



## Results of open arthrolysis for elbow stiffness A series of 22 cases

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Severe posttraumatic elbow stiffness represents a significant invalidity. Between 1990 and 2005 two surgeons performed open elbow arthrolysis in 30 adult patients (6 women, 24 men, mean age 30.8 years). All cases resulted from severe initial trauma, which had occurred on average 15.5 months previously. Four patients had extrinsic and 18 had mixed contractures ; 13 had heterotopic ossifications. Operative complications included two peroperative joint instabilities and 3 transient nerve palsies. Seven elbows were remobilized under anaesthesia, one month after the arthrolysis.

Twenty-two patients could be reviewed, on average 56 months after the arthrolysis. Seventy seven percent of the patients were satisfied. At final follow-up, the average arc of flexion-extension was  $95^{\circ} \pm 15^{\circ}$  (average flexion  $120^{\circ} \pm 13^{\circ}$ , average flexion contracture  $31^{\circ} \pm 6^{\circ}$ ), with a mean improvement of  $51^{\circ}$  relative to the preoperative range ( $p < 0.001$ ). The average arc of forearm rotation at final follow-up was  $151^{\circ} \pm 23^{\circ}$ , with a mean improvement of  $41^{\circ}$  ( $p < 0.05$ ). No patient suffered persistent weakness or instability. The average VAS was 5/10, the average MEPI score 76, with 6 excellent, 6 good, 6 fair and 4 poor results, mainly because of persisting pain. The average DASH score was 31.6 and the average SF-36 was 66. Significant correlations were observed between VAS and DASH, MEPI and SF-36.

This series demonstrates that open arthrolysis may restore acceptable elbow motion in young active patients presenting with elbow stiffness following major trauma. However, full restoration of motion is rare ; only 18% of the patients regained the functional arcs of motion reported by Morrey, but the majority were satisfied, given their preoperative

degree of elbow stiffness. The ultimate result from both the patient's and the surgeon's perspectives is strongly dependent on persisting pain, which was frequent in this series and influenced the DASH, MEPI and the SF-36 scores. Arthrolysis did not address the issue, if pain was the chief complaint.

**Keywords :** elbow ; post traumatic stiffness ; elbow arthrolysis.

### INTRODUCTION

Severe posttraumatic elbow stiffness represents a significant invalidity. According to Morrey (5), the causes for elbow stiffness are either extrinsic or intrinsic. Extrinsic aetiologies include contractures

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of the capsule and/or collateral ligaments, and ectopic bone formation. When the joint surfaces are abnormal as a consequence of an insufficiently reduced intra-articular fracture, one speaks of an intrinsic stiffness. The changes then consist either of loss of articular cartilage, incongruity of the joint surfaces, intra-articular adhesions, or of fracture callus within the joint. In such instances, associated soft-tissue contractures (extrinsic component of stiffness) are always present.

The importance of impairment related to elbow stiffness varies according to each patient's activities and needs. Morrey *et al* (6) have shown that most activities of daily living can be accomplished with an arc of motion from 30 to 130 degrees of flexion and 50 to 50 degrees of pronation-supination.

Whatever the cause of stiffness and the importance of related impairment, elbow arthrolysis may restore the joint mobility, at least partly. The operation however remains a challenging procedure, which is indicated in motivated patients presenting with persistent elbow stiffness despite prolonged physiotherapy. The purpose of this retrospective study is to report our experience with open elbow arthrolysis for loss of motion resulting from severe injury.

## MATERIALS AND METHODS

Between 1990 and 2005 two surgeons performed elbow arthrolysis in 30 adult patients with persistent posttraumatic elbow stiffness despite prolonged physiotherapy. All cases resulted from very severe initial trauma. The patients were invited to return for examination and questionnaires. An investigator not involved in the treatment performed the final evaluations, and studied the patients' characteristics, the type of stiffness, the surgical approach and the outcome of the surgery. The patient was invited to state if he/she was globally satisfied – or not – with the operation. Flexion and extension motion was assessed with a hand held goniometer centered on the lateral epicondyle and positioned along the lateral aspect of the arm and forearm. Pronation-supination was evaluated with a gravity goniometer resting on the dorsal aspect of the wrist. Hand strength was assessed using a Jamar dynamometer and a key pinchmeter. The chosen clinical scores were the visual analogue scale (VAS) measuring pain, the Mayo Elbow Performance Index (MEPI) (7), the Disability Arm and Shoulder and Hand

questionnaire (DASH) (2) and the short form-36 (SF-36) (10). Pain evaluated using VAS ranges between 0 (no pain) and 10 (extreme pain). In the MEPI, the total score may be between 5 and 100 points, with higher scores indicating better function. Ratings were assigned as follows : 90 to 100, excellent ; 75 to 89, good ; 60 to 74, fair ; less than 60, poor. The DASH questionnaire, containing 30 items, is scaled between 0 and 100, with higher scores indicating worse upper-extremity function. The short form-36 item health survey (SF-36) measures health status. Its eight subscales quantify a vast range of health questions, both physical and mental ; the indices are standardized based on their values in a normal population ; high SF-36 ratings scores indicate a better health status.

## Statistical Analysis

As motion results did not follow a normal distribution, we used non parametric Friedman's tests for repeated measures. When the test was significant we used Wilcoxon's rank-sum test to compare the motion changes pre-per and postoperative two-two. The non parametric test of Mann and Whitney was used to compare the motion of the operated elbow to the non-operated side. Multiple linear regression analysis was used to identify significant correlations between VAS, DASH, MEPI and SF-36 considering these variables as quantitative. The association between quantitative variables (range of motion, age, follow-up, etc.) and qualitative variables (presence of ectopic ossifications, polytrauma status, etc.) was evaluated using the Chi-square analysis.

## Patients

Over a 15 years period, six women and 24 men with an average age of 30.8 years (range : 16-62 years) underwent elbow arthrolysis. Of these 30 patients, six could not be contacted and two declined the evaluation. Twenty-two patients could therefore be reviewed, on average 56 months after the arthrolysis (range : 12-134 months). Of the 22 examined patients, elbow stiffness involved the dominant arm in 14 patients.

The original injury was quite severe in most patients. Nine patients suffered polytrauma, including an associated cranial trauma in seven of them. Seven patients presented additional lesions of the ipsilateral upper extremity, one patient had lesions of the contralateral upper extremity. Eight patients had an intra-articular fracture of the distal humerus, three of them with associated fractures of the proximal radius or ulna. Four

patients had an olecranon fracture, one of them with an associated elbow dislocation. Two patients suffered an isolated radial head fracture, and two patients presented a radial head fracture associated with an elbow dislocation. One patient presented an isolated posterior elbow dislocation; another patient had an elbow dislocation with associated fractures of the proximal radius and ulna. One patient had been treated for a floating elbow. Three patients had no elbow fracture: one severe ligamentous injury, one polytrauma patient with no obvious elbow trauma; the last patient had prolonged elbow immobilisation for a Mc Gregor inguinal flap.

The treatment of the initial injury was surgical in nine patients, and included open reduction and internal fixation of the fracture (eight patients) or fracture-dislocation of the elbow, and excision of a radial head fracture fragment in one patient. Six patients were treated with closed reduction and cast or splint immobilisation.

Four patients had pure extrinsic and 18 patients had mixed intrinsic and extrinsic contractures. Ectopic ossifications were present in 13 patients. Before referral to us, three patients had a prior open elbow contracture release and one patient had an elbow arthroscopy for removal of free osteochondral fragments.

The time interval between the initial injury and the arthrolysis was on average 15.5 months (range: 2-49 months). The preoperative arc of ulnohumeral motion averaged  $45^\circ \pm 12^\circ$  with an average elbow flexion of  $90^\circ \pm 13^\circ$  and an average flexion contracture was  $52^\circ \pm 9^\circ$ . The average arc of forearm rotation was  $142^\circ \pm 18^\circ$ , with an average pronation of  $53^\circ \pm 19^\circ$  and an average supination of  $48^\circ \pm 19^\circ$ .

### Surgical Technique

The surgical technique varied according to the causes of contracture and the prior treatments. Nine patients had elbow capsulectomy through a single approach (three lateral, three medial and three through a single posterior skin incision). When the single approach proved inadequate, a double exposure was performed (thirteen patients). Neurolysis of the ulnar nerve was simultaneously performed in thirteen patients, with subcutaneous anterior transposition of the nerve in seven cases.

### Postoperative management

Seventeen patients had a postoperative brachial plexus catheter. Continuous passive motion and alternate splinting were not used. All patients began assisted elbow range-of-motion exercises immediately after sur-

gery. The exercise program was continued on average for 8.8 months after discharge, with no forcible elbow manipulation. Thirteen patients had heterotopic ossifications prevention using anti-inflammatory drugs (12 cases with Indomethacin) during six weeks and one patient had preoperative radiation as prophylaxis against recurrence.

### Complications and Subsequent surgeries

There were two cases of perioperative instability (medial collateral ligament rupture, triceps rupture, both immediately repaired). Dynamic external fixation was used to allow immediate postoperative motion despite instability in one patient. There were three cases of transient nerve palsy (radial, median and ulnar, one each) and one case of a pre-existing ulnar neuropathy, aggravated after the surgery. Seven elbows were re-manipulated under anaesthesia, one month after the arthrolysis.

## RESULTS

Seventy seven percent of the patients were satisfied with the results of the surgery. The average flexion-extension arc immediately after the arthrolysis was  $103^\circ \pm 11^\circ$ . The average flexion was  $122^\circ \pm 7^\circ$ , and the average flexion contracture was reduced to a mean of  $15^\circ \pm 6^\circ$ . At final follow-up, the average arc of ulnohumeral motion was  $95^\circ \pm 15^\circ$ , with an average flexion of  $120^\circ \pm 13^\circ$  and an average flexion contracture of  $31^\circ \pm 6^\circ$ . The average improvement in the arc of ulnohumeral motion was  $51^\circ$  ( $p < 0.001$ ). The average arc of forearm rotation at final follow-up was  $151^\circ \pm 23^\circ$ , with an average pronation of  $74^\circ \pm 12^\circ$  and an average supination of  $73^\circ \pm 13^\circ$ . The average improvement was  $41^\circ$  ( $p < 0.05$ ) (Fig. 1).

No patient had persistent weakness or instability. The average VAS pain scale score was five points out of ten. The average score on the MEPI at final evaluation was 76, with six excellent, six good, six fair and four poor results, the latter mainly because of persistent pain. The average DASH score was 31.6, and the average SF-36 score, 66. Correlations were observed between VAS and DASH ( $R^2 = 0.22$ ,  $p = 0.05$ ), MEPI ( $R^2 = 0.41$ ,  $p = 0.01$ ) and SF-36 ( $R^2 = 0.22$ ,  $p = 0.05$ ). No significant correlations were found between age, contracture duration or follow-up duration, versus any of the health status

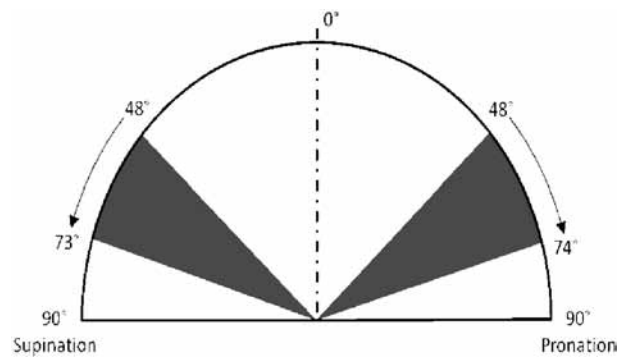
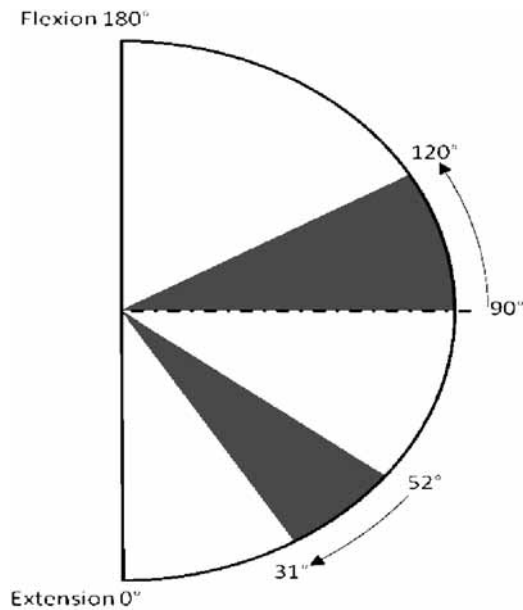


Fig. 1. — Average improvement in elbow range of motion, as compared to the preoperative situation.

measures (MEPI, DASH, SF-36) or level of pain. Multiple linear regression identified the DASH score as predictor of a higher MEPI score ( $R^2 = 0.81$ ) (Fig. 2).

**DISCUSSION**

This retrospective study of a group of 22 patients specifically addresses the results of open arthrolysis for elbow contracture resulting from a severe initial trauma. Most of these cases were not indications for elbow arthroscopic arthrolysis ; the latter procedure was anyway not as popular as it is today by the time when the patients had been operated (1990-2005). One major concern with arthroscopy is the risk of iatrogenic nerve lesions ; three nerve palsies occurred in the present series of open arthrolysis, all fortunately transient.

Most of the articles on open elbow arthrolysis found in the literature review a specific approach : anterior (8), lateral (4), medial (9) or combined (1) or include heterogenous cases of traumatic and non-traumatic causes of elbow stiffness (3). The present series deals with a relatively homogenous group of young active patients, who presented with posttraumatic elbow stiffness. Forty one percent of cases were the final result of high-energy polytrauma, 41% of the patients had other limb fractures and

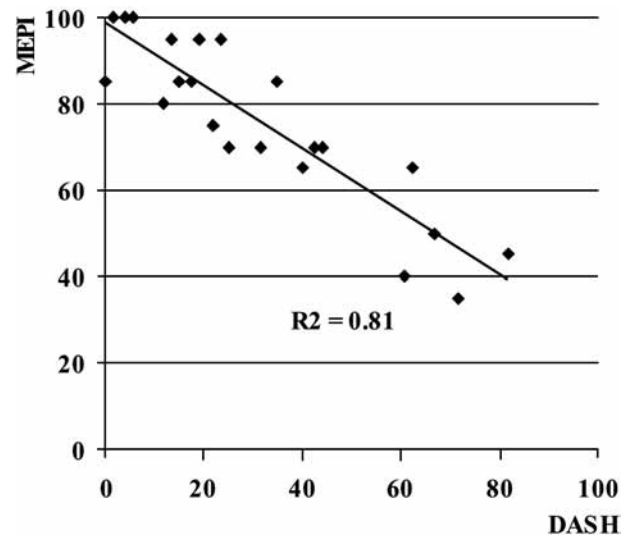


Fig. 2. — Correlation between MEPI and DASH scores

31% presented an associated cranial trauma. The dominant limb was not statistically more affected, indicating that elbow contracture is also invalidating in the non-dominant arm.

Intrinsic elbow stiffness carries a less favourable prognosis after arthrolysis (8). In this series, the origin of the contracture (intrinsic or extrinsic) was not found to influence the clinical results, probably due to the relatively small number of patients. We

did not find a relationship between the final restoration of the elbow range or motion and the preoperative duration of the contracture, which was fifteen months on average. We performed ulnar nerve decompression in 59% of the cases. One advantage of decompression of the ulnar nerve as a part of the procedure is to avoid further ulnar nerve irritation which might impose a secondary neurolysis procedure.

Our data suggest that open arthrolysis after trauma can restore motion in the majority of the patients. However, full restoration of motion is rare ; only 18% of the patients even regain the functional arcs of motion reported by Morrey. Despite this, 77% of our patients were satisfied. The ultimate result from both the patient's and the surgeon's perspectives is strongly dependent on persistent pain, which was frequent in this series and influenced the DASH, MEPI and the physical dimension of the SF-36 scores. Arthrolysis does not address this issue, if pain is the main complaint.

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