Indications and Limits to Arthroscopic Postraumatic Elbow Stiffness

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Stiffness is a well-defined sequela following elbow trauma. The causes of this predisposition are unknown, and the functional limitation that results is variable, but the existence of effective surgical procedures has increased the ability of specialists to deal with this problem. The advent of arthroscopy has made progress in the treatment of these patients, although the potential for neurovascular complications and the learning curve have limited its expansion.

Definition

Elbow stiffness is defined as a loss of arc of movement of the elbow following a trauma, degenerative changes, brain trauma, burns, or neuromuscular problems. Classically, these alterations produce two types of stiffness: extrinsic contracture and intrinsic contracture. In practice, cases of mixed stiffness are the most common (with extrinsic predominance). Stiffness with extrinsic predominance includes all those structures that can limit elbow mobility (joint capsule, heterotopic ossification, skin contractures, and marginal osteophytes) with an integrity of the joint surface. Treatment will vary according to the cause of the patient's problem, which makes an understanding of all of the factors implicated a critical step for planning a given surgical procedure. Based on a series of patient interviews, the arc of functional mobility was defined as between 30–130°. With this arc of movement, patients were able to perform 90% of all their activities.[2] Normal elbow mobility, as defined by the American Academy of Orthopaedic Surgeons, ranges between 0 and 145°. A 50% reduction in elbow mobility can cause an 80% decrease in the functionality of the upper limb. Each patient's individual needs must be evaluated before surgery since some occupations have specific requirements (above all for full extension).

Pathogenesis

The reasons for predisposition to elbow stiffness are unknown, but several causes have been postulated, such as a highly congruent joint, the existence of 3 continuous joints within the same synovial joint cavity, and anatomical proximity to ligaments in the joint capsule and surrounding muscles. The nature of the joint capsule has been studied, showing a predisposition to early biochemical and structural changes, even after minor trauma, that produces a thickening and loss of elasticity in the tissues that lead to a loss of movement in the elbow. In the joint capsules with stiffness, increases in collagen crosslinks and decreases in proteoglycan content and total water content have been shown. In the treatment of intra-articular fractures, the goal is to achieve a congruent joint and stable osteosynthesis that allows proceeding with an early mobility protocol. Nonadherence to these treatment principles can lead to an increase in the incidence of post-traumatic elbow stiffness. A prolonged immobilization period is another isolated etiopathogenic factor that must be avoided when possible.

Indications

Those patients with a limited range of extension greater than 30° are candidates for surgery. Some patients with less than 30° of extension and with pain upon stretching the elbow or that limits their professional or vocational activity can also be candidates for corrective surgery. The loss of flexion (<100º) can limit daily hygienic activities and also must be considered as an indication for surgery. The treatment objective must be to reach a functional arc of movement free of pain.

The choice of an arthroscopic technique or a conventional open surgery is based on individual etiological factors and the experience of the surgeon. Independent of the surgical option used, achieving a congruent joint is an essential condition for determining the success of the procedure. Satisfactory results can be obtained with a simple capsulectomy for mild joint conditions, as long as the central articular axis is unscathed and the clinical evaluation shows acceptable joint congruency. When more advanced joint damage existsis associated with stiffness, an interposition arthroplasty may be considered.

When an arthroscopic technique is an option, the state and position of the ulnar nerve are of paramount importance. While transposition is not a formal contraindication, it may require a separate incision to locate and protect the nerve. Otherwise, it can be found preoperatively with ultrasound and marked appropriately. If the ulnar nerve is released during surgery, this can be performed through a small dedicated incision although some very skilled surgeons will be able to decompress the nerve through an arthroscopic technique.

The presence of previous fixation material such as plates and screws are again not a formal contraindication but may require modifications to the surgical technique. When removal of the fixation is needed it should be the last part of the procedure before closure.

Contraindications

The patient must be compliant and committed since the postoperative treatment and rehabilitation are essential for optimal results. Any patient that does not comply with these requirements should not be a candidate for surgery since this is one of the factors implicated in obtaining inferior results in younger patients. Mainly, two types of splints exist, static and dynamic splints. Currently, the preference of the majority of surgeons is for static splints, in which the patient controls the stretching of the tissues. In any case, it is important to prevent capsular damage (hemorrhages or partial tears) with the use of this type of treatment.

Surgical treatment:

Capsulectomy

Arthroscopic treatment

Arthroscopic techniques have entailed a significant advance in the treatment of an important group of patients with posttraumatic degenerative elbow stiffness. Most neurovascular complications occurring during elbow arthroscopy are associated with techniques that include anterior arthroscopic capsulectomy, for which only those surgeons that are highly familiarized with arthroscopic elbow anatomy should perform this procedure. Nevertheless, existing results confirm the efficacy of this technique.

Surgical technique

The patient is placed in a lateral lying position with the arm on a specially designed support for elbow arthroscopy. It is my preference to use general anesthesia because it provides an adequate control of pain, a complete muscular relaxation during the procedure, and allows for immediate postoperative exploration of the neurovascular state of the patient. A 4 mm arthroscope with a 30° angle of vision is used with gravity-fed serum and low pump pressure (30–40 mmHg).A tourniquet is employed systematically, avoiding its prolonged use for more than 90 min. Otherwise, the ischemia sleeve is lowered and replaced following a period of reperfusion. The joint is distended with saline before inserting the arthroscope. The volume received in these cases can be less than 10 cc (standard: between 20–30 cc), since the distance from bones and neurovascular structures is lower than in other procedures and, as such, increases the risk of complications.

Control of the ulnar nerve during the procedure is essential, and in cases with a previous transposition of the ulnar nerve, open surgery is required or, at the least, an associate minimal approach must be performed over the ulnar nerve, identifying it before proceeding with the elbow arthroscopy. When preoperative flexion is at 100-110°, a transposition or decompression of the ulnar nerve is recommended. In any case, if the ulnar nerve is unstable following release or in cases where subjacent damage can compromise the integrity of the nerve, it should be transposed. A diagnostic arthroscopy is performed through the proximal anterior portals (anteromedial and anterolateral).

The use of retractors, as described by O'Driscoll, facilitates intra-articular procedures and can significantly reduce the number of complications. Debridement of the intra-articular adherences and a synovectomy is performed in both joints (radiocapitellar and ulnohumeral) through these two portals. If an associated bone procedure is required, this must be done before starting the capsulectomy. The capsulectomy is begun with the optics in the anterolateral portal and the basket clamp at the anteromedial portal, progressing into the radiocapitellar region, where the position of the instruments must be inverted. In this zone, the radial nerve is in close contact with the capsule, necessitating a meticulous and careful dissection to avoid iatrogenic complications. Once the capsulectomy has been performed, the procedure is completed with a motorized resector without suction.

The posterior part of the arthroscopy is performed through the posterior and posterolateral portals. The posteromedial region, where the ulnar nerve is located, must be protected throughout the procedure. The synovectomy is completed, along with resections of the olecranon osteophytes and fossa. The posterolateral gutter debridement is performed with vision in the central portal and the resector in the posterolateral portal, although a mediolateral portal may also be necessary (soft point) for resection of scar tissue in the posterior area of the radiocapitellar joint. Postoperative treatment is similar to the procedure used for open surgery since the technical objective is the same even though the surgical technique used is different.

Postoperative Management

Active assisted motion exercises are the mainstay of treatment for uncomplicated cases. Very stiff elbows or those with a lot of postoperative edema are put through a CPM machine for 48-96 hours. Patients are then instructed on a self-assisted program of a static progressive splint that they use accordingly for six weeks. Some patients may need an additional period of 6 weeks. Most patients can discontinue this kind of splints by three months.

Results

Koddle et al. summarized the available results in a systematic review. The average gain after arthroscopic surgery was 40º of motion with a rate of complications of 5%. As the extent fo surgery

increased (open and distraction arthroplasty) the range of motion gain also increased, usually due to a more severe preoperative condition, but with an increase rate of complications ranging for 23 to 73%.

Literature