Open arthrolysis for post-traumatic stiffness of the elbow

RESULTS ARE DURABLE OVER THE MEDIUM TERM

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We present a retrospective study of 25 patients treated by open arthrolysis of the elbow for post-traumatic stiffness. The mean follow-up was for 7.8 years (5 to 10.8). The range of movement of the elbow, pain scores and functional outcomes were recorded pre- and post-operatively. An improvement in the mean range of movement from 55° (0° to 95°) to 105° (55° to 135°) was obtained in our patients at one year. This improvement was maintained over the mean follow-up period of 7.8 years (5 to 10.8). Improvement in pain, function and patient satisfaction was recorded in 23 of the 25 patients at final follow-up.

On the basis of this study, we believe that the results of open arthrolysis for post-traumatic stiffness of the elbow are durable over the medium term.

Post-traumatic stiffness is common following injury to the elbow joint. The presence of three articulations with a single synovial tissue-lined capsule, the close proximity of the joint capsule to the ligaments and extracapsular muscle, and the intrinsic congruity of the humeroulnar articulation have all been suggested as predisposing factors.¹⁻³ Fortunately, most activities of daily living are performed within a 100° arc of movement between 30° and 130°.⁴ However, if the patient has an extension deformity of more than 30° and flexion of less than 130° six months after the injury which is not improving, elbow arthrolysis should be considered. A number of papers over the last decade have reported the early benefit of elbow arthrolysis for post-traumatic stiffness with a mean follow-up of 3.5 years (1 to 4).^{1-3,5-16} The aim of this study was to assess the medium-term results of open elbow arthrolysis in patients with a minimum follow-up of five years.

Patients and Methods

A retrospective review of 25 patients who had an open elbow arthrolysis for post-traumatic stiffness between October 1991 and May 1997 was undertaken (Table I). All patients had an extension deformity of > 30° and flexion of < 130°. All had a congruous humeroulnar joint at the time of arthrolysis. There were 19 men and six women, with a mean age of 34 years (15 to 62) at the time of operation. The median interval between injury and arthrolysis was 13 months (5 to 420). The mean follow-up

was 7.8 years (5 to 10.8). We excluded patients with an associated head injury, rheumatoid arthritis or primary osteoarthritis. According to the classification of Mansat and Morrey¹⁰ 23 patients had an intrinsic injury to the elbow and two an extrinsic injury.

Open arthrolysis was performed under a combination of regional anaesthesia (continuous brachial plexus block) and general anaesthesia. A lateral approach was used in six patients, a posterior approach in 16, and a combination of lateral and medial approaches in three. The surgical technique in all patients included releasing the contracted capsule, lateral collateral ligament and posterior band of medial collateral ligament. A triceps and brachialis tenolysis was performed using a periosteal elevator. Any bony sources of impingement affecting flexion and extension were removed. This included excision of the tip of the coronoid and olecranon and burring out the radial and olecranon fossae if necessary. If a satisfactory range of movement could not be obtained despite these measures, the elbow joint was subluxed, any intra-articular adhesions cleared, and the articular surfaces of the incongruous humeroulnar joint were 'sculpted' with a burr. Resection of the radial head was performed in five patients. Continuous passive movement of the elbow under brachial plexus block was used post-operatively for a mean of three days (2 to 3.5). A fine catheter was threaded into the brachial sheath through which a low dose of bupivacaine (0.125%) was infused, the dosage being titrated against

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Table I. Details of the 25 patients who had an open elbow arthrolysis

Mean age (yrs)	34 (15 to 62)
Gender	
M:F	19:6
Median interval between injury and open elbow arthrolysis (mths)	13 (5 to 420)
Mean follow-up (mths)	7.8 (5 to 10.8)
Elbow injury (Morrey grade ¹⁸)	
Intrinsic:extrinsic	23:2
Initial injury	
Fracture distal humerus	12
Fracture radial head	4
Fracture olecranon/proximal ulna	2
Fracture radial head + proximal ulna	3
Posteror dislocation elbow	2
Fracture-dislocation elbow	2

the patient's pain. In addition, patients also had the use of a continuous morphine pump in the post-operative period.

Patients were discharged after three days and advised to actively mobilise their elbow. None received physiotherapy after discharge, and none received any prophylaxis against heterotopic ossification.

At follow-up the range of movement (ROM) was measured using a goniometer, pain by a visual analogue score (VAS),¹⁷ and function by the Mayo Elbow Performance Index.¹⁸ Physical examination recorded the presence of crepitus on movement, pain over the humeroulnar and capitellar-radial joints, medial and lateral instability, and motor and sensory function in the limbs. Anteroposterior and lateral radiographs of the elbow were taken and compared with previous radiographs for the appearance of osteophytes, changes in joint degeneration, and the presence of heterotopic bone.

The pre-operative ROM, VAS and Mayo Elbow Performance scores were compared with those at one year after arthrolysis. The Mayo score considers the variables of pain (45 points), ROM (20 points), stability (10 points), and function (25 points) with a maximum score of 100. A score of 60 to 74 was considered a fair result, 75 to 89 good, and 90 to 100 excellent.¹² We chose the results one year after operation as a reference point for comparison with the latest follow-up results because the ROM, VAS and Mayo scores continued to improve up to one year after arthrolysis.

The results were analysed using Student's two-tailed *t*-test for ROM and Wilcoxon's rank-sum test for the VAS and the Mayo score. A *p*-value of 0.05 was regarded as significant.

Results

The total range of elbow movement improved in 23 of 25 patients. Improvement in the arc of movement increased from a mean of 55° (0° to 95°) pre-operatively to 105° (55° to 135°) one year after arthrolysis (*p* < 0.001). This

improvement was maintained over a mean follow-up of 7.8 years (5 to 10.8), to 110° (45° to 140°; *p* = 0.12). The ROM remained within 10° of the ROM obtained one year after arthrolysis in 15 patients, eight showed a subsequent increase in the ROM of more than 10° (10° to 30°), and two deteriorated by 20° (15° to 25°). Mean elbow flexion improved from 115° to 135° (improvement of flexion, 0° to 85°), and mean extension improved from 60° to 30° (range of improvement of extension 0° to 60°; *p* < 0.001) over the mean follow-up of 7.8 years.

Peak pain and the general level of pain decreased from a mean of 4.5 (1 to 9) on the VAS to a mean of 2.0 (0 to 8) at the one-year post-operative assessment (*p* < 0.001). There was a marginal increase in pain, with a mean score of 2.5 (0 to 8) at the latest post-operative assessment (*p* = 0.08). Of the 25 patients, 23 had some relief of pain following arthrolysis. One patient had no relief of pain and one reported an increase in pain at the one-year post-operative assessment. This pain, however, improved following ulnar nerve decompression and she was free from pain at her latest follow-up.

The mean Mayo score improved from a pre-operative level of 65 (5 to 70) to 90 (50 to 100) at the one-year assessment (*p* < 0.001) and to 85 (50 to 100; *p* = 0.12) at the latest follow-up.

Of the 25 patients, 22 were satisfied with the outcome. One patient had an improvement in ROM but increased pain which resolved following ulnar nerve decompression 18 months after her arthrolysis. She was satisfied at her last assessment. Two patients were dissatisfied both at their one-year post-operative assessment, and at final follow-up.

On examination, no patient had crepitus during active flexion and extension of the elbow. None had instability of the elbow, but five had some local tenderness. Three complained of paraesthesia in the ulnar nerve distribution, although none had motor weakness. Radiological evidence of progressive humeroulnar degeneration was seen in four patients, but three did not notice any increase in pain.

Post-operative triceps avulsion occurred in one patient, in whom arthrolysis was performed 35 years after an intra-articular fracture of the distal humerus with residual extension of 70° and flexion of 100°. There was no improvement in the ROM and he refused further surgery. One patient, in whom we performed a revision arthrolysis for post-operative stiffness following an intra-articular fracture of the humerus with an associated type I¹⁸ open fracture of the mid-shaft of the radius and ulna, required a further revision arthrolysis 18 months later, as the improvement in extension from 70° to 50° was lost in the post-operative period. Following revision arthrolysis, there was no improvement in extension, although her flexion improved from 100° to 130°. No patient developed an infection or had any problems with their wound in the post-operative period.

Discussion

Established loss of movement following elbow injury can occasionally be treated by conservative measures such as braces or dynamic splints. Gausepohl, Mader and Pennig¹⁹ recently reported satisfactory results in 14 cases of post-traumatic elbow stiffness in children and adolescents treated by mechanical distraction, but the results of other studies have been unpredictable.²⁰⁻²²

Recent papers on arthroscopic arthrolysis of the elbow for post-traumatic stiffness report an improvement in movement ranging between 18° and 50°.²³⁻²⁷ However, this procedure is not without risk. Transection of the median and radial nerves during the procedure has been reported.²⁸ Arthroscopic arthrolysis may have a role in the treatment of primary osteoarthritis of the elbow,^{29,30} but its role in post-traumatic elbow stiffness remains debatable. Many patients who have post-traumatic elbow stiffness following fixation of an intra-articular fracture require removal of the metalwork, which may be a source of impingement, and open elbow arthrolysis can easily be performed at the same time.

Open arthrolysis has been the gold standard for the treatment of post-traumatic stiffness of the elbow. Various techniques and surgical approaches have been described.^{1-3,5-16} The principles of releasing the contracted capsule and ligaments around the elbow have not changed. Most series report a greater improvement in ROM than that obtained by arthroscopic arthrolysis, particularly in patients with severe contractures. The majority of patients are satisfied if they achieve a functional arc of more than 30° to 130°. Improvements in ROM and pain are probably attributable to the removal of sources of bony and soft-tissue impingement. Partial denervation of the elbow following release of the anterior and posterior capsule may also contribute. The short-term benefits of the procedure are well known, but no previous mid-term results have been reported.

In this series we used a variety of surgical approaches. The results one year after surgery are comparable with those

reported in the literature.^{1-3,5-16} However, the results at a mean follow-up of 7.8 years show no significant change in either ROM or the Mayo score compared with those one year after surgery.

All except two patients were satisfied with the result at final follow-up. One, who developed a triceps avulsion post-operatively, refused further surgery and continued to have only 70° of extension. In this patient arthrolysis was performed 35 years after an intra-articular fracture of the distal humerus. The long period of pre-operative stiffness may have been a contributing factor to the failure of the procedure. Cikes et al,¹² in a recent paper, reported that the best results following open elbow arthrolysis were achieved when the procedure was performed within one year of the initial injury. The other dissatisfied patient had three attempts at arthrolysis, two of which were performed by us. Her range of flexion improved from 100° to 135°, but extension did not improve from the pre-operative value of 70°. Injuries to the ipsilateral radius and ulna sustained at the time of injury may have contributed to her poor outcome.

The main weakness of this study is the limited number of patients available with a minimum five-year follow-up. However, all the surgical procedures were carried out by a single surgeon (LAR) and all patients followed the same post-operative regimen. A standard method of data collection was used both pre-operatively and during the follow-up period. We have shown that open arthrolysis of the elbow combined with continuous brachial plexus block and continuous passive movement in the post-operative period can improve ROM and function in patients suffering from post-traumatic stiffness of the elbow, and that this improvement can be maintained over a mean follow-up of 7.8 years.

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