Review article

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ARTHROSCOPIC MANAGEMENT OF STIFF ELBOW

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Stiff elbow is a common clinical consequence in the elbow joint. Impairment in active daily living is noted in flexion-extension stiffness as well as rotational stiffness.

Elbow stiffness can be divided into 3 different types: intrinsic, extrinsic and mixed type. The intrinsic type is referred to as articular deficit and loss of conformity resulting from trauma, infection or arthritic changes of intra-articular origin. The extrinsic stiffness is caused by fibrotic changes or scar formation of surrounding muscles, ligaments or skin. Ectopic ossification is a typical example of the extrinsic type of stiff elbow. The mixed type is defined when both intrinsic and extrinsic causes are combined, and is most common among post-traumatic elbow stiffness.

Arthroscopic release of the anterior capsule for flexion contracture can be done in a safe way. In cases of severe joint contracture, however, it is safe to release and isolate the ulnar nerve with minimal incision before the arthroscopic capsular release; otherwise sudden gain of flexion after extensive release of the capsule may tether the ulnar nerve around posterior aspect of the medial epicondyle.

A recent trend of arthroscopy is to draw equal clinical outcomes compared to existing open surgery by incising minimally and starting early rehabilitation to lessen patients' pain and achieve better range of motion. But a thoughtful understanding of the elbow anatomy and skillful arthroscopic technique is essential to minimize neurovascular insult or other surgical complication caused by inexperience.

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Introduction

Stiff elbow is a common clinical consequence in the elbow joint. Impairment in active daily living is noted in flexion-extension stiffness as well as rotational stiffness. There are many potential causes, such as simple dislocation or fracture of the radial head or intra-articular distal humerus fracture. Elbow contracture can happen as the result of a complex fracture caused by high energy and usually associated with the surrounding muscles, collateral ligaments and joint capsule, and this has been indicated as the cause of post-traumatic joint stiffness or systemic diseases like hemophilia, osteoarthritis and rheumatoid arthritis (1).

The treatment of stiff elbow was classically done in open procedures, yet worsening of residual pain and stiffness, as well as infection are possible complications of open surgery. Arthroscopic procedures have advantages in minimizing damage to the surrounding soft tissues and relieving post-operative pain allowing the patients to start early mobilization and easy rehabilitation (2). Significant improvement of pain and elbow motion in patients who underwent arthroscopic treatment was observed in different studies (2-4). The trans-articular portal devised by Kim et al. is frequently used in elbow arthroscopy because it has a safer approach to the elbow joint, compared to others.

Diagnosis

There are different opinions about normal range of motion in elbow joint. Morrey from Mayo

clinic defined it as possible performance of more than 90% of daily activities with flexion-extension range of motion from 30 to 130 degrees and supination-pronation range of motion of 60 degrees (5).

Precise investigation regarding the cause of stiffness is a key to successful treatment. Elbow stiffness can be divided into 3 different types: intrinsic, extrinsic and mixed type. The intrinsic type is referred to as articular deficit and loss of conformity resulting from trauma, infection or arthritic changes of intra-articular origin. The extrinsic stiffness is caused by fibrotic changes or scar formation of the surrounding muscles, ligaments or skin. Ectopic ossification is a typical example of extrinsic type of stiff elbow. The mixed type is defined when both intrinsic and extrinsic causes are combined, and is most common among post-traumatic elbow stiffness.

Treatment

Conservative treatment

Most of the patients with a mild limitation of elbow motion showed good response to conservative treatment and satisfying clinical results were reported with aggressive rehabilitation in patients with mild flexion contracture, especially caused by long-term immobilization due to simple dislocation of the elbow. NSAIDS and intra-articular steroid injection are good in controlling patients' pain and improve their daily activities.

Arthroscopic surgery

Many authors have reported techniques of arthroscopic elbow surgery since the first introduction of arthroscopic capsular release of elbow in 1992 (6, 7). Anterior and posterior capsular release is applicable to post-traumatic patients with external type of stiff elbow. Arthroscopic release of anterior capsule for flexion contracture can be done in a safe way. In cases of severe joint contracture, however, it is safer to release and isolate the ulnar nerve with minimal incision before arthroscopic capsular release; otherwise sudden gain of flexion after extensive release of the capsule may tether the ulnar nerve around the posterior aspect of the medial epicondyle (8).

Although we generally use a 4.5 mm arthroscopic device, a 2.7 mm arthroscopic device for small joints can be used. The cannula is rarely used during elbow arthroscopy for its disadvantages in limiting the mobility of instruments. Prone position is the preferred position as it allows better access to the anterior and posterior capsular structures. However, other positions may be used such as the supine or lateral decubitus (1). Approach procedures for capsular release differ depending on the operator and the lesions affected, but the author prefer releasing anterior capsule first since neurological complications can occur more often in situation of visual disturbance in severe joint swelling. On the contrary, it is better to start with posterior capsular release when the ulnar nerve decompression is necessary. As contractures may alter the normal anatomy of the elbow, and the neurovascular structures may be displaced during insufflation (5). Moreover, it is important to precisely mark the anatomical structures on the skin in stiff elbow surgery, thus the medial/lateral epicondyle, radial head, ulnar nerve, intermuscular septum should be marked before joint influation (Figure 1).

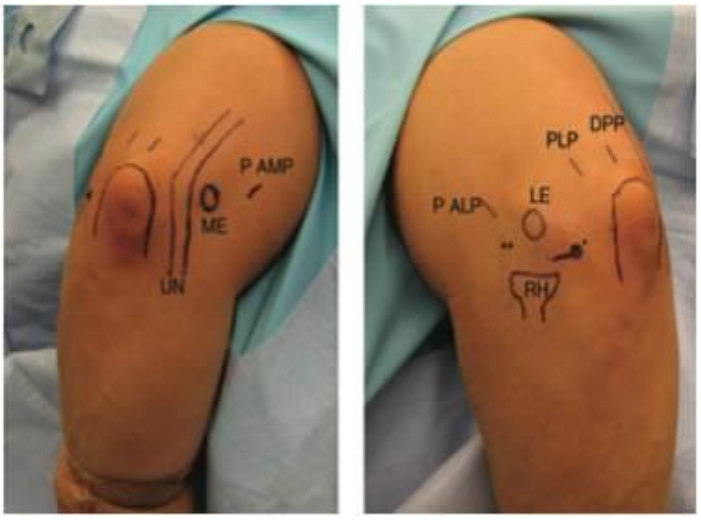

Figure 1. Exact skin marking is crucial in arthroscopic stiff elbow surgery.
The lateral epicondyle, medial epicondyle, radial head and ulnar nerve are drawn.
The arthroscopic portals are marked around the elbow joint.

Sometimes it is hard to insert instruments in to the joint, especially in severe stiff elbow. In such circumstances, the trans-articular portal devised by Kim et al. (9) is useful in inserting the device safely into the elbow joint. The entry point for the trans-articular approach is the intersecting point of horizontal line drawn from the capitellum to the olecranon and the sagittal line of the lateral margin of the olecranon. After the entry portal is made, a trocar is inserted and the space between radius-ulna-capitellum is carefully widen (Figure 2). Using this widened space, we can easily access to the anterior compartment.

Figure 2. Approach to the anterior compartment of the elbow by using the trans-articular portal, devised by Kim et al.

The extra-articular approach is another method to reach in to the space between the fibrous joint capsule and the brachioradialis muscle, but there are more chances of nerve damage (10).

The proximal anterolateral portal (P-ALP) and anteromedial portal (P-AMP) are frequently used in procedures. The P-ALP is located 2 cm proximal, 1 cm anterior to lateral epicondyle, and is a safer portal in terms of ulnar nerve damage. It is used as an extra portal to insert traction device into the joint. An intra-articular traction device is especially helpful when scar formation is very severe or extensive bone resection is required to gain operating space and secure good visual field in the anterior compartment (Figure 3).

Figure 3. The anterolateral portal (ALP) can serve as an extra portal for intra-articular traction device. Traction device is put to use in extending the operating room in the stiff elbow surgery and maintaining good arthroscopic vision during surgery.

First, we insert the shaver to remove the loose body and synovium, then use burr to remove the radial head fossa and bony spurs. It is favorable to deal with a lesion around the anterior compartment before releasing the anterior capsule. The capsule should be released from the lateral side and proximal attachment of the distal humerus (Figure 4). Since the radial nerve runs between the brachialis and brachioradialis muscle, just 2-3 cm anterior to the radial head, scar formation and adhesion derived from the capsular contracture can deteriorate normal anatomical structure. Thus, extreme caution is required during the soft tissue dissection and release in order to avoid radial nerve damage.

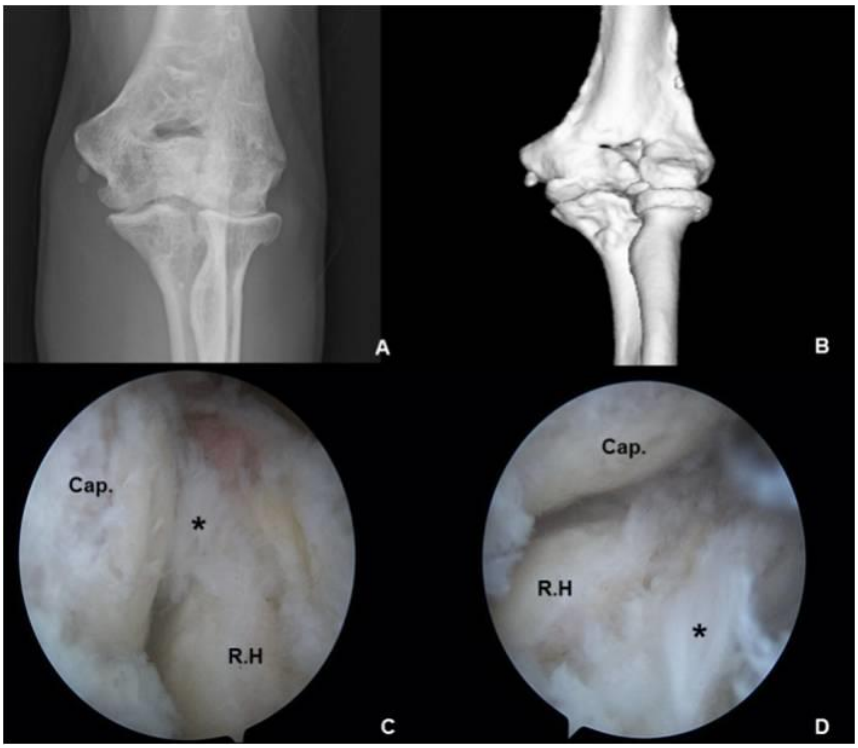

Figure 4. Radiologic and arthroscopic images of stiff elbow.
A. AP view X-ray image of stiff elbow.
B. 3D reconstruction image of affected elbow.
C-D. Arthroscopic image of the radiocapitellar joint.
The forearm should be supinated and pronated during operation to visually identify fibrotic scars (*) around radial head and severe fibrosis should be removed around the radiocapitellar joint, ulno-humeral joint, proximal radioulnar joint space. (Cap: capitellum, R.H: Radial head)

The posterior compartment is relatively safe from neurovascular insult compared to the anterior compartment. The posterior, posterolateral, and soft spot portals are commonly used in operation. Primarily, the posterolateral portal should be made at the lateral border of the triceps residing directly superior to the olecranon. Then, make the posterior portal by using spinal needle to insert the shaver. The posterior capsular release is done after obtaining clear vision, by removing fibrotic tissues and fat tissues with the shaver. Special attention should be paid on ulnar nerve damage during posteromedial capsular release and possibility of bony impingement during elbow flexion and extension as well (Figure 5).

The next step is to move the scope posteriorly to visualize the radiocapitellar joint and radio-ulnar joint and look for any rotational disability. If rotational abnormality is mainly due to abnormal articular surface of the proximal radius, radial head resection and removal of fibrotic scars can help to restore rotational stiffness.

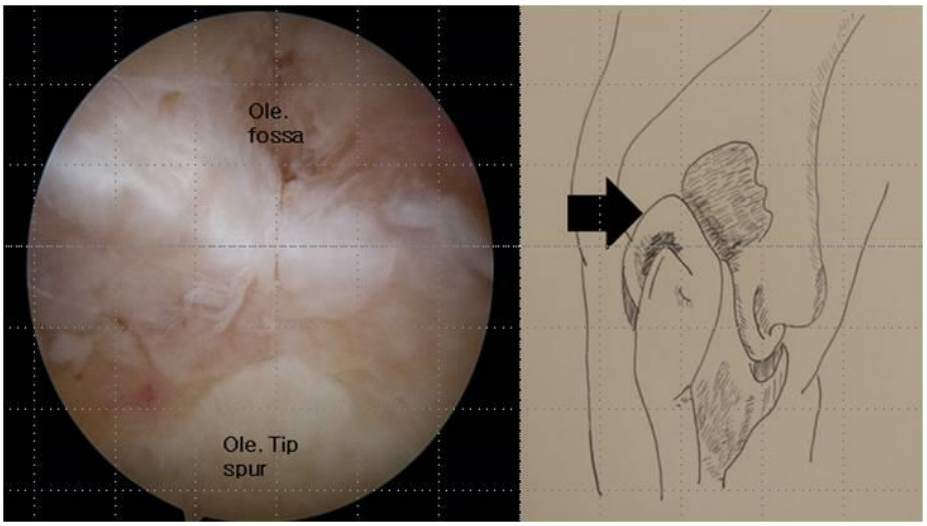

Figure 5. The posterior compartment of stiff elbow.
A. Arthroscopic image of the elbow joint.
Posterior bony impingement can be visualized by passive flexion and extension during surgery.
B. Schematic drawing of bony spurs at the tip of the olecranon.

Complication

Complication rate of arthroscopic stiff elbow surgery is relatively high among others. Infection rate is reported to be about 0.8-2%. Since the elbow joint is located just beneath the skin tissue, infection through the portals or fistula formation is more common and for this reason post-operative wound management is very crucial in elbow surgery. Furthermore, the nerve damage rate of around 2.5% is reported. Temporary nerve palsy was reported the most frequently (11). The risk factors are rheumatoid arthritis and contracture. However, permanent neurovascular injuries, hematomas or compartment syndrome were low or even neglected.

Rehabilitation

Post-operative immobilization is unnecessary in most cases. Early rehabilitation is started as early as within 3-4 postoperative days. In fact, the primary target of early rehabilitation is to lessen the pain of patients and to reduce swelling of the affected joint in order to start active exercise. We recommend repeating active assisted elbow ROM exercise 4-5 times a day, 5-10 minutes each (Figure 6).

Figure 6. Post-operative elbow rehabilitation.
Repeat active assisted elbow ROM exercise 4-5 times a day, 5-10 minutes each.

Clinical Results

Overall, clinical outcome after arthroscopic surgery of the elbow is favorable. Many of the reports included both the intrinsic and extrinsic type of stiff elbow showed good results in mild and moderate grade of stiff elbow without articular defect (Table 1). Savoie et al. (12) have reported 388 cases of arthroscopic capsular release of the stiff elbow. Clinical results showed the increase in the range of average elbow extension from -40 degrees to -5 degrees, while elbow ROM increased by 65 degrees. Overall 93% of the patients expressed satisfaction about the result of surgery.

Table 1. Outcomes of elbow arthroscopy in the treatment of elbow stiffness

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

Conclusion

Stiff elbow is hard to treat effectively and most of the intrinsic and extrinsic causes bring about limitation of motion. A recent trend of arthroscopy is to draw equal clinical outcomes compared to existing open surgery by incising minimally and starting early rehabilitation to lessen patients' pain and achieve better range of motion (13). But a thoughtful understanding of the elbow anatomy and skillful arthroscopic technique is essential to minimize neurovascular insult or other surgical complication caused by inexperience.

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ARTROSKOPSKO LEČENJE UKOČENOG LAKTA

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Ukočen lakat je česta klinička posledica u zglobu lakta. Ukočenost u vidu savijanja i opružanja u laktu, kao i ukočenost rotacionih pokreta u laktu, u mnogome utiče na normalno obavljanje svakodnevnih aktivnosti.

Ukočenost lakta deli se na tri tipa: unutrašnji, spoljašnji i kombinovani tip.

Unutrašnji tip ukočenosti u laktu podrazumeva zglobni deficit, koji je rezultat traume, infekcije ili artrotičnih promena unutar zgloba.

Spoljašnji tip ukočenosti u laktu uzrokuju fibrozne ili ožiljne promene na okolnim ligamentima, mišićima ili koži oko lakta. Ektopični kalcifikati su tipičan primer spoljašnjeg tipa ukočenog lakta.

Kombinovani tip ukočenog lakta posledica je kombinacije unutrašnjih i spoljašnjih uzroka i najčešći je uzrok posttraumatske ukočenosti.

Artroskopsko osolobađanje prednje kapsule zgloba lakta za fleksionu kontrakturu bezbedana je hirurška tehnika. U slučajevima teške kontrakture, potrebno je osloboditi i izolovati ulnarni živac minimalnom kožnom incizijom pre artroskopske operacije, budući da bi dobijeni pokret fleksije u laktu, nakon opsežnog oslobađanja kapsule, mogao da dovede do natezanja ulnarnog živca oko zadnjeg dela medijalnog epikondila.

Najnoviji rezultati u lečenju ukočenosti lakta metodom artroskopije ukazuju na postizanje jednakih kliničkih rezultata u poređenju sa tradicionalnom otvorenom hirurgijom i omogućavanje rane rehabilitacije, kako bi se postigao što bolji obim pokreta. Za uspeh artroskopskog lečenja ukočenog lakta neophodni su odlično poznavanje anatomije i vešta artroskopska tehnika, radi minimalizovanja neurovaskularnih povreda ili drugih hirurških komplikacija uzrokovanih neiskustvom.

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Ključne reči: *artroskopija, ukočen lakat*