted range of motion. This is a difficult and complex procedure with many possible pitfalls, and the surgeon must be prepared to switch to an open approach.

**Osteochondritis Dissecans/Panner’s Disease**

OCD is usually described as a discreet lesion in the older child/adolescent, while Panner’s disease is thought of as a lesion of the entire capitellum in a younger child. It is caused by repetitive microtrauma, frequently observed in young throwers or gymnasts. Patients often complain of a dull pain on the lateral aspect of the elbow with a loss of motion, usually extension. In the presence of loose bodies or cartilage flaps, patients also frequently complain of a catching or locking. The indications for operative management are: 1) failure of nonoperative treatment, 2) loose bodies, and 3) locked elbow. Loose fragments are excised, and the lesion is débrided and drilled. There is no evidence that reattachment of the loose fragment enhances a long-term outcome.

**Valgus Extension Overload**

A description popularized by Andrews, valgus extension overload is also known as “thrower’s elbow.” The patient complains of posteromedial pain during the acceleration phase of throwing; the pain is caused by excessive valgus force. The pitcher will have stiffness and a limitation of throwing ability, both of which are caused by bony hypertrophy and soft tissue contracture. Arthroscopy shows postero medial osteophytes on the olecranon tip, with impingement of the olecranon fossa. A concomitant OCD lesion on the trochlea is termed the “kissing lesion.” If nonoperative treatment such as NSAIDs, rest, and physical therapy fail, operative arthroscopy is indicated. Synovial tissue obstructing the view of the olecranon is removed as well as all osteophytes and loose bodies. The proximity and vulnerability of the ulnar nerve should be noted. Recurrences have been reported, even after successful arthroscopy, as these patients frequently return have microinstability of their medial collateral ligaments. The posterior medial osteophytes are the body’s attempt to stabilize the elbow; removal of the osteophytes destabilizes the elbow and results in further impingement.

**Lateral Epicondylitis**

Tennis elbow may be treated arthroscopically if it is refractory to nonoperative treatment, and PIN compression syndrome has been ruled out. Grifka and coworkers described the release at the extensor origin in 32 patients with no complications. The proximal medial portal is used for viewing and the lateral portal for resection. The PIN and radial collateral ligament are in proximity and must be
protected. The ECRB is débrided to the posterolateral edge of its origin on the humerus, and the lateral epicondyle is drilled. One should note that the source of pain may actually be a synovial plica band that is clicking or catching over the radial head. Antuna and O’Driscoll reported good results with excision of this band.15

Fractures
Fixation of minimally displaced fractures with arthroscopic guidance has been reported in the literature as well as the removal of osteochondral fragments that may be blocking motion. The surgeon is also able to check for evidence of instability and the status of the articular cartilage. Feldman reported two cases of excision of a Type II (Kocher-Lorenz) capitellum fracture which blocked motion.16 He felt that arthroscopy allowed for increased postoperative motion as compared to open excision. In the treatment of radial head fractures, the proximal medial head is used for visualization, the lateral or anterolateral portal for K-wire insertion into the fractured piece as a joy stick, and the posterolateral portal for instrumentation.

Instability
Arthroscopy has been proven to aid in the diagnosis and treatment of the intra-articular sequelae caused by instability. The primary restraint to valgus loads is the anterior oblique bundle of the medial collateral ligament. Pitchers with valgus instability often complain of fatigue during acceleration and ulnar nerve symptoms. A diagnosis of valgus instability, accomplished by arthroscopy, is made indirectly, because the entire MCL cannot be seen. Field and associates performed a cadaveric study and determined that although all of the posterior bundle can be visualized, only 15% to 20%, on average, of the anterior bundle can be seen.17 They noted that a 70° scope may increase visualization and that the best view was from the proximal lateral portal. Field and Altchek also performed a cadaveric study in which they cut the anterior and posterior bundles sequentially while testing the instability view.18 They observed the most medial aspect of the ulnohumeral articulation at 60° while they performed a valgus stress. They determined that if the joint opens 1 mm, it is significant for anterior bundle insufficiency. If the joint opens greater than 4 mm, it is significant for a complete MCL rupture. Pronating the elbow has also been shown to open the medial side and aid in the diagnosis. Posterolateral rotatory instability is due to insufficiency of the lateral ulna collateral ligament. The symptoms usually include a sensation of popping, grinding, or catching. Patients usually report a history of trauma or a previous surgery (tennis elbow release) when presenting with lateral ulna collateral ligament insufficiency. Symptoms often arise from axial load such as rising from a chair. The diagnosis can be made with the pivot shift test. As one views from the proximal medial portal, the radial head can be seen subluxating on the humerus in the posterolateral direction. A varus load may open the radiocapitellar joint.

Radial Head Resection
Often preferred for posttraumatic arthritis or rheumatoid arthritis, radial head resection is now able to be done arthroscopically. The use of the arthroscope also allows the surgeon to address accompanying joint pathology. The arthroscope is placed in the proximal medial portal and an abrader in the anterolateral portal to resect the anterior three-fourths of the head and 2 mm to 3 mm of the neck. To resect the posterior aspect and the proximal radial ulnar joint (PRUJ) remnants, the abrader is placed in the direct lateral portal. Care must be taken to keep the annular ligament intact to maintain PRUJ stability. Rymaszewski and colleagues questioned the resection of the radial head in advanced rheumatoid arthritis, due to attenuation of the MCL and the possible increased stress on the ulnohumeral articulation.20

Contraindications
Any distortion of normal bony/soft tissue anatomy that precludes the safe entry of the arthroscope into the joint is a contraindication to elbow arthroscopy. Examples include: 1) a history of previous ulnar nerve transposition; 2) elbows in which the joint cannot be adequately distended, as seen with ankylosing spondylitis; 3) significant heterotopic ossification or displaced radial head fractures which may put the PIN at risk; and 4) local skin infection.

Complications
A review of the literature shows an overall complication rate of 6% to 15% with approximately half of those being neurological.21,22 Nerve injuries have been reported to be caused by compression, anesthetic extravasation, and direct trauma. Major complications include: permanent nerve injury, compartment syndrome, postoperative joint infection, vascular injury, and a loss of motion greater than 30°. In regard to nerve injuries, the radial nerve and PIN are more frequently injured, while the ulnar and median nerves are injured less frequently and damage is usually transient. However, Ruch did report an anterior interosseous nerve transection following synovecmy.23 As mentioned before, the anterior capsule and brachialis are thin and atrophic in rheumatoid arthritis and offer less protection to the median nerve and its branches.

The most common minor complication is transient neurapraxia, with the ulnar nerve the most susceptible. It is frequently due to anesthetic extravasation and is most often seen in rheumatoid patients and patients with contractures.
Other minor complications include hematoma formation, superficial infections with continuous drainage from the portals, and a loss of motion of 30° or less. The development of heterotopic ossification six weeks postoperatively was recently reported in a 47-year-old male who underwent debridement for osteoarthritis. The investigators recommended prophylaxis following extensive debridement with indomethacin for two weeks.25

Other methods to help prevent complications include the closure of portals along the posterolateral aspect to prevent synovial fistula. O’Driscoll recommends the use of a He-movac drain after excessive debridement and 36 hours of elevation and extension splinting to decrease the capsular volume.12 The surgeon should also realize the limitation of capsular volume in an arthrofibrotic/arthritis elbow and consider deferring to an open procedure if distension is not practical. To decrease the chance of nerve injury, the skin should be properly marked prior to incision, the elbow should be flexed to 90°, capsular distension should be achieved (increases nerve to bone distance, not nerve to capsule distance), and pronation performed to protect the PIN. Judicious use of retractors during synovectomy or capsulectomy can reduce the incidence of nerve injury. If necessary, nerves should be explored and identified to protect them in the region of a capsulectomy. Of note, Papilion and associates reported a PIN palsy distal to the lateral epicondyle using the standard anterolateral portal of 3 cm.24 Stothers and coworkers recommend moving the anterolateral portal proximal to the radial head to increase the nerve to portal distance.25 They recommend the same technique be applied to the anteromedial portal. Some authors prefer to use an osteotome instead of a Burr for bony resection, as this allows for a more controlled resection.

Kelly and colleagues reported on 473 arthroscopies, with 89% done by experienced elbow surgeons.21 They reported no permanent nerve injuries, 0.8% major complications with wound infection dominating, and 11% minor complications with 2.4% transient nerve palsies. Nerve palsies were most frequently seen with rheumatoid arthritis and contracture.

Postoperative Rehabilitation

Most authors recommend splinting the elbow at 90° for the first three postoperative days unless a contracture release is done. When a contracture release is performed, many investigators recommend splinting in extension, while others eschew splinting and allow immediate motion.11 Rehabilitation is organized in fairly distinct phases. The first two weeks of therapy are meant to restore range of motion, minimize pain and inflammation, and avoid atrophy. Hand, wrist, and elbow exercises include grip strengthening with putty and wrist curls using weights during flexion and extension. At two to four weeks, range of motion exercises are continued and strengthening exercises are added. During the third phase, from four to six weeks, the patient should increase total arm strength, power, and endurance. This phase should be started when the patient has full range of motion and minimal pain. Such a plan leads to a progressive increase in activities to prepare for unrestricted functional participation.

Results

O’Driscoll and Morrey reported on 71 consecutive arthroscopies, with approximately three-quarters of the patients reporting they benefited from the procedure. In this study, 31% benefited diagnostically, 24% had a diagnostic and therapeutic benefit, and 17% had therapeutic benefit only. The investigators concluded that the ideal indication for elbow arthroscopy is the removal of loose bodies and that posttraumatic or primary degenerative joint disease, in its later stages, is not improved. Reddy and associates reported on 172 patients with a mean follow-up of 42 months.26 They had 85% good to excellent results and a 1.6% complication rate, with one complete ulnar nerve transection. The greatest patient improvement was in the pain score. A small percentage (15%) of baseball players were not able to return to their prior level of competition. Savoie and coworkers published a two to five year follow-up for ulnohumeral arthroplasty and reported an improvement of 81° in range of motion with no neurovascular complications.27 Cohen and colleagues compared the open Outerbridge-Kashiwagi technique to ulnohumeral arthroplasty. With a diagnosis of osteoarthritis in 89% of the patients, the open procedure resulted in a greater increase in range of motion, while the arthroscopic procedure resulted in a greater improvement in pain.28 They reported it was difficult to completely debride the olecranon tip and fossa with arthroscopy. Lee and Morrey reported 93% good to excellent results for synovectomy in patients with rheumatoid arthritis.29 However, at 42 months, this figure dropped to 57%. The conclusion by the investigators was that good results deteriorate more rapidly using arthroscopy for this condition than with open debridement. Savoie and Field reported a study of over 200 patients diagnosed with arthrofibrosis, and showed an average increase in extension from -46° to -5° and in flexion from 96° to 138°.11 There was a significant decrease in pain, with only three failures, where motion or pain was not controlled. Phillips and Strasburger reported on 25 patients with arthrofibrosis who had a 41° average increase in arc of motion.30 Larger gains were reported with posttraumatic degenerative joint disease than with degenerative osteoarthritis, and no neurovascular complications were reported.

Baumgarten and associates published a study of 16 adolescents with OCD lesions at a mean of 48 months; 13 lesions were grade IV (loose, nondisplaced) or grade V (displaced).31 Two of nine patients stopped throwing and one of five patients stopped performing gymnastics. All other patients returned to their preinjury levels of activity. The average increase in range of motion was 20°.

Ruch and coworkers reported on 12 patients with OCD lesions who averaged 14.5 years.32 They reported an overall good satisfaction rate, where the only consistent correlation
with a worse outcome was the presence of a lateral bony fragment not visible during arthroscopy but seen on plain film radiograph.

Owens and colleagues reported on 16 patients with an average age of 50 and a minimum of one year follow-up from tennis elbow release. All patients had good to excellent subjective results and there was no reported lateral collateral injury. They concluded that arthroscopic release has a lower morbidity and an earlier return to work compared with open procedures.

Ward and Anderson reported on 35 consecutive patients with a mostly athletic population of baseball players and weight lifters; 84% were able to return to their premorbid sports activities, with an increase in nearly 50% in functional scores. The largest improvement was seen in the pain score, with a 97% satisfaction rating. The average gain in motion was 7° of flexion and 6° of extension. The highest percentage of return to sport was in baseball players, who went from 28% preoperatively to 78% postoperatively.

Andrews and Timmerman reported on 72 professional baseball players, 80% of whom returned to play for at least one season, 73% at the same or higher level. Thirty-three percent needed a reoperation, with 25% of those requiring a UCL reconstruction. A second operation was performed on 41% for posteromedial osteophytes. The investigators concluded that instability for many of these patients had continued unrecognized, and UCL injury had been underestimated at the time of the first surgery.

Finally, Micheli and associates reported on 47 pediatric and adolescent patients with an average age of 14 years and an average follow-up of 4.7 years. The most common indication for surgery was OCD, but patients also had surgery for loose bodies, joint contractures, and arthrofibrosis. Eighty-five percent had good to excellent results, with 90% returning to sports without limitation. The average gain in total range of motion was 30°.

Conclusions
Elbow arthroscopy continues to evolve. The technical expertise of surgeons and sophistication of equipment continues to improve, with new indications certain to increase. The surgeon must keep in mind that elbow arthroscopy is a technically demanding procedure and mastery of the knowledge of the regional anatomy is imperative. Strict adherence to principles will allow for the treatment of a variety of disorders in a safe and effective manner.

References
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