

Arthroscopic Arthrolysis of Stiff Elbow

Pablo Cañete San Pastor, M.D.



Elbow stiffness is defined as an arc of flexion-extension motion of less than 100° and/or a contracture of more than 30° in flexion. Stiff elbow is common and can be very disabling, preventing individuals from carrying out the basic activities of daily living. The most common cause of stiff elbow is the sequela of an injury, but osteoarthritis can also produce limitations of mobility, which can benefit from surgical treatment. The treatment of stiff elbow is initially orthopedic. If the patient still has functional limitations of the elbow after 6 months of suitable rehabilitation treatment, the option of surgical treatment must be considered. Surgical arthrolysis of the elbow can be performed with open surgery as well as with arthroscopic surgery. Good results can be obtained with both techniques achieving a functional arc of at least -30° extension to 130° of flexion. Arthroscopic surgery enables results comparable with those of open surgery but with a lower percentage of complications.

Introduction

Elbow stiffness is defined as an arc of flexion-extension motion of less than 100° and/or a contracture of more than 30° in flexion.¹ Morrey et al.¹ defined a functional range of mobility of the elbow of 100° in both planes (130°-30° in flexion-extension and 50°-50° in supination-pronation), with which the majority of activities of daily living could be carried out.

Stiff elbow is common and can be very disabling, preventing the carrying out of basic activities of daily living like fastening a shirt button, lifting a spoon to the mouth, or washing the face. The most common cause of stiff elbow found in the clinic of an elbow surgeon is the sequela of an injury, usually of a bone or osteochondral fracture, with or without surgical treatment. Osteoarthritis of the elbow can also produce limitations of mobility of the elbow, which can benefit from surgical treatment.^{2,3}

The treatment of stiff elbow is initially conservative, with rehabilitation, exercises, and stretching, for at least 6 months.^{4,5} If after 6 months of suitable rehabilitation treatment, the patient still has functional limitations of the

elbow (due to a deficiency in mobility or pain), the option of surgical treatment may be considered. Surgical arthrolysis of the elbow can be performed by open surgery as well as with arthroscopic surgery. Good results can be obtained with both techniques,⁶⁻¹⁰ achieving a functional arc of at least -30° extension to 130° of flexion in the majority of the patients. Arthroscopic surgery enables results comparable with those of open surgery, but with a lower percentage of complications (Table 1). In open surgery these can be up to 23%^{11,12} and include cutaneous and muscular fibrosis, soft tissue injuries, hematomas, infection, heterotopic ossification, or injuries to nerves. In both cases, the patients must have an early and lengthy postoperative rehabilitation after the surgery. It is essential that the patient is aware of the postsurgical phase and is motivated to carry out the rehabilitation.

Indications and Preoperative Planning

If after 6 months of rehabilitation, the patient still has functional limitations of the elbow and severe or very severe stiffness according to the Morrey scale¹³ (very severe: less than 30° of mobility; severe, 30° to 60°), surgical treatment would be indicated. If the patient has complete pronosupination but an elbow extension of -80° and an elbow flexion of 100°, the patient has a severe elbow stiffness and an arthroscopic arthrolysis of stiffness could be indicated (Figs. 1 and 2) (Video 1).

Three-dimensional CT scanning is performed prior to the surgery, which is mandatory to prepare for the surgery and studying where and how many osteophytes and free bodies have to be resected (Fig. 3).

From Hospital de Manises, Valencia, Spain.

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Address correspondence to Pablo Cañete San Pastor, M.D., Av. Emilio Baró 8, pta. 9., 46020, Valencia, Spain. E-mail: pablotrauma@gmail.com

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Table 1. Advantages and Disadvantages of the Arthroscopic Arthrolysis Technique

Advantages	Disadvantages
Less pain, inflammation, and soft tissue injury of the elbow	Complex technique with long learning curve. First cases may get worse results ¹²
Good results comparable with open surgery ^{5-9,17,20-22}	Risk of continuous drainage of portals and infection ¹⁴⁻¹⁷
Lower percentage of complications (23%) in open surgery): cutaneous and muscular fibrosis, soft tissue injury, bruising, infection, heterotopic ossification, or nerve lesions ^{10,11}	Specific arthroscopic instrumentation is necessary
Allows earlier start of rehabilitation ^{21,22}	Most expensive technique ²²
Better cosmetic results	There is still a risk of neurovascular injury ^{14-17,22}
	Open surgery is necessary for the removal of plates or other osteosynthesis

Patient Setup

The intervention is performed with the patient in the lateral decubitus position and under brachial plexus block anesthesia. An ischemic cuff is used on the arm at 250 mm Hg. The ischemia time has to be less than 2 hours. If more than 30° of elbow motion is expected, ulnar nerve release is performed, using an incision of about 2 cm at the beginning of the surgery as suggested by ÓDriscoll and Morrey¹² or Blonna and O’Driscoll.¹³ This also served to protect the nerve during the arthroscopy (Fig. 4).

After the release of the ulnar nerve, the arthroscopy is performed, by first accessing the anterior part of the elbow. It is insufflated via the anterior “soft spot” (a point in the center of the triangle between the epicondyle, the olecranon, and the radial head) with

20-40 ml of normal saline in order to distend the joint and reduce the risk of neurovascular injury, as suggested by Hilgersom et al.¹⁸ The elbow is accessed through the anteromedial portal,¹⁹ where the scope is placed. The anterolateral portal is made, being guided with a needle of a 14 Abbocath catheter (an outside-to-inside technique).

First, a mild synovectomy with the shaver without suction is made, just to improve the visibility. Suction is not used to decrease the risk of collapse of the anterior capsule and neurovascular damage. Then the loose bodies are removed (Fig. 5) and the osteophytes of the coronoid process and the coronoid fossa are resected (Fig. 6). Once the bone part is finished, a synovectomy and anterior capsulotomy are performed to improve the elbow extension. The anterior capsulotomy is started



Fig. 1. Measurement of passive preoperative extension of the elbow with the patient under brachial plexus block anesthesia, in this case, -75° . It is important to measure the mobility of the elbow under anesthesia before and after surgery and to reflect it in the clinical history of the patient.



Fig. 2. Measurement of passive preoperative flexion of the elbow with the patient under the brachial plexus block anesthesia, in this case, 110° . It is important to measure the mobility of the elbow under anesthesia before and after surgery and to reflect it in the clinical history of the patient

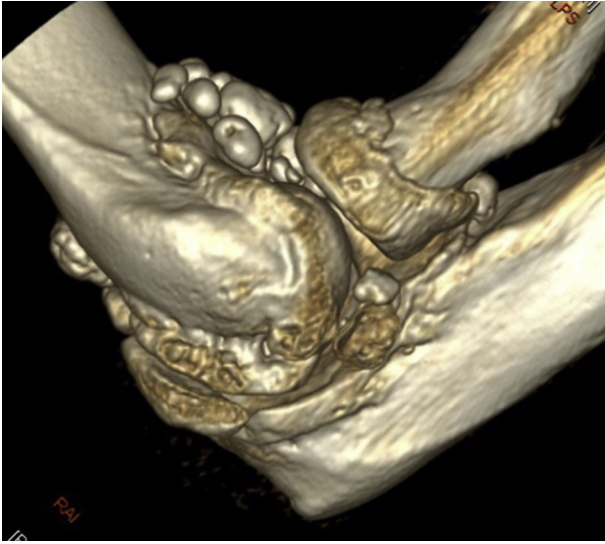


Fig. 3. Three-dimensional computed tomography is performed before surgery. This is mandatory to prepare for surgery and to know the locations and quantities of the osteophytes and free bodies we will resect. This surgery has to be planned in detail to locate free bodies in the anterior and posterior chambers of the elbow and to locate osteophytes in the coronoid tip and coronoid fossae, in the olecranon and olecranon fossae, and in the lateral and medial gutters of the elbow. These osteophytes and free bodies must be resected to recover mobility of the elbow.

from medial to lateral, approximately 1 cm to the tip of the coronoid process using a “hook” radiofrequency ablation probe (VAPR, DePuy Synthes, Raynham, MA) (a tool that is very useful and very advisable for this task, as it provides very good control of the depth of the resection of the capsule in order to avoid injuring the neighboring neurovascular structures) (Fig. 7). It is advisable to take great care with the joint capsule that is above the radial head, since the posterior interosseous nerve is close and is at risk. The capsule above the radial head is leaved intact or just partially resected and later with forced extension of the elbow the resection of this part of the capsule is completed. Once the anterior capsulotomy is completed, the muscle tissue of the brachial muscle should be seen (Fig. 8) (Video 1).

Next, the work is performed in the posterior chamber of the elbow, using the central transtricipital portal as viewing portal and the posterolateral portal as the working portal (these portals will change their function during the surgery and more central and proximal portal is created).¹⁴ A posteromedial portal is not made so as not to put the ulnar nerve at risk, as suggested by Hilgersom et al.¹⁸ In the posterior part, work is performed in the same order, first, the extraction of the loose bodies and the resection of the osteophytes in the olecranon tip, olecranon fossa, and the lateral and medial part of the elbow (protecting the ulnar nerve in this last step). After the bone part, the posterior

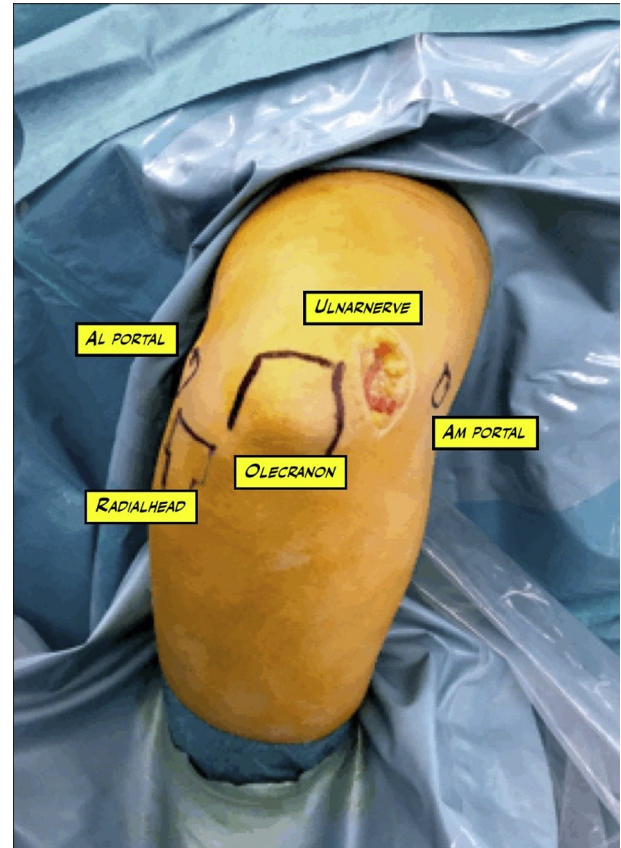


Fig. 4. Ulnar nerve open release before arthroscopic surgery. Before arthroscopy, an open release of the ulnar nerve is made with a small incision, without transposition. This allows protection of the nerve during surgery and prevents the appearance of ulnar neuritis in the postoperative period. AM, anteromedial; AL, anterolateral.

capsulotomy is performed, in order to obtain complete flexion of the elbow (Table 2).²⁰

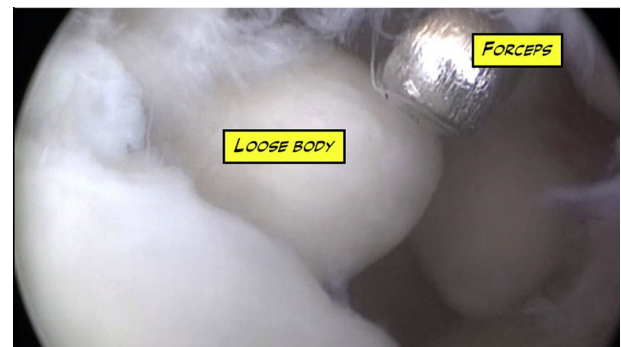


Fig. 5. Arthroscopic view of the anterior chamber of the elbow with the scope in the anteromedial portal and a Kocher forceps from the anterolateral portal. For loose body extraction, one of the first things that is done in the arthroscopy is the removal of free bodies with a Kocher clamp. After extraction of free bodies, vision is improved. If resection of osteophytes and capsulectomy are performed first, the extraction is more difficult and migration of free bodies can happen.

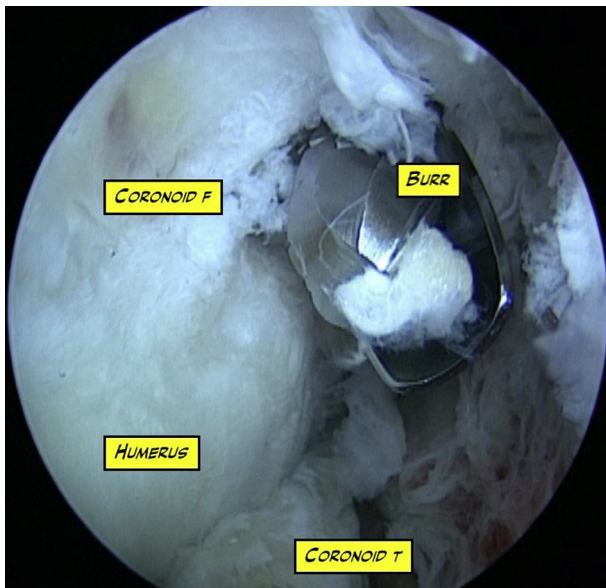


Fig. 6. Arthroscopic view of the anterior chamber of the elbow with the scope in the anteromedial portal and a burr from the anterolateral portal to perform resection of the osteophytes of the coronoid fossa. These osteophytes in the coronoid fossa and in the tip of the coronoid had previously been studied in the preoperative three-dimensional CT scan (Coronoid F) and the osteophytes of the coronoid tip (Coronoid T).

Before closing the portals, a passive mobilization of the elbow and a measure of the final mobility achieved are performed. Then the skin portals are closed with mattress stitches. No drains are left in.

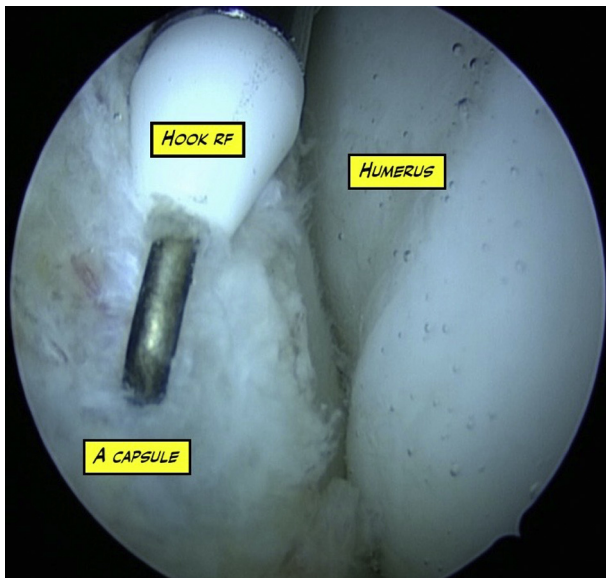


Fig. 7. Arthroscopic view of the anterior chamber of the elbow with the scope in the anteromedial portal and a hook radiofrequency ablation probe (Hook RF) from the anterolateral portal to perform capsulotomy of the anterior capsule (A Capsule). Use a "hook" radiofrequency ablation probe to achieve good control of the depth of the resection of the capsule to decrease the risks of neurovascular injury.

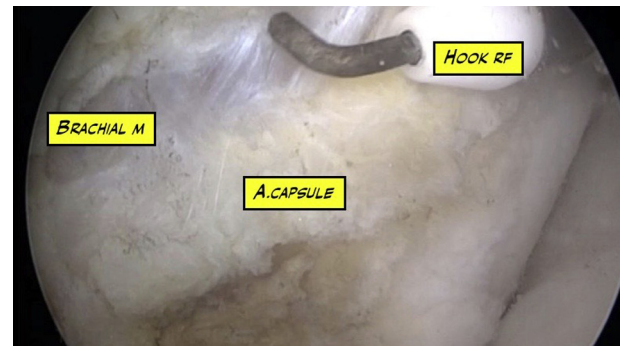


Fig. 8. Arthroscopic view of the anterior chamber of the elbow with the scope in the anteromedial portal and a hook radiofrequency ablation probe (Hook RF) from the anterolateral portal after the capsulotomy of the anterior capsule (A.Capsule). We can appreciate the muscle fibers of the brachial muscle (Brachial M). After the anterior capsulotomy, it is important to avoid damaging the brachial muscle fibers as the median nerve and humeral artery are close and to avoid bleeding from the brachial muscle to reduce the risk of heterotopic calcifications.

Postoperative Management

A plaster splint with the elbow in extension is used. The patient is discharged from the hospital at 24 hours. The plaster splint is removed at 48 hours in the clinic, and the first cure is performed and instructions to do active and self-assisted exercises are given to the patient. An CPM is not used on the elbow. The patient is referred to the Rehabilitation Department within 7-10 days to start treatment.

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Table 2. Pearls and Pitfalls of the Arthroscopic Arthrolysis Technique

Pearls	Pitfalls
Open release of ulnar nerve before arthroscopy ^{12,13,18,22} ; prevents ulnar neuritis, protects the nerve during the surgery, allows to section the posterior band of the medial collateral ligament in cases of limitation of elbow flexion	Elbow stiffness is not an indication for beginners. Gain experience in elbow arthroscopy with simpler indications ¹²
Insufflate 20-40 ml of normal saline in order to distend the joint and reduce the risk of neurovascular injury	Never exceed 2 hours of arm ischemia. If more than 2 hours are expected for the procedure, go to open surgery ^{21,22}
Go first to anterior elbow, the most risky and difficult part	Take great care with the joint capsule that is above the radial head, since the posterior interosseous nerve is close and is at risk ^{12,13,21,22}
First do the bony part of the procedure ^{12,20-22}	Do not resect bone after capsulotomy: vascular structures have a higher risk of injury without protection of anterior capsule ^{12,22}
Use a “hook” radiofrequency ablation probe; provides very good control of the depth of the resection of the capsule ²²	Avoid bleeding from the brachial muscle to reduce the risk of heterotopic calcifications ¹²
Leave the capsule above the radial head just partially resected and later do a forced extension of the elbow to complete the anterior capsulotomy ^{12,22}	Avoid posteromedial portal: risk of ulnar nerve damage ¹⁸
Before closing of the portals, do an elbow mobilization and measure the achieved motion	
Hermetic closing of the portals to avoid drainage and infection risk	

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