Arthroscopic Management of the Stiff Elbow

Article *in* The Journal of the American Academy of Orthopaedic Surgeons · May 2011

DOI: 10.5435/00124635-201105000-00004 · Source: PubMed

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Review Article

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Abstract

Elbow stiffness is a challenge to manage effectively. Elbow contractures commonly result from both intrinsic and extrinsic factors, causing limited motion. Recent technical advances in elbow arthroscopy have led to the development of minimally invasive procedures for the management of select cases of recalcitrant elbow stiffness. As with most arthroscopic procedures, a notable learning curve is associated with the safe, effective execution of these surgical techniques. Certain clinical scenarios require that special attention be paid to the ulnar nerve and the posterior bundle of the medial ulnar collateral ligament to improve motion safely. Arthroscopic capsular release of the elbow is effective for restoring a functional arc of motion in the short term in most patients with extrinsic contractures.

Elbow contracture is a common and difficult problem to manage. Limited range of motion (ROM) of the elbow and forearm causes pain and difficulty with activities of daily living. Elbow stiffness results from a variety of traumatic and atraumatic conditions. Even a simple injury (eg, nondisplaced radial head fracture, elbow subluxation) can result in notable loss of motion, especially after prolonged immobilization. Complex elbow fractures and fracture-dislocations are associated with high rates of elbow contracture.[1-5] These injuries are often complicated by ligament and muscle tears, nerve damage, and formation of heterotopic ossification. Surgical management may increase scar formation around the elbow. Furthermore, postoperative immobilization may be necessary to maintain stability and allow preliminary bone and soft-tissue healing. Postoperative stiffness is particularly challenging after complex elbow dislocations because the balance between stiffness and instability is difficult to achieve.

Elbow contracture commonly occurs with systemic disorders, including osteoarthritis, rheumatoid arthritis, and hemophilia. Arthroscopic evaluation facilitates the assessment and management of the associated intra-articular pathology as well as release of the joint contracture. Elbow stiffness may complicate burn injuries (local and remote), brain and spinal cord injuries, and other neuromuscular disorders. Frequently, these conditions are associated with the formation of heterotopic bone or with the presence of muscular contracture or tone abnormalities (increased muscle tone as a result of a head injury or cerebral palsy). Thus, these conditions represent some causes of stiffness that are not amenable to arthroscopic treatment.

Historically, elbow stiffness was addressed using an open surgical approach. These operations were associated with such perioperative morbidity

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Dr. Galatz or an immediate family member serves as a board member, owner, officer, or committee member of the American Shoulder and Elbow Surgeons and serves as an unpaid consultant to Tornier. Neither Dr. Keener nor any immediate family member has received anything of value from or owns stock in a commercial company or institution related directly or indirectly to the subject of this article.

J Am Acad Orthop Surg 2011;19: 265-274

as bleeding, wound complications, further elbow stiffness, and pain. Although an arthroscopic approach may not completely obviate these factors, potential advantages include minimal incision size, decreased soft-tissue dissection, diminished blood loss, decreased postoperative pain and, subsequently, easier rehabilitation.[6-10] Disadvantages include increased risk of nerve injury[11-14] and the requirement of advanced arthroscopic skills for the sake of safety and effectiveness.

Surgical Indications and Contraindications

Elbow contractures result from either intrinsic or extrinsic factors. Intrinsic contractures include joint incongruity, arthritis of the joint surfaces, or any cause within the joint. Extrinsic contractures include capsular tightness, muscle contracture, heterotopic ossification, and skin contractures (ie, burns). Some stiff elbows may develop both intrinsic and extrinsic factors over time. Arthroscopic treatment is ideal for stiffness secondary to capsular tightness because this tissue is easily released through a minimally invasive approach. Some intrinsic factors, such as osteophyte formation, can be addressed arthroscopically. Severe joint incongruity, cartilage loss, heterotopic ossification, and muscle contracture are not amenable to arthroscopic treatment and are best managed through an open approach.

The primary indication for arthroscopic treatment of elbow stiffness is loss of the functional arc of flexion and extension of the elbow joint that is resistant to nonsurgical management. Morrey et al[15] showed that an arc of 30° to 130° of flexion and extension is needed to perform most activities of daily living; however, some patients report pain or difficulty with activities requiring extension of <30°. Most patients with an arc of motion of ≥100° function well. An arthroscopic release is a reasonable option for patients with clinical loss of motion, depending on individual functional and occupational demands. Nonsurgical treatment should be attempted for 3 to 4 months before surgery is indicated, unless associated intra-articular abnormalities that hinder ROM are present.

Many contraindications for arthroscopic elbow release must be considered. Elbow contractures associated with extensive heterotopic bone formation usually require open release and bone débridement. Severe elbow contractures are often associated with notable, extra-articular soft-tissue adhesions and muscle contractures that are difficult to address arthroscopically. It is difficult to insufflate the joint in the setting of a severe contracture; although this is not necessarily a contraindication to arthroscopy itself, it substantially increases the level of difficulty. Loss of forearm pronation and supination cannot be reliably addressed with elbow arthroscopy; this loss is more reliably managed with open surgery.

Prior ulnar nerve transposition, especially submuscular, is a relative contraindication for arthroscopy because of the risk of iatrogenic nerve injury. In patients who have undergone an ulnar nerve transposition, modifications of the surgical technique should be used when establishing access to the medial aspect of the elbow. These modifications theoretically lessen the chance of nerve injury; however, we believe that consideration for an open release should be made for patients with a submuscular transposition. Arthroscopic elbow release alone cannot address pathology associated with severe articular cartilage damage or articular incongruity secondary to fractures or arthritis.

In patients with a limitation of elbow flexion of 90° to 100°, prophylactic treatment of the ulnar nerve must be performed before release in order to prevent nerve compression associated with improved flexion. The ulnar nerve at the level of the elbow joint is located within the confines of the cubital tunnel, the floor of which is composed of the posterior bundle of the medial ulnar collateral ligament. With flexion of the elbow >90°, the dimensions of the cubital tunnel decrease and pressure within the ulnar nerve increases.[16] In elbows with substantial loss of flexion, the posterior bundle of the medial ulnar collateral ligament scars and becomes contracted. Flexion cannot be restored if contracture of the posterior bundle is not addressed. Furthermore, injury to the ulnar nerve may occur with manipulation of the elbow into flexion as the posterior bundle becomes taut.

Imaging

Routine radiographs are needed to fully assess potential causes of loss of elbow motion. These are helpful to identify articular congruity and degeneration, the presence and location of loose bodies and marginal osteophytes, and heterotopic ossification. In select cases, advanced imaging studies (eg, CT with three-dimensional reconstructions) can be helpful for surgical planning by further defining the location and size of intra-articular blocks to ROM. Such blocks are often seen in patients with primary and posttraumatic osteoarthritis.

Surgical Technique

Equipment

A standard large joint arthroscope (4.5 mm) is commonly used for elbow arthroscopy; however, a small arthroscope (2.7 mm) may be used if desired. A standard 30° lens is appropriate for most arthroscopic elbow procedures. The fluid system may be gravity flow or pump-controlled. Low pump pressures (ie, 25 to 35 mm Hg) minimize soft-tissue swelling, which can progress rapidly during elbow arthroscopy. The actual pressure differs between pumps made by different manufacturers; thus, the pump may need to be adjusted. However, pressures should be lower than that used in the shoulder and other joints.

Low-flow cannulas with no side fenestrations should be used to minimize soft-tissue fluid insufflation. Because the elbow joint is small and much of the surgical technique is performed at the margins of the joint, a nonfenestrated cannula will help minimize fluid extravasation into the soft tissues. All trochars should be blunt-tipped to avoid potential neurovascular or articular cartilage injury.

A variety of working cannulas can be used, usually ≤5.5 mm. Portals can be established safely by dilating sequentially over a needle placed from the outside in under direct visualization. This technique avoids repeated passage of cannulas and instruments through the surrounding soft tissues, theoretically lessening the chance of neurovascular injury. Standard arthroscopy equipment includes a shaver (nonaggressive), electrocautery device, graspers, and probes. A small-caliber burr should be available as well as small curved osteotomes. Specially designed capsular biters and soft-tissue retractors can be helpful. Alternatively, basket biters and switching sticks may substitute for these instruments.

Patient Positioning

Elbow arthroscopy may be performed with the patient in the lateral decubitus, prone, or supine position. The advantages of the lateral decubitus and prone positions include freedom of movement of the extremity and the lack of need for extremity-holding or traction devices. In addition, easy access to the posterior compartment allows the surgeon to use osteotomes and large burrs to remove osteophytes from the tip of the olecranon. We prefer the lateral decubitus position because it simplifies airway management compared with the prone position. A padded tourniquet is placed on the upper arm. The upper arm is supported on a padded arm holder. Before sterile prep and draping are performed, freedom of flexion and extension of the elbow should be confirmed because otherwise the forearm during flexion may come into contact with the beanbag, table, or arm holder.

Portal Placement and Capsular Release

Although the choice of performing the initial débridement in the anterior or posterior compartment is generally left to the discretion of the surgeon, it may be influenced by individual pathology. Difficulty with visualization and risk of nerve injury are more an issue in the anterior compartment and are compounded by progressive swelling. For this reason, many surgeons choose to work in the anterior compartment initially. However, in some cases (eg, advanced posterior compartment osteoarthritis, ulnar nerve scarring), initiating the procedure in the posterior compartment may be advantageous.

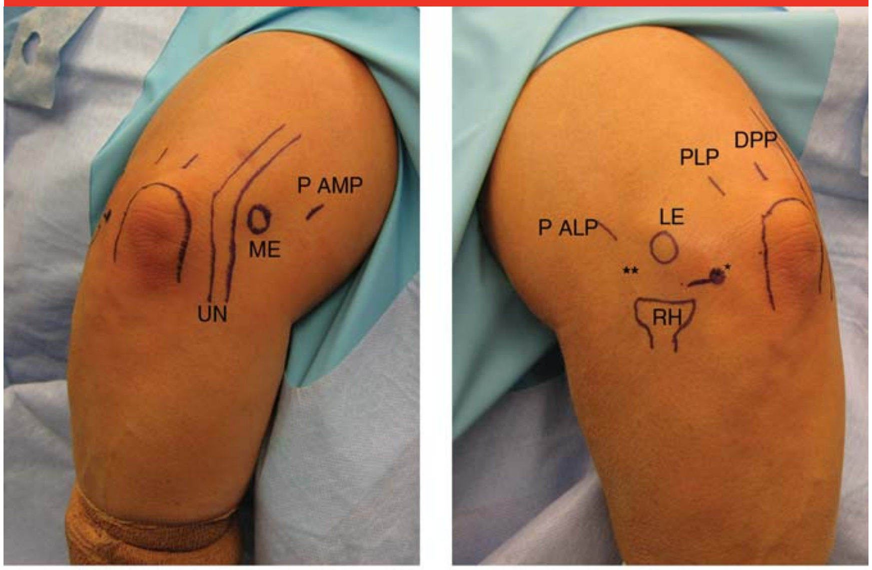
Anterior Débridement

The pertinent anatomic landmarks are marked on the skin before the incision to guide the appropriate placement of portals (Figure 1). These landmarks include the medial epicondyle, lateral epicondyle, radial head, and olecranon. The medial intermuscular septum and the ulnar nerve are also identified. The elbow joint is insufflated with sterile isotonic fluid. In normal elbows, joint distention increases the distance between the nerves and the humerus anteriorly. This is typically done with a spinal needle directed into the lateral soft spot of the elbow, which is a triangle on the lateral elbow bordered by the radial head, the tip of the olecranon, and the lateral epicondyle (Figure 1). In most cases of elbow contracture, the volume of the joint is decreased and the capsule is noncompliant, which minimizes the potential benefit of joint insufflation in protecting the surrounding neurovascular structures.

The ulnar nerve and medial intermuscular septum are palpated and marked before establishing the proximal anteromedial portal. In cases of prior ulnar nerve transposition, a larger incision is made and blunt dissection is performed, confirming a safe and direct path to the proximal flexor/pronator mass free from the ulnar nerve. The location of the proximal anteromedial portal is approximately 2 cm proximal and 1 cm anterior to the medial epicondyle.[17] Only the skin is incised in order to protect branches of the medial antebrachial cutaneous nerve; the cannula is directed anterior to the intermuscular septum into the elbow joint. Diagnostic arthroscopy of the anterior compartment of the elbow is performed.

A single lateral portal or multiple lateral portals are then established. We prefer a proximal anterolateral portal performed with an outside-in technique. Alternatively, the mid anterolateral portal can be established (Figure 2, A). On the lateral aspect of the elbow, proximally located portals are farther from the radial nerve than are those placed more distally.

Figure 1



A **B**

A, Superficial anatomy of the medial aspect of the left elbow. The ulnar nerve (UN) is traced. **B,** Superficial anatomy of the lateral aspect of the left elbow. DPP = direct posterior portal, LE = lateral epicondyle, ME = medial epicondyle, P ALP = proximal anterolateral portal, P AMP = proximal anteromedial portal, PLP = posterolateral portal, RH = radial head, * = soft spot, ** = mid anterolateral portal, which is helpful for placement of retractors to improve visualization

The location of the proximal anterolateral portal is 2 cm proximal and 1 cm anterior to the lateral epicondyle.[18] A cannula is introduced through this portal tract for instrumentation.

A shaver is introduced to débride loose bodies, synovium, and fibrotic tissue throughout the radiocapitellar and lateral ulnohumeral joints. A small burr can be used to remove osteophytes from the proximal aspect of the radial and coronoid fossa. Complete débridement of intrinsic disease of the anterior elbow should be performed before capsular release because, once the capsule has been released, capsular distention is diminished, making visualization more difficult.

The use of retractors placed through accessory portals can be helpful in cases in which visualization is difficult or when extensive débridement of osteophytes is required. For example, a retractor can be placed in the mid anterolateral portal to retract the anterior capsule, thereby expanding the working space and improving visualization of the anterior compartment (Figures 1, B, and 2, B). Additionally, the use of retractors may further protect surrounding neurovascular structures during capsular release.

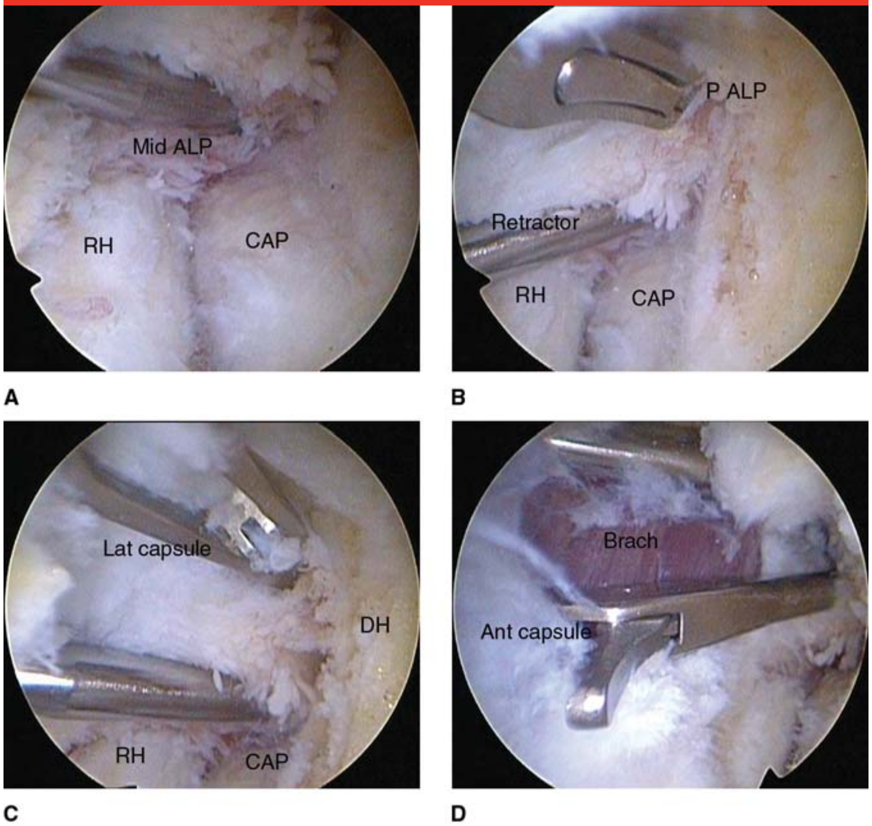
Capsular release begins from the lateral aspect of the joint. A blunt trochar is placed through the lateral portal to elevate the proximal lateral capsule off of the humerus. A capsular biter is then used laterally to cut the capsule proximally, moving across the joint in a medial direction. Care is taken to divide the lateral capsule 2 to 3 cm proximal to the radial head to avoid injury to the radial and/or deep radial nerves located distally near the radial head between the lateral edge of the brachialis and the brachioradialis muscles. The deep radial nerve is located immediately adjacent to the anterior joint capsule in the distal half of the elbow. Displaced radial head fractures may produce excessive local scarring of the capsule and tethering of the deep radial nerve; therefore, with these injuries, special care should be taken when débriding or releasing tissue around the radial head. When visualization is difficult, an accessory mid anterolateral portal can be made just anterior to the radiocapitellar joint. A retractor or switching stick can be used to retract the capsule away from the humerus, improving visualization (Figure 2, B).

The capsule is cut as far medial as visualization will allow from the medial portal (Figure 2, C and D). The scope is then moved to the lateral portal over switching sticks. The most medial aspect of the joint is débrided. The anteromedial capsule is then cut with a biter, completing the anterior capsular release. On the medial aspect of the joint, capsular release is safer because the brachialis protects the median nerve and brachial artery. The edges of the cut capsule are carefully débrided with a shaver, both medially and laterally, to prevent recurrent scarring. A complete release will allow excellent visualization of the brachialis muscle.

Posterior Débridement

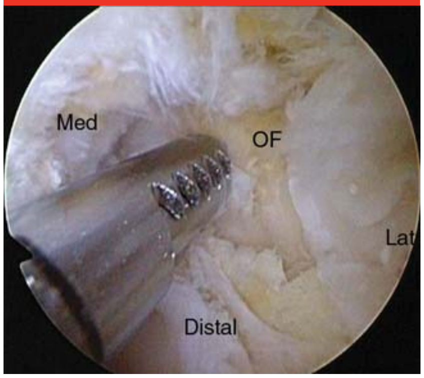
Once the anterior compartment has been released, attention is directed to the posterior compartment. Three posterior portals allow visualization of the posterior compartment of the ulnohumeral and radiocapitellar joints. These portals are generally safe because they are far from major neurovascular structures. The initial viewing portal is a posteroloteral portal established along the postero-

Figure 2



Arthroscopic views of a right elbow. **A,** The mid anterolateral portal (Mid ALP) is established via the outside-in portal localization technique. **B,** View from the medial aspect of the joint. A retractor is placed through the Mid ALP to retract the anterior capsule. A capsular biter enters through the proximal anterolateral portal (P ALP). **C,** The anterolateral capsule (Lat capsule) is cut in a lateral-to-medial direction well proximal to the radial head (RH). **D,** The capsular release continues medially along the anterior capsule (Ant capsule). The underlying brachialis (Brach) is seen. The retractor has been switched to the P ALP. CAP = capitellum, DH = distal humerus

Figure 3



Arthroscopic view of a right elbow. The posterior compartment of the elbow is débrided, exposing the olecranon fossa (OF). Shaver blades are pointed away from the ulnar nerve. Lat = lateral, Med = medial

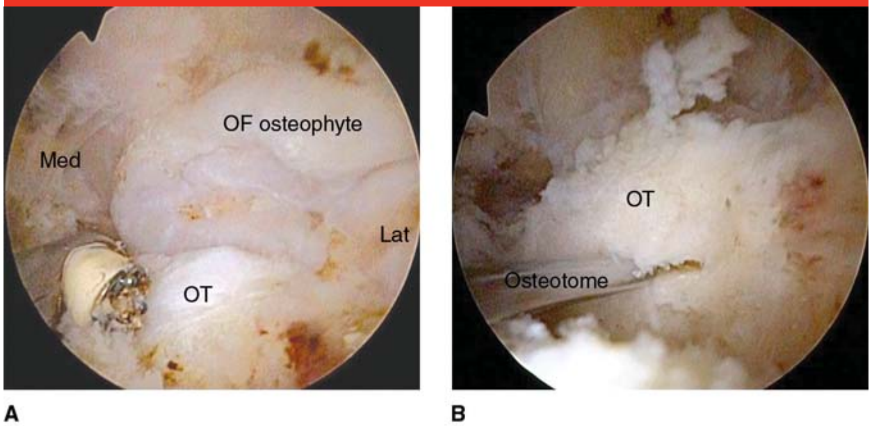
lateral ridge of the elbow approximately 1 cm proximal and lateral to the olecranon tip (Figure 1). The skin and soft tissues are incised lateral to the central triceps tendon down to bone. The blunt tip of the trochar sweeps soft tissue out of the olecranon fossa and releases the deep capsule off the posterior aspect of the distal humerus. The camera is inserted to visualize the posterior compartment. A direct posterior portal is made 2 to 3 cm proximal to the olecranon tip (Figure 1). This portal can be localized under direct visualization with a spinal needle through the triceps tendon. The skin and triceps tendon are split, and a shaver is introduced.

The posterior compartment is débrided of fibrotic and synovial tissue (Figure 3). Débridement should initially be focused in the lateral and midline aspects of the posterior compartment to improve visualization and allow proper orientation. Care is taken to avoid initial débridement of the posteromedial aspect of the joint because the ulnar nerve is located immediately adjacent to the posteromedial capsule and floor of the cubital tunnel. Local scarring can distort this relationship and draw the nerve closer to the midline of the joint.

The posterior fat pad is removed with a shaver and electrocautery device. A diagnostic evaluation is performed along the posteromedial gutter and olecranon fossa. Loose bodies and osteophytes within the olecranon fossa are removed. Soft tissues are cleared from the olecranon tip. The elbow is extended to ensure that, in maximal extension, there is no mechanical contact of the olecranon tip and the boundaries of the olecranon fossa. Often, a portion of the olecranon or local osteophytes will need to be removed to ensure maximal elbow extension. This can be performed with a burr or small osteotomes placed through the direct posterior portal (Figure 4). A recent anatomic study has shown that 12 to 14 mm of bony resection of the olecranon tip can be performed without compromise of the triceps tendon insertion.[19] We advocate judicious resection of any potential block to extension motion that may result from bony impingement of the olecranon tip.

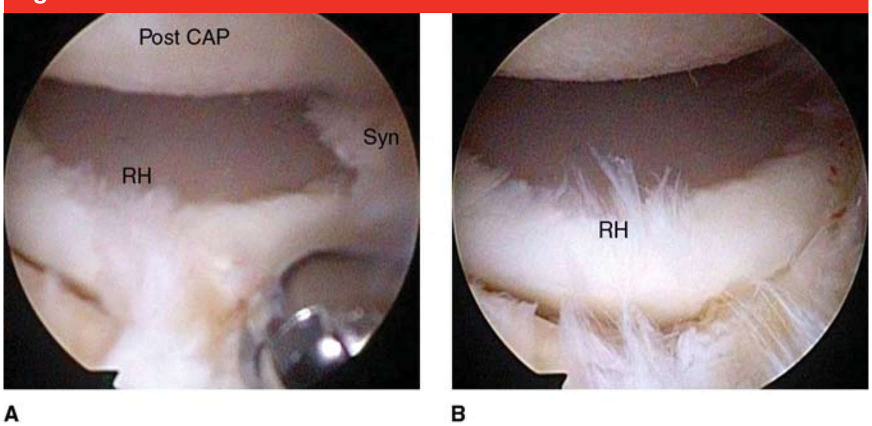
A full release of the posterolateral and posteromedial capsule should be

Figure 4



Arthroscopic views of a right elbow. **A,** The posterior compartment has been cleared of soft tissue, exposing an olecranon fossa osteophyte (OF osteophyte), which is removed with a burr. **B,** An osteotome is used to remove the olecranon tip (OT), thereby ensuring no bony contact with the olecranon fossa in full elbow extension. Lat = lateral, Med = medial

Figure 5



Arthroscopic views of a right elbow. **A,** The posterior aspect of the radiocapitellar joint is débrided through the midlateral soft spot portal. The posterior plica and synovial tissue is cleared. **B,** Improved visualization of the radial head (RH). Post CAP = posterior capitellum, Syn = synovitis

performed. Any proximal adhesions between the deep triceps and distal humerus should be released by sweeping with a blunt trochar.

Next, the posterior radiocapitellar joint is débrided. From the posterolateral portal, the cannula is used to sweep distally down the posterolateral column and is placed at the posterior radiocapitellar joint. Initial visualization of the radiocapitellar joint is often obscured by local capsule, deep anconeus muscle fascia, and/or scar tissue. A midlateral (soft spot) portal is made by directing a spinal needle through the anconeus muscle at the level of the posterior radiocapitellar joint. A shaver is introduced, and the local soft tissues are débrided. Once the shaver tip is well visualized, the posterior capsule, plica, and scar tissue are removed until the radial head is well visualized (Figure 5).

Severe Loss of Elbow Flexion

In all elbows with ≤90° of flexion or in which signs of ulnar nerve irritation exist preoperatively, the ulnar nerve should be decompressed as a part of the surgery before manipulation of the elbow. In these situations, the nerve may be decompressed either arthroscopically or open, depending on surgeon preference and experience. We prefer a small open approach centered over the cubital tunnel. The ulnar nerve is dissected and released distal to the medial epicondyle. The nerve is retracted posteriorly, exposing the floor of the cubital tunnel, but it is not routinely transposed. The posterior bundle of the medial ulnar collateral ligament is released sharply, starting proximally, exposing the medial ulnohumeral joint, and continuing distally to the anterior bundle of the medial ulnar collateral ligament, which is left intact. After complete release, manipulation of the elbow can be performed with minimal risk to the ulnar nerve. Ruch et al[20] have demonstrated notable improvements in posttraumatic loss of elbow flexion (mean preoperative and postoperative flexion motion, 96° and 130°, respectively) with open release of the posterior and transverse bundles of the medial ulnar collateral ligament without compromise of elbow stability.

Postoperative Care

Most elbow arthroscopic releases are performed on an outpatient basis. After wound closure, the elbow is covered with a sterile dressing that is maintained for a full week. The relative risk of infection is higher after elbow arthroscopy compared with other joints, so portals should be closed properly and protected from exposure initially. A soft dressing allows early ROM of the elbow and forearm. In elbows with a primary flexion contracture, we prefer to splint the elbow in maximal extension for 24 hours. A removable night splint in maximal extension is fabricated to maintain extension. Judicious use of ice and elevation of the extremity is important for the initial 3 days postoperatively.

Therapy regimens vary among surgeons. The goals of the rehabilitation program are to decrease pain and swelling while maintaining maximal elbow ROM. The authors instruct each patient with a self-assist program of active and passive stretching of the elbow and forearm, to be performed every 2 hours while awake. Physical therapy is usually prescribed three times per week for the first 4 to 6 weeks; however, a patient-directed therapy program performed several times per day is critical to maintain intraoperative gains in ROM. Nighttime static extension splints help maintain extension ROM and are generally used for 3 to 4 weeks following surgery. Some have advocated the use of continuous passive motion machines combined with continuous regional anesthetics;[21-24] however, the efficacy of this treatment is debated.[25] In some cases, dynamic flexion- or extension-assist braces can be used in the subacute postoperative period (ie, 4 to 6 weeks).

Complications

Complications of elbow arthroscopy are not uncommon. The risk of neurovascular injury and infection is higher in the elbow than in other joints. The largest series of elbow arthroscopic surgery to date showed a 2% risk of superficial infection and 0.8% risk of deep infection following surgery.[11] These authors reported a 2.5% chance of a notable, although temporary, nerve palsy following surgery. Surgery for the diagnosis of elbow contracture was identified as a risk factor for the development of postoperative nerve palsy. In addition, there are many case reports of permanent nerve injuries following elbow arthroscopy.[12-14]

Outcomes

Several authors have published results following arthroscopic release of elbow joint contractures. Most of these series report a small number of patients, often heterogeneous in diagnosis, with short-term follow-up (Table 1).[6-10,26-29] Most studies are composed of patients with both intrinsic and extrinsic causes of joint contractures, with exclusion of those with articular incongruity or notable heterotopic ossification. Despite the design limitations of these studies, early results suggest that arthroscopic release can be a safe and effective method of management in selected cases of persistent elbow contracture. Optimal outcomes following arthroscopic elbow contracture release are seen in patients with mild to moderate posttraumatic stiffness associated with minimal heterotopic bone formation and articular incongruity. Although elbow motion is not normalized, a functional arc of elbow motion typically can be restored when a successful release is performed in a motivated and compliant patient.

It is important to recognize the potential need for an additional open medial release in patients with preoperative flexion motion restriction of 90° to 100°. Outcome studies of surgeries that included open release of the posterior bundle of the medial ulnar collateral ligament have demonstrated the value of this procedure to address preoperative loss of flexion motion.[20,30,31] In these studies, the gains in total arc of motion (59° to 64°)[30,31] and final flexion (127° to 130°)[20,30] compare favorably with the gains reported in previous studies of open release isolated to the lateral or anterior aspect of the joint.[21,23,32]

Pearls and Pitfalls

Precise positioning of arthroscopic portals facilitates access to the joint while protecting the surrounding neurovascular structures. Tracing the ulnar nerve on the skin is a helpful reminder of the proper medial-to-lateral orientation of the joint. Proximal anterior portals are safer and provide better access to the anterior joint space. Portal placement in the contracted elbow requires caution to avoid misdirection through scarred and hypertrophied tissue. Neurovascular structures are close to the joint when soft tissues are contracted and are at risk during portal placement and capsular release.

The benefits of joint distention are minimized by the decreased joint volume seen with elbow contractures. After a lateral working portal is established, initial visualization can quickly be improved by sweeping the capsule proximally off the humerus. Distortion of the capsular anatomy can accompany various elbow fractures, especially following radial head fractures; the surgeon must be aware of this to avoid a neurovascular injury. When visualization is poor, an accessory anterolateral portal allows the placement of a capsular retractor. Use of electrocautery devices should be limited in the lateral aspect of the joint near the radial head, given the proximity of the radial nerve. The capsular release is performed after treatment of intrinsic problems because the benefits of capsular distention are lost following release. The capsular release should be performed proximal to the radio-

Table 1

Outcomes of Elbow Arthroscopy for the Treatment of Elbow Stiffness

Study	No. of Patients	Surgery	Mean Follow-up in Months (range)
Nguyen et al[7]	22 (11 arthritic, 8 trauma related)	Capsulectomy/capsulotomy. Removal of loose body and osteophytes when needed	25 (12-47)
Lapner et al[8]	12 (stiffness following radial head fracture)	Débridement (n = 12) and capsular release (n = 6)	54 (12-120)
Ball et al[6]	14 (all post trauma)	Débridement and capsular release	(12-29)
Savoie et al[9]	24 (all arthritic)	Débridement of osteophytes, capsular release, removal of radial head	32 (24-60)
Phillips and Strasburger[29]	25 (10 arthritic)	Débridement	18 (6-34)
Kim et al[10]	25 (12 post-trauma)	Loose body removal, anterior capsule release, osteophyte removal, partial radial head resection	25 (12-46)
Timmerman and Andrews[28]	19 (all post-trauma, 4 with moderate arthritis)	Débridement, capsular release and manipulation	29 (12-51)
Byrd[27]	5 (type 1 radial head fracture)	Arthroscopic débridement	24 (12-41)
Jones and Savoie[26]	12	Arthroscopic release	22 (15-32)

ASES = American Shoulder and Elbow Surgeons, ASES-e = American Shoulder and Elbow Surgeons elbow, MEPI = Mayo Elbow Performance Index, PIN = posterior interosseous nerve, Pt = patient, ROM = range of motion, VAS = Visual Analog Scale

capitellar joint line to minimize risk of injury to the radial nerve. It is usually necessary to switch the arthroscope to a lateral viewing portal to fully release the medial aspect of the anterior capsule under direct visualization.

The initial débridement of the posterior compartment should be directed laterally, thereby improving visualization in order to avoid injury to the medially located ulnar nerve. This is especially true in patients with an adherent posterior capsule or olecranon deformity. The medial gutter should be carefully cleared, with the shaver blades always facing away from the ulnar nerve. The olecranon tip should be fully exposed and assessed for signs of bony impingement in full extension. Bone can safely be removed from the olecranon tip, if needed, to gain extension motion.

In patients with <90° to 100° of flexion, it is very important to decompress the ulnar nerve and release the posterior bundle of the medial ulnar collateral ligament before the elbow is manipulated into flexion. The distal aspect of the triceps should be released from the distal humerus, thereby releasing all adhesions that may block flexion motion.

The key to maintaining the intraoperative gains in elbow motion is early and aggressive motion following surgery. Patients should be followed at regular intervals postoperatively to help direct their recovery. The rehabilitation protocol is adjusted as needed.

Summary

Elbow arthroscopy has advanced substantially in the past several years. Newer techniques have facilitated the treatment of more severe pathology. Open elbow surgery is associated with high postoperative morbidity and slow recovery. Minimally invasive techniques offer a viable alternative in select patients, allowing smaller incisions, decreased soft-tissue dissection and disruption, and, theoretically, easier rehabilitation. Arthroscopic management of elbow stiffness requires advanced skills and carries notable risk of nerve injury. However, with experience, this procedure may take its place in the armamentarium of the upper extremity surgeon.

Table 1 (continued)

Outcomes of Elbow Arthroscopy for the Treatment of Elbow Stiffness

Mean ROM (degrees)			
Preop	Postop	Mean Improvement in Arc of Motion (degrees)	Further Results
38-122	19-141	38	MEPI improved from 57 to 81. Postop ASES-e function score, 31/36. One temporary ulnar nerve palsy.
22-130	10-137	18	MEPI improved from 64 to 89. Pt satisfaction score, 8/10.
35-118	9-133	41	Pt satisfaction, 8.4/10. ASES function, 28.3/30.
40-90	8-139	81	23 pts satisfied. VAS pain decreased from 8.8 to 2.2. 22/24 pts with good/excellent results (Andrews-Carson score); 2 reoperations.
31-118	7-134	41	All pts improved. 1 reoperation
21-113	14-130	24	92% pt satisfaction. Morrey score improved from 2.8 to 4.6. 92% satisfied. 2 transient median nerve palsies.
29-123	11-134	29	Subjective score improved from 31 to 91. 79% good/excellent results (Andrews-Carson score). 2 reoperations.
41-124	30-138	44	All pts improved.
38-106	3-138	67	1 permanent PIN palsy.

ASES = American Shoulder and Elbow Surgeons, ASES-e = American Shoulder and Elbow Surgeons elbow, MEPI = Mayo Elbow Performance Index, PIN = posterior interosseous nerve, Pt = patient, ROM = range of motion, VAS = Visual Analog Scale

References

Evidence-based Medicine: References 15, 16, 18, 19, and 22 are level II studies. Reference 25 is a level III study. Reference 17 is level V expert opinion. The remaining references are level IV studies.

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