OPERATIVE TREATMENT OF ELBOW STIFFNESS : EVALUATION AND OUTCOME

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The purpose of the present study was to review the long-term results of surgical arthrolysis of the elbow. We reviewed 16 patients, with a mean follow-up of 47 months. Elbow motion before, during and after operation was measured. DASH score, pain and patient satisfaction were assessed. We found a significant ($p < 0.05$) improvement in elbow motion postoperatively. The total arc of motion improved from 47 to 87°. However part of the initially obtained arc of elbow motion was lost with longer follow-up when compared to the immediate postoperative result. Results were significantly ($p < 0.05$) better when performing the arthrolysis no later than one year after onset of symptoms. Treating an extrinsic contracture resulted in greater improvement of elbow motion when compared to treating an intrinsic contracture. The amount of improvement in elbow motion and the overall elbow motion achieved postoperatively correlate significantly ($p < 0.01$ and $p < 0.05$ respectively) with better results of the DASH score and the patient satisfaction score.

INTRODUCTION

Elbow stiffness is a well-recognized, sometimes hard to treat condition. Elbow stiffness can result from developmental paediatric elbow disorders, burn contractures, heterotopic ossification after neural axis trauma or degenerative arthritis. Most frequently however it is a sequel of trauma to the elbow (11). Anatomical reduction and stable fixation that allow early mobilisation give the best functional outcome. Immobilisation is still often applied, sometimes leaving patients with significant stiffness and pain.

Initial nonoperative treatment of a stiff elbow includes splinting and physical therapy. Passive exercises, active assisted exercises, active exercises, CPM, static and dynamic splinting (7), serial casting (27), and manipulation under anesthesia (5) have all been used. Particularly if started soon after development of the stiffness, conservative treatment often leads to an improvement of function and range of motion of the elbow. However in some patients a decreased range of motion and severe functional deficit persist. Operative arthrolysis of the elbow is justified when conservative treatment has failed.

Many reports have been published about arthrolysis of stiff elbows using various techniques for various conditions. Wolfgang *et al*. (26) reported marked improvement of range of motion with arthroscopic excision of the radial head and synovectomy. Husband and Hastings (10) described an extensile lateral approach and Weiss *et al* (24) a medial approach to the elbow. Morrey *et al* (17) have used semiconstrained total elbow arthroplasty to treat the stiff elbow. Hotchkiss *et al* (8) have reported satisfying results using the Ilizarov technique.

The aim of this study was to review our results with operative arthrolysis of the elbow. We tried to identify factors influencing the result of the procedure. We also evaluated the impact of arthrolysis on the disability of the upper limb (DASH score (9, 21)).

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PATIENTS AND METHODS

Population

Between January 1991 and February 2000, 20 elbow arthrolyses were performed. Sixteen patients were available for long-term follow-up and were retrospectively assessed by an independent examiner. Four patients were lost to follow-up, or presented with incomplete data. There were 12 women and 4 men. Mean age at surgery was 38 years (range 14 to 70 years) ; 12 injuries were in the dominant arm, 4 in the nondominant arm ; 13 were on the right side, 3 on the left side. There were no bilateral injuries. Seven patients had one or more previous operations on the elbow in other institutions. All these operations were done to improve elbow movement. The elbow contracture was caused by degenerative arthritis in one and myositis ossificans following neurotrauma in two ; in 13 patients the contracture was caused by trauma. The contracture was found to be mainly intrinsic in 10 patients, extrinsic in 6 patients. Preoperatively the total arc of movement ranged from 10° to 100° (average 49°). There was an average lack of extension of 57° (range 20° to 90°) ; the mean flexion was 104° (range 85° to 130°). There was moderate restriction of pronation (average 65°) and supination (average 75°). Before surgery was performed, conservative therapy with physical therapy and/or splinting was attempted in all patients for a minimum of 6 months. When loss of elbow motion persisted after that period and interfered with daily or occupational activities, surgery was proposed.

Surgical procedure

Surgery was performed at a mean of 29 months (range 6 – 120 months) after onset of symptoms. The surgical approach varied depending on presence of scars from previous operations, location of the contracture, associated compression of nerves, and skin condition. In two cases a posterior approach was chosen, in two an anterior approach. In one case a combined posterior and anterior approach was necessary ; 11 operations were done through a lateral approach combined where needed with a medial approach. When using a medial approach the ulnar nerve was routinely exposed. Anterior capsulotomy was done in 11 cases, posterior capsulotomy in 3 cases. Hardware was present and removed in 5 cases. Excision of the olecranon or coronoid tip was performed in 7 and 4 cases respectively because of bony impingement. Fascial arthroplasty was done in one case. Loose bodies, osteophytes and ectopic bone were removed in 10 cases. Postoperatively a bulky dressing was applied. All patients received adequate analgesia using an IV pain pump. Casts or splints were not used immediately postoperatively. Continuous passive motion was started immediately after the operation for all patients as tolerated. All patients followed a vigorous protocol of physical therapy with passive, active-assisted and active motion exercises. All continued physical therapy for a minimum of three months after leaving the hospital. Only when persistent wound drainage or excessive swelling was present, was mobilisation of the elbow slowed accordingly.

Evaluation

There was a minimum of three separate visits when data were collected (before surgery, during surgery, and at a minimum of 6 months after surgery). On each visit function and range of motion (flexion, extension, pronation, supination) were measured with the use of a handheld goniometer. At final follow-up (mean 47 months, range 6 – 120 months) patients were asked to complete the DASH score questionnaire. Also relief of pain and patient satisfaction were assessed at final follow-up using a visual analogue scale (VAS) (range 0 to 10). The SAS package was used to compute differences and correlations. $P < 0.05$ was set for significance.

RESULTS

Measuring the intra-operative range of motion (average 113°, range 80° to 140°) showed a significant ($p < 0.01$) improvement in elbow motion. The final postoperative (> 6 months) elbow motion (average 87°, range 30° to 140°) still showed a significant ($p < 0.05$) improvement compared to the preoperative values. The same was found when comparing flexion and extension loss (table I) pre- and postoperatively. There were important differences in the magnitude of improvement of range of motion between patients. Two patients actually lost elbow motion (-10° and -16°).

An important degree of motion present immediately after surgery is lost with longer follow-up. Intra-operatively obtained flexion averages 132° versus 122° after at least 6 months follow-up. The same goes for extension loss (-17° intra-operatively versus -36° postoperatively) and overall range of motion (114° intra-operatively versus 87°

Table I

	Flexion mean/ range	Extension loss average/ range	ROM average/ range
Preoperative	104° (85° - 130°)	57° (20° - 90°)	47° (10° - 100°)
Intra-operative	132° (105 - 150°)	17° (0° - 40°)	114° (80° - 140°)
Final postoperative	122° (90° - 142°)	36° (0° - 60°)	87° (30° - 140°)

postoperatively). There is a significant ($p < 0.05$) correlation between preoperative arc of motion and final arc improvement. This means that the better the preoperative elbow motion is, the more gain in elbow motion can be expected. Most of the postoperative loss of motion occurs in the first six months after surgery. The same goes for the postoperative physical therapy protocol, where most of the improvement of range of motion occurs in the first six months. Longer follow-up does not change the arc of motion for more than 5° to 10° in this series.

When performing the arthrolysis no more than one year after the onset of symptoms a significantly ($p < 0.05$) better postoperative result can be expected. Improvement of arc of motion averaged 52° when treating an elbow contracture less than one year after onset of symptoms versus 22° when treatment is delayed for more than one year.

Treating an extrinsic elbow contracture leaves the patient with better (though in this series not significantly) elbow motion compared to arthrolysis of an intrinsic contracture. Arc of motion improved 44° on average versus 35° on average respectively). We found no significant correlation between improvement of arc of motion and gender or age at time of surgery.

The DASH score averaged 53.4 points (range 14 to 86 points). Mean pain score on the visual analogue scale was 5 points, (range 1 to 8 points). According to this scale 6 patients had minimal or no pain, 7 patients had moderate pain, and 3 had severe pain. Patient satisfaction measured using a visual analogue scale averaged 6.5 points, (range 2 to 9 points) ; 3 patients were not satisfied, 5 were satisfied and 8 were very satisfied.

When correlating these values we found a significant correlation between the DASH score and the pain score ($p < 0.01$) and between the DASH score and the patient satisfaction score ($p < 0.01$). Also we found a significant ($p < 0.01$) correlation between the improvement of the arc of motion and the DASH score and the patient satisfaction score. Overall postoperative arc of motion also correlates ($p < 0.05$) significantly with the DASH score and the patient satisfaction score. There was no significant correlation ($p = 0.14$) between improvement in elbow motion and the pain score. This showed that better elbow motion improves elbow function and patient satisfaction, but does not always decrease the pain.

DISCUSSION

Despite increasing knowledge and experience about treating elbow stiffness, it still remains a difficult condition to treat with a sometimes unpredictable outcome. Various treatment protocols and surgical approaches have been proposed with good results. As ours, most series are limited and with mixed pathology.

Urbaniak *et al* (22) used an anterior approach with good results in 15 patients. The flexion contracture was reduced from 48° to 19°. Better results were obtained when continuous passive motion (CPM) was added in the postoperative phase (6). Without CPM the average gain in arc of motion was 25° and with CPM it was 48°.

A lateral approach was used in most series, usually with a good outcome. This approach was promoted and fully described by Husband and Hastings in 1990 (10). In their initial series of 7 patients they gained 46° in arc of motion. Later Cohen and Hastings (3, 4) described a ligament-sparing technique with an average improvement of 55° arc of motion in 22 elbows. The Mayo

group (16) reported 26 patients with a total arc of motion of 130° increasing to 96°. Mansat and Morrey (14) had a gain of 45° in arc of motion with a limited lateral approach.

Vardakas *et al* (23) had a 79% improvement in flexion arc of 59° in 34 posttraumatic cases. Other (European) series had a similar outcome. Weizenbluth *et al* (25) had 13 cases with a gain of 52°, Chantelot *et al* (2) had 23 cases with a benefit of 38°, Boerboom *et al* (1) had 12 cases with an improvement of 39°, Schindler *et al* (19) had 31 cases with 35°2 improvement, Lahoda *et al* (12) had 69 cases with 62°3 of improvement.

A large series (70 cases) was reported by Lamine *et al.* (13). The analysis is less detailed. At final follow-up only 21.4% of the elbows had a functional range of motion. Pediatric patients were also reported : Mih and Wolf (15) (9 cases) had 53° improvement and Stans *et al* (20) (37 cases) only 28°.

In cases with ulnar neuropathy or medial ossifications, a medial approach is however recommended. Randall (18) and Weiss and Sacchar (24) even propose this as a routine approach. They reported an improvement in flexion arc from 32° to 97°. In our series surgical treatment was advised for patients when conservative treatment failed to improve elbow motion after at least 6 months. Ideally all patients gain full range of motion or obtain a functional arc of motion (-30° to 130°). Unfortunately this is not always the case. In our series the mean arc of motion achieved intra-operatively was -17° to 132°. However with longer follow-up the mean arc of motion decreased (mean - 36° to 122°) despite intensive physical therapy over a long period.

When further analysing the results we found no correlation between improvement in arc of motion and gender or age at surgery. On the other hand results were significantly better when arthrolysis was performed less than one year after onset of symptoms. Also better results were obtained when treating an extrinsic elbow contracture compared to an intrinsic contracture. This was also confirmed by other authors.

We also found a significant correlation when comparing the patient satisfaction score and the DASH score with postoperative elbow motion. As far as we know this is the first report correlating the disability with the gain in movement.

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