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Research Article

Can we Obtain Good Results in the Treatment of Elbow Stiffness of Degenerative or Posttraumatic Origin

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Abstract

Purpose: The purpose of this study is to evaluate the outcomes and the complication rates of arthroscopic arthrolysis of the stiff elbow. The hypothesis presented is that arthroscopic arthrolysis is a safe and effective technique that can return patients to high range of motion and function in their elbows and a great degree of patient satisfaction, whether the stiffness is of osteoarthritic or post-traumatic origin.

Methods: This is a retrospective study. We have made a review on 38 patients with stiff elbow due to degenerative or post-traumatic reasons, and who were treated by arthroscopic arthrolysis between 2013 and 2016, with a mean follow-up of 25 months (38-15). Elbow stiffness was classified following the Morrey scale and the Mayo Elbow Performance Index (MEPI) functional scale was used to evaluate pain, mobility, stability and elbow function pre- and post-operatively. The arthroscopic procedures performed on each patient are described, including synovectomy, debridement of fibrous tissue, anterior and/or posterior capsulotomy, resection of osteophytes in the anterior and posterior part of the elbow, extirpation of loose bodies and open release of the ulnar nerve.

Results: Mobility increased 40.13; 16.71 degrees in flexion and 23'42º in extension. The MEPI scale improved from 65 (+/- 15) to 93 (+/- 20). 35 patients achieved a functional range of motion of at least 100º (130º of flexion and -30º of extension). The patients of group 1 (degenerative origin of elbow stiffness) improved 35º and those of group 2 (posttraumatic origin of elbow stiffness) improved 45'83º. All of these results being statistically significant ($p < 0´05$) We had 1 case of superficial infection in a portal, which solved with antibiotic treatment; 3 cases of ulnar nerve neuritis, with spontaneous recovery before 6 months; and 2 cases in which a reoperation was necessary due to recurrence of stiffness: one with good results (from -40º of preoperative extension and 100º of flexion to -30º of postoperative extension and 120º of flexion) and the other continues with good mobility but pain that doesn´t allow him to do his job, he has requested for work disability and does not want a new surgical intervention.

Conclusion: Arthroscopic arthrolysis of the elbow is a safe and effective technique which enables good functional results to be obtained in the treatment of degenerative or post-traumatic stiff elbow, even in severe cases, with a low complication rate.

In the patients of this study, the complete mobility of the elbow could not be restored with this technique; we must inform our patients of this risk Level of Evidence: IV

Keywords: Elbow Arthroscopy; Elbow Stiffness; Elbow Arthrolysis

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 [19]. Morrey defined a functional range of mobility of the elbow of 100º in both planes (130º-30º in flexion-extension; and 50º-50º in supination-pronation), with which the majority of activities of daily living could be carried out.

Approximately 12% of the injuries suffered by the elbow (fractures, dislocations, ruptures of the bicep tendon [11]) end up as contractures that require surgical treatment [21]. Osteoarthritis of the elbow can also produce limitations of mobility of the elbow, which can benefit from surgical treatment.

For a long time, it has been considered that stiff elbow, whether as a result of osteoarthritis of the elbow or the sequela of a frac-

ture, had to be come to terms with by the patient. The treatment of stiff elbow is initially orthopaedic, with rehabilitation, exercises, and stretching, for at least 6 months [5,30]. 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 must 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 [2,8,23,24,35], achieving a functional arc of at least -30º extension to 130º of flexion in the majority of the patients. Arthroscopic surgery enables results to be obtained that are comparable with those of open surgery, but with a lower percentage of complications. In open surgery these can be up to 23% [15,18], and include cutaneous and muscular fibrosis, soft tissue injuries, haematomas, infection, heterotopic ossification or injuries to nerves. In both cases, the patients must have an early and lengthy post-operative rehabilitation after the surgery. It is essential that the patient is aware of the post-surgical phase and is motivated to carry out the rehabilitation.

Purpose

The purpose of this study is to evaluate the outcomes and the complication rates of arthroscopic arthrolysis of the stiff elbow. The hypothesis presented is that arthroscopic arthrolysis is a safe and effective technique that can return patients to high range of motion and function in their elbows and a great degree of patient satisfaction, whether the stiffness is of osteoarthritic or post-traumatic origin.

Methods

We have performed 41 arthroscopic arthrolysis for the treatment of stiff elbow refractory to nonoperatively treatment, from January 2013 to May 2016. Of those 41 patients, a retroscpective analysis was carried out on 38 patients with stiff elbow due to different causes (postraumatic or degenerative). We have lost 3 patients; two patients did no come to the three months control, and the other one did no come to the six month control. The mean follow of the patients was 25 (15-38) months. Stiffness was classified according to the Morrey scale [20] (very severe: less than 30º of mobility; severe, between 30º and 60º; moderate, between 60º and 90º; and mild, greater than 90º), and the Mayo Elbow Performance Index (MEPI) functional scale was used to evaluate pain, mobility, stability and function of the elbow, pre- and post-operatively. In all cases a 3D CT Scan has been performed prior to the surgery, which is very useful for preparing the surgery and studying where and how many osteophytes and free bodies we are going to resect (Video 0-1:36).

Table 1		**Table Of Cases**							
Case	Gender-Age	Laterality - Occupation	Cause	Grupe	Pre-op mobility (F-E and P-S)	Post-op mobility (F-E and P-S)	Mobility gain (F-E and P-S)	Surgical tips	Complications
1	M-44	Right Furniture assembler	Lateral condyle osteochondritis dissecans	1	130 a -30 90-90	140 a -10 90-90	30º 0º	Synovectomy, capsulotomy, ulnar neurolysis, unstable fragment extraction + perforations	
2	M-47	Right Trumpet player	Primary osteoarthritis	1	130 a -40 90-90	140 a- 20 90-90	30º 0º	Synovectomy, loose bodies, osteophytes, ulnar neurolysis, capsulotomy	Cubital neuritis resolved at 3 months

3	M-50	Right Assembly line	Primary osteoarthritis	1	120 a -35 70-90	135 a -10 90-90	40º 20º	Synovectomy, loose bodies osteophytes, ulnar neurolysis capsulotomy	
4	W-50	Left Housewife	Olecranon fracture	2	110 a -50 80-80	130 a -20 80-80	50º 0º	Synovectomy, capsulotomy, ulnar neurolysis	
5	M-24	Left Student	Simple dislocation	2	130 a -40 80-70	135 a -15 90-90	30º 30º	Synovectomy, capsulotomy, ulnar neurolysis	
6	W-43	Right Office worker	Capitellum fracture and radial head (orthopaedic)	2	120 a -70 80-60	140 a -30 80-80	60º 20º	Adherences, capsulotomy, ulnar neurolysis, radial head and capitellum osteochondral unstable fragments	
7	W-34	Right Office worker	Simple dislocation	2	120 a -30 80-70	140 a -10 85-85	40º 20º	Ulnar neurolysis, capsulotomy	
8	W-32	Right Nurse	Radial head fracture (orthopaedic)	2	120 a -20 70-70	140 a -10 85-85	30º 30º	Fibrosis, radioulnar adherences, ulnar neurolysis, capsulotomy,	
9	M-55	Right Mechanic	Lateral condyle osteochondritis dissecans	1	110 a -30 80-65	110 a -30 80-65	0º 0º	Synovectomy, capsulotomy, ulnar neurolysis, unstable fragment extraction + perforations	Poor outcome. Cubital neuritis resolved at 6 months
10	W-49	Right Sales	Post-traumatic osteoarthritis (fracture 20 years ago)	1	120 to -30 85-85	130 to -10 85-85	30º 0º	Synovectomy, capsulotomy, ulnar neurolysis, osteophytes	
11	W-51	Right Shop worker	Radial head fracture (orthopaedic)	2	120 a -60 70-65	140 a -20 85-80	60º 30º	Fibrosis, radioulnar adherences, ulnar neurolysis, capsulotomy, loose body	
12	W-73	Right Housewife	Radial head fracture (orthopaedic)	2	120 to -50 70-70	135 to -25 80-80	40º 20º	Radioulnar adherences, coronoid calcifications, capsulotomy, ulnar neurolysis	

13	M-19	Right Student	Osteochondritis dissecans. Fish tail deformity	1	120 a -30 85-85	130 a -20 85-85	20º 0º	Synovectomy, adherences, ulnar neurolysis, unstable fragment extraction + perforations	
14	M-47	Left Office worker	Radial head fracture (orthopaedic)	2	100 a -40 70-70	120 a -30 80-80	30º 20º	Fibrosis, adherences, capsulotomy, ulnar neurolysis	Intervened twice + unit pain. Well at 2 years
15	M-34	Right Engineer	Simple dislocation	2	110 a -30 70-80	145 a 10 90-90	55º 30º	Adherences, fibrosis, posterior osteochondral lesion (debridement + perforations), capsulotomy, ulnar neurolysis	
16	M-48	Right Manual worker	Radial head fracture (orthopaedic)	2	110 a -40 70-70	130 a -15º 80-85	45º 25º	Radioulnar adherences, capsulotomy, ulnar neurolysis	
17	M-36	Left Office worker	Radial head fracture (orthopaedic)	2	110 a -50 70-80	140 a -20º 80-85	60º 15º	Radioulnar adherences, capsulotomy, ulnar neurolysis	
18	M-46	Right Assembly line	Radial head fracture (orthopaedic)	2	120 a -40 80-80	130 a -30 80-80	20º 0º	Synovectomy, loose bodies, osteophytes, ulnar neurolysis, capsulotomy	Poor outcome. Pain. Intervened 4 times. Disabled
19	M-21	Right Student	Childhood osteochondral lesion	1	130 a -20 85-85	140 a -10º 85-85	20º 0º	Debridement and perforations, osteochondral lesion in radial head and in humeral condyle, loose body, ulnar neurolysis	
20	W-66	Right Housewife	Radial head fracture (orthopaedic)	2	100 a -40 60-70	140 a -10 80-85	70º 35º	Fibrosis, capsulotomy, ulnar neurolysis, radial head extraction	
21	M-29	Left Sales	Radial diaphyseal fracture (intervened with plate)	2	120 a -40 70-70	140 a -10 85-80	50º 25º	Fibrosis, capsulotomy, ulnar neurolysis, removal of the osteosynthesis material (plate)	

22	M-66	Right Truck driver	Primary osteoarthritis	1	120 a -35 80-80	140 a -10 80-80	45º 0º	Loose bodies, osteophytes, Ulnar neurolysis, capsulotomy	Ulnar neurolysis, Numbness of 5th finger (resolved at 4 months)
23	M-24	Left Construction	Radial head fracture (orthopaedic)	2	120 a -30 70-70	140 a -10 80-80	40º 20º	Fibrosis, capsulotomy, ulnar neurolysis	
24	M-58	Left Construction	Osteoarthritis (primary versus over use)	1	110 a -25 85-85	140 a -15 85-85	40º 0º	Osteophytes, ulnar neurolysis	
25	M-51	Right Sales	Gouty osteoarthritis	1	120 a -20 85-85	140 a -10 85-85	30º 0º	Loose bodies, osteophytes, ulnar neurolysis	
26	M-56	Right Operator	Osteoarthritis	1	120 a -20 80-70	140 a -10º 80-85	30º 15º	Loose bodies, osteophytes, ulnar neurolysis	
27	W-54	Left Teacher	Radial head fracture (orthopaedic)	2	130 a -50 70-60	140 a -10 80-80	50º 30º	Fibrosis, radioulnar adherences, capsulotomy, ulnar neurolysis	Superficial portal LA infection that improved with antibiotics
28	M-65	Left Bus driver	Osteoarthritis	1	110 a -40 80-75	130 a -10º 80-85	50º 10º	Loose bodies, osteophytes, ulnar neurolysis, capsulotomy	
29	M-55	Right Manual worker	Osteoarthritis (primary versus over use)	1	100 a -30 80-80	120 a -10 80-80	40º 0º	Loose bodies, osteophytes, ulnar neurolysis, capsulotomy	NOTE: capsulectomy in osteoarthritis
30	M-58	Right Operator	Osteochondral lesion (lateral condyle)	1	130 a -40 85-75	140 a -20 85-85	30º 10º	Fibrosis, radial plica, osteochondral lesion curettage, ulnar neurolysis	
31	M-52	Left Caretaker	Epicondylitis surgery sequela	1	120 a -90 70-80	140 a -60 80-80	50º 10º	Capsulotomy	
32	W-66	Right Housewife	Osteoarthritis	1	110 a -40 85-85	130 a 10 85-85	50º 0º	Loose bodies, osteophytes, ulnar neurolysis, capsulotomy	

33	W-53	Left Assistant	Radial head fracture (orthopaedic)	2	100 a -40 70-70	130 a -15 85-85	55º 30º	Fibrosis, capsulotomy, ulnar neurolysis	
34	M-35	Right Judo teacher	Osteoarthitis (overuse)	1	120 a -70 90-90	135 a -30 90-90	55º 0º	Loose bodies, osteophytes, ulnar neurolysis, capsulotomy	
35	M-22	Right Student	ChildhoodRadial head sequelae	1	120 a -40 10-10	130 a -10 20-20	40º 20º	Fibrosis, osteophytes, ulnar neurolysis, capsulotomy	
36	W-37	Right Lawyer	Radial head fracture (orthopaedic)	2	130 a -40 60-70	130 a -20 80-80	20º 30º	Fibrosis, ulnar neurolysis, capsulotomy	
37	W-27	Left Computer engineer	Childhood fracture sequelae	1	130 a -30 10-10	130 a -10 10-10	20º 0º	Fibrosis, ulnar neurolysis, capsulotomy	
38	M-22	Right Ball player	Osteoarthitis (overuse)	1	130 a -40 85-85	140 a -20 85-85	30º 0º	osteophytes, ulnar neurolysis, capsulotomy	

Table 1: Table with the data of each patient evaluated in this study.

To better understand the results according to the cause of the stiffness, we have divided the patients into two groups. Patients in group 1 are patients with degenerative osteoarthritis: primary osteoarthritis, post-traumatic osteoarthritis (trauma more than two years ago), overuse osteoarthritis (occupational or sports, including chronic osteochondritis). Group 2 includes patients with post-traumatic stiffness (Table 1).

In our study there are 20 patients with degenerative stiffness (18 men and 2 women, mean age of 45.9 years (19-66)). And 18 patients with posttraumatic stiffness (10 women and 8 men, mean age of 43.39 (24-73)).

In patients of group 2 (posttraumatic) we found: 1 olecranon fracture, 3 simple dislocations, 1 fracture of the capitellum, 12 radial head fractures, 1 fracture of the diaphysis of the radius. Only this last case of diaphyseal fracture of the radius has been treated with acute surgery (open reduction and fixation with screwed plate); the rest of fractures were treated non operatively, without surgery.

Surgical technique

All the arthroscopies were performed by the same surgeon, with experience in this type of surgery. All the interventions were performed with the patient in the lateral decubitus position, and under plexular +/- general anaesthesia (depending on the decision by the anaesthetist). An ischaemic cuff was used on the arm at 250 mmHg. The maximum ischaemia time was 1.5 hours. If it was hoped to gain more than 30º of flexion, and in the patients that showed signs of neuritis of the ulnar nerve, an ulnar nerve release was performed, using an incision of about 2 cm at the beginning of the surgery as suggested by O´Driscoll or Blonna [4,22]. This also served to protect the nerve during the arthroscopy, and in order to section the posterior bundle of the medial collateral ligament in case of a large deficit in flexion, generally in cases of post-traumatic stiffness. Kim [13] in 2017 found flexion improvement at 6 months in degenerative elbow stiffness patients he performed a release of the posterior band of the medial collateral ligament, but no differences in the final result with respect to those he did not release it. Therefore, Kim doesn´t recommend the section of the posterior band of the medial collateral ligament in cases of elbow stiffness due to osteoarthritis.

In this series, ulnar nerve neurolysis was performed in all cases except one (a case of stiffness as a sequela of an epicondylitis intervention). Transposition of the ulnar nerve was not performed in any of the cases (Figures 1 and 2).

After the release of the ulnar nerve, the arthroscopy was performed, by firstly accessing the anterior part of the elbow. It was insulated via the anterior “soft spot” (a point in the centre 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 Verhaar and Hilgersom [9,32]. The elbow was accessed through the anteromedial portal [6], where we put the scope. The anterolateral

portal was made, being guided with an abbocath needle (an outside to inside technique). Occasionally a more proximal accessory anterolateral portal would need to made, through which could be introduced the same arthroscopy trocar or a wissinger rod as a separator, in order to separate the anterior capsule and neurovascular structures while working inside the elbow (Figures 3 and 4).

Figure 1: Patient in lateral decubitus to perform elbow arthroscopy. This is the position in which patients are usually placed. This allows complete and free movement of the elbow, on being able to perform shoulder abduction.

Figure 2: Left elbow in lateral decubitus position. A small incision can be seen in the posteromedial area of the elbow, which is used to release the ulnar nerve (not transpose it), and in order to section the posterior bundle of the medial collateral ligament in cases with a large lost of flexion.

Figure 3: External view of the use of a retractor through an accessory anterolateral portal, to move the vascular nerve structures away from the instruments.

Figure 4: Two-dimensional and 3-dimensional CT scan of a right elbow with osteoarthritis. 3D CT Scan is always requested on patients with stiff elbow in order to evaluate the presence, size, and location of the osteophytes and loose bodies. This pre-operative study is essential to adequately perform resections of the osteophytes during the surgery.

The bone part was always performed at first, resecting the osteophytes of the coronoid process and the coronoid fossa, as well as the radial head or the radio-ulnar joint if necessary. Once the bone part was finished, a synovectomy and anterior capsulectomy would be performed, whenever this is indicated, generally in cases of post-traumatic stiffness with swelling of the anterior joint capsule, which limits the extension. The anterior capsulectomy would be started from medial to lateral, approximately one centimetre to the tip of the coronoid process using a "hook" radiofrequency

ablation probe (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 neighbouring neurovascular structures), and basket forceps are also very useful for the resection of the capsule, particularly in cases in which it is very swollen and hardened (Figure 5). It is advisable to take great care with the joint capsule that is above the radial head, since the posterior interosseous nerve is very close and is at risk. Occasionally, it is advisable to leave that capsule intact or partially resected and to complete the resection with forced extension of the elbow. Once the anterior capsulectomy is completed, the muscle tissue of the brachial muscle should be seen (Figure 6). At this time, it is not advisable to resect more bone or soft tissue for different reasons: on not having the protection of the anterior capsule, the vascular nerve structures are at a greater risk of being damaged. Also, in cases of brachial muscle stiffness it may be thinner, due to muscle atrophy [22]. Another reason is to prevent the muscle from bleeding, in order to reduce the risk of heterotopic calcifications. If

Figure 5: Artrhoscopy of a right elbow. Arthroscopic view of the brachial muscle on completing the anterior capsulotomy.

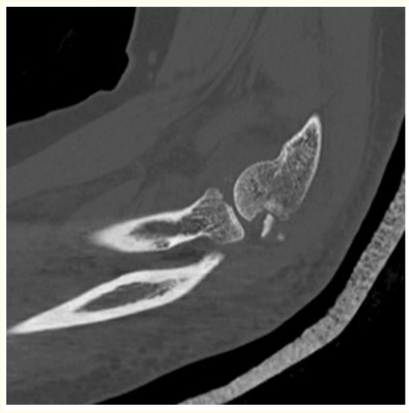

Figure 6A: Patient number 6: CT scan of a right elbow of a patient with post-traumatic stiffness with an osteochondral fracture of the radial head and of the lateral humeral condyle.

Figure 6B: Arthroscopic view of the thickening and hypervascularisation of the anterior capsule of the elbow, responsible for the extension deficit.

Figure 6C: Arthroscopic view of the extraction of an unstable osteochondral fragment of the radial head.

Figure 6D: Arthroscopic view after the resection of the unstable fragment. The thickening and inflammation of the anterior capsule can be seen.

Figure 6E: Arthroscopic view of the resection of the unstable osteochondral fragment of the humeral condyle. In this case from the posterior chamber of the elbow, with the scope in the posterior trans-tricipital portal and the forceps in the posterolateral portal.

Figure 6F: Arthroscopic view after the resection of the osteochondral fragment of the humeral condyle; the articulation of the condyle with the humeral head can be observed.

more bone needs to be resected after the capsulectomy, a separator should be used through an accessory anterolateral portal and a synoviotome or a circular burr with no aspirator connected (Video 1:36-2:46).

Next, the work is performed in the posterior chamber of the elbow, using the central trans-tricipital 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 portals can be added, as well as the "soft spot" portal) [31]. A postero-medial port will not be made so as not to put the ulnar nerve at risk, as suggested by Hilgersom [9]. In the posterior part, work is performed in the same order, first, 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), as well as the extraction of loose bodies, or treatment of osteochondral lesions in the posterior part of the lateral condyle of the humerus (most frequent location), with debridement of the unstable tissue and perforations. After the bone part, the posterior capsulectomy is performed, in order to obtain flexion of the elbow (Video 2:46-4:25), (Clinical case Patient number 6: Figures 6 a,b,c,d,e,f)

Before closing the portals, we perform a passive mobilization of the elbow and mesure the final mobility achieved. Then we close the skin portals with mattress stitches. No drains are left in. We put a plaster with the elbow in extension. The patient is discharged from the hospital at 24 hours. We remove the plaster at 48 hours in the clinic, perform the first cure and instruct the patient to do active and self-assisted exercices. An CPM is not used on the elbow. The patient is referred to the Rehabilitation Department within 7-10 days to start treatment.

Assessment

The previous elbow stiffness is assessed and classified according to the Morrey scale (mild, 2 cases; moderate, 18 cases; severe, 11 cases; and 2 cases very severe). Mobility is also assessed, as well as the pre- and post-operative MEPI scale. All patients were evaluated at least at 1, 3, 6 and 12 months.

Statistical Analysis

The statistical analysis was performed using the IBM SPSS v.® Software. Differences in elbow range of motion before and after the surgery were analysed statistically with the paired Student´s t-test. The differences between other qualitative variables were analyzed with the chi-squared test. It was considered a statistically significant value with a P<0´5.

Results

The mean pre-operative flexion was 118º (+/-9´3º) and the post-operative was 134º (+/-7´21). The mean pre-operative extension was -39º (+/-14´6º) and the post-operative was -15´92º (+/-11´73º). Therefore, there was a mean gain of 40´13º(+/-16´3º) in elbow range of motion (16´71º of flexion and 23´42º in extension). The patients have improved the pronosupination in a mean of 13´03º (+/-12,6º) (Table 2). The MEPI scale improved from 65 (+/-15), to 93 (+/-20).

Grupe 1	Flexion	Extension	Range of motion	Gain of mobility
Preoperative	120º (+\- 8´6)	-36´75º (+\-16´64)	83´2º	35º (+\-15´13)
Postoperative	134º (+\-8´04)	-15´75º (+\-13´5)	118´25º	
GRUPE 2	Flexion	Extension	Range of motion	Gain of mobility
Preoperative	116´11º (+\-9´75)	-42´22º (+\-11´66)	73´89º	45´83º (+\- 16´02)
Postoperative	135´83º (+\-6´24)	-16´11º (+\-9´78)	119´72º	
TOTAL	Flexion	Extension	Range of motion	Gain of mobility
Preoperative	118,16º (+\-9´3)	-39´34º (+\-14´6)	78´82º	40´13º (+\-16´3)
Postoperative	134´87º (+\-7´21)	-15´92º (+\-11,73)	118´95º	
Pacients with functional range of motion	PREOPERATIVE	POSTOPERATIVE		
GRUPE 1	5\20	18\20		
GRUPE 2	0\18	17\18		
TOTAL	5\38	35\38		

Table 2: Table with the final results of the study; results of all of the patients in general and of the patients grouped according to the etiology of the elbow stiffness. As well as patients who have achieved a functional range of elbow motion.

All patients except three achieved a functional range of motion of at least 100º. The three patients who remained with less than 100º of mobility have been for different reasons: elbow stiffness after epicondylitis surgery, orthopedic management of a radial head fracture and osteochondritis dissecans sequelae. We did not find statistically significant differences between the cause of the stiffness and the failure to achieve a functional elbow range of motion (100º) in the final result.

If we analyze the results by groups, in group 1 (degenerative), the flexion improves from 120º (+ \ - 8'6) to 134º (+ \ - 8'04); and the extension from -36'75 (+ \ - 16'64) to -15'75º (+ \ - 13'5). And in group 2 (post-traumatic), the flexion improves from 116'11º (+ \ - 9'75) to 135'83º (+ \ - 6'24); and the extension from -42'22º (+ \ - 11'66) to -16'11º (+ \ - 9'78).

Therefore, the patients of group 1 have gained 35º (+/- 15'13) of total elbow range of motion and those of group 2 have gained 45'83º (+ \ - 16'02). All of these results being statistically significant.

The final results between the two groups are comparable; although it is true that in patients with posttraumatic stiffness we achieve greater improvement in range of motion, since we start with more severe stifness (Table 2).

Complications

There was 1 case of a superficial infection in a port, which reduced with antibiotic treatment; 3 cases of ulnar nerve neuritis, with a spontaneous recovery before 6 months; and 2 cases in which a re-intervention was necessary due to a recurrence of the stiffness; one with a good result (-30º to 120º), and the other with good mobility but with pain that prevented carrying out his work, a request for work incapacity, and refused a new intervention.

These complications are comparable to those published by other authors [31,12,28]. We did not find statistically significant results when comparing the causes of elbow stiffness and the appearance of complications.

Discussion

Stiff elbow is a frequent complaint in the clinics of the orthopaedic surgeon. The most common cause is due to trauma, with or without a visible fracture in the initial x-ray, but almost always with a lesion (bone, chondral, or osteochondral), immobilised by medical prescription or due to pain.

The other common cause of elbow stiffness is elbow degenerative, post-traumatic or overuse arthritis. Willinger already differenced between two reasons of elbow stiffness and the evolution after arthroscopic treatment, achieving comparable results in both groups and improvement in range of motion [34].

On too many occasions stiff elbow is still being considered as a "normal" outcome of an injury, and something that the patient has to accept. But, in most of the cases, the mobility of the elbow can be increased and the pain reduced, giving the patient back a functional elbow with which to carry out all their activities of daily living [19]. Arthroscopic arthrolysis is an effective treatment to restore the functioning of the stiff elbow (post-traumatic or degenerative), achieving good and excellent clinical outcomes, comparable to open surgery, and with less complications [10,25,27,34,36]. As important is the recover of the elbow range of motion as the improvement of pain in these patients.

Various articles have been published in the last few years on the arthroscopic treatment of stiff elbow, and the majority of authors report similar results to those found in our study, with improvements between 30º and 50º in the range of motion.

Willinger [34] achieves 46º of mobility improvement in cases of post-traumatic elbow stiffness. Wu [36] achieves improvements of up to 66º in cases of severe elbow stiffness. Most studies achieve a functional range of motion (greater than 100º, according to Morrey's functional arc [19]).

Lim [16] put at 80º of preoperative mobility the limit to achieve a functional arch of postoperative mobility.

They also demonstrate that the patients with post-traumatic stiffness have a lower pre-operative mobility, and gain more mobility after the intervention, achieving a result very similar to the patients with stiffness due to osteoarthritis of the elbow [1,7].

Pederzini [25] also compares these two groups and achieves improvements of 33º in degenerative and 35º in those of post-traumatic origin. In the article by Willinger [34], patients with posttraumatic stiffness also have significantly less preoperative mobility than those of degenerative origin; there were no differences in postoperative mobility in both groups. Concluding, as in our review, that patients with severe posttraumatic stiffness of the elbow can obtain good results with arthroscopic treatment. Lubiatowski [17] shows that we can expect great improvements of up to 55º in patients with severe contractures and obviously lower gains (19º) in patients with mild contractures. Kodde [15] in a systematic review points out that we can expect improvements between 19º and 74º after the arthroscopic treatment of elbow stiffness.

Lubiatowski [17] measures the mobility of the elbow achieved in the surgery and the evolution during the following months of evolution. He concludes that the mobility achieved in the surgery decreases a lot during the first weeks, and later with rehabilitation, it begins to improve, achieving maximum recovery no sooner than 6 months and without recovering the extension achieved in the surgery. It could be due to scar tissue formation during the first weeks after surgery. Although we have not measured this data (it is one of the weaknesses of this study), we do have the feeling that our patients also follow this curve of loss and subsequent recovery of mobility after surgery.

In cases of post-traumatic stiffness, the joint capsule is more contracted, fibrosed and swollen (especially the anterior capsule, causing a limitation of the extension of the elbow). A capsulotomy is necessary in order to recover mobility, either with a radiofrequency ablation probe or basket forceps. In degenerative cases, there is less fibrosis and the consistency of the capsule is lower, with the osteophytes and the loose bodies being responsible for the decrease in mobility. Savoie [29] notes that in most cases of stiff elbows due to osteoarthritis it is not necessary to perform a capsulotomy, since the problem in these cases is bone. Kim [13] does not consider it necessary to release the posterior band of the medial collateral ligament in cases of stiff elbows due to osteoarthritis. Other authors such as Phillips [26], Lubiatowski [17] or Kim himself [14] in the year 2000, show that capsulotomy increases the mobility of the elbow and this also applies to the rigid degenerative elbow. Kim [14] suggests performing the anterior capsulotomy if the contracture in flexion is greater than 30º.

What seems clear is that in cases of posttraumatic stiffness we do have to perform an "aggressive" anterior capsulotomy and in elbows with degenerative stiffness, in case of doing it, we will be much less aggressive.

We recommend neurolysis of the ulnar nerve in the majority of cases, in particular in cases of moderate-severe stiffness, and in cases with a previous clinical history of ulnar neuritis. Blonna and O'Driscoll [4] demonstrate that the release of the ulnar nerve reduces the risk of neuropathy. Similarly, Antuña [3] recommends prophylactic decompression of the ulnar nerve in patients with a flexion less than 100º and an extension less than 60º. Williams [33] recommends releasing the ulnar nerve in patients with preoperative symptoms of ulnar neuritis or a positive Tinell.

Willinger [34] performs neurolysis of the ulnar nerve when there are symptoms of preoperative paresthesia (45% in post-traumatic patients and 13% in degenerative patients). Pederzini [25] obtains 95% improvement after neurolysis (without transposition) in patients with symptoms of ulnar paresthesia and elbow stiffness.

The complications rate in the present study was 16%, of which 11% were minor (ulnar neuritis and superficial portal infection, with complete recovery), and 5% major (patients with a poor outcome), and is comparable with that published by other authors. Paraesthesia's and ulnar neuritis are the complications that are of most concern in this surgery [33].

This is a study with limitations; it is a retrospective study, with 38 patients and without a standard methodology in the taking of the preoperative data: we have obtained the preoperative elbow range of motion data of the annotations in the patient's clinical history. A methodology has been followed for data collection and measurement of postoperative mobility. The mobility data were not taken in the immediate postoperative period (inmediatelly after the surgery), we have no compared the variation in mobility in the different postoperative controls (1,3,6,12 months). Another limitation is that no data have been taken on the mobility and functionality of the contralateral elbow.

However, this study includes the clinical and functional evolution of patients with elbow stiffness due to two different origins, as well as complications. All surgeries have been performed by the same surgeon; and all patients have received the same postoperative protocol, immobilization and rehabilitation. We believe that this study can help elbow surgeons assess the risk and benefit of arthroscopic stiff elbow arthrolysis, and predict the results that can be obtained.

Conclusions

Arthroscopic arthrolysis of the elbow is a safe and effective technique which enables good functional results to be obtained in the treatment of degenerative or post-traumatic stiff elbow, even in severe cases, with a low complication rate.

The complete mobility of the elbow can not be restored with this technique; we must tell our patients.

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