Open reduction for late-presenting posterior dislocation of the elbow

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ABSTRACT

Purpose. To evaluate results of open reduction for late-presenting (more than 3 weeks) posterior dislocation of the elbow in 10 patients.

Method. Elbow stiffness was the main indication for surgery. The mean age of the patients was 34 (range, 13–65) years; the mean time since injury was 4 (range, 2–6) months. All patients had non-functional elbow movement for any activity of daily living. Three patients had associated fractures around the elbow joint.

Results. At a mean follow-up of 19 (range, 11–28) months, 8 patients regained a functional range of movement for activities of daily living and maintained a median arc of flexion of 100 degrees and a supination-pronation arc of 140 degrees. According to the Mayo Elbow Performance Index, the results of 5 patients were excellent, 3 were good, and 2 were poor. Complications included pin site infection (n=2), ulnar neuritis (n=1), and delayed wound healing (n=1).

Conclusion. In patients with late-presenting, unreduced elbow dislocation occurring up to 6 months earlier, open reduction is effective in restoring the joint to a painless, stable and functional state.

Key words: dislocations; elbow

INTRODUCTION

Late-presenting, unreduced posterior dislocation of the elbow is a challenge for surgeons. Due to misconceptions and ignorance, many patients go to local bonesetters for traditional treatment such as massage and manipulation, which only aggravates the problem. ‘Unreduced’ is defined as those posterior elbow dislocations not treated within 3 weeks of injury.1–3 These elbows are fixed in either extension or flexion with only a few degrees of flexion, supination, and pronation, and have a non-functional range of movement for activities of daily living.2,4

The time since injury and patient age determine the mode of treatment.3,5 Most authorities recommend...
open reduction for late-presenting cases (up to 3 months after injury). The likelihood of restoring useful function of the elbow by open reduction alone is inversely proportional to the time since injury. Total elbow arthroplasty, excisional arthroplasty or arthrodesis is advised for cases presenting after 3 months, though there are no clear-cut treatment guidelines for such cases. We treated 10 patients with unreduced posterior dislocation of the elbow using open reduction, regardless of the time since injury or the age of the patient.

MATERIALS AND METHODS

Between the period October 1999 and October 2002 inclusive, 7 men and 3 women aged 13 to 65 (mean, 34) years were treated at our institute for unreduced posterior dislocation of the elbow. The time since injury ranged from 2 to 6 (mean, 4) months. The numbers of dominant or non-dominant elbows involved were equal. Six patients were initially treated with massage by local bone setters. Elbow stiffness was the main indication for surgery. Four patients had no pain in the elbow, 3 had mild pain and occasionally used analgesics, and 3 had moderate pain and regularly used analgesics. All patients had an anteriorly prominent distal humerus. The olecranon was prominent and the shortened triceps was seen tenting on the posterior aspect of the elbow. The 3-point relationship of the tip of the olecranon, medial and lateral epicondyles was disturbed and the joint was tender. The elbow was stable in 4 patients and moderately stable in 6. The active range of flexion, extension, pronation, and supination were measured using a handheld goniometer. The joints were fixed in either extension or flexion with only a few degrees of flexion (Table). All patients had non-functional elbow movement preoperatively. Hypoesthesia of the hand over the ulnar nerve was present in 2 patients. Dislocation was posterolateral in 7 patients and posteromedial in 3.

The patient was positioned laterally with the elbow flexed at 90° on a sandbag. A pneumatic tourniquet was applied high up. Speed’s procedure for open reduction was used. Dense fibrous tissue filled up the olecranon, coronoid fossae, and the radial head, whilst the collateral ligaments were cut. The shortened triceps bound down by fibrous tissue to the humerus was incised to expose the joint surfaces. Well-preserved articular surfaces were seen in all. Subperiosteal new bone formation was seen on the anterior aspect of the elbow in one patient and in another it was on the posterior aspect (and was therefore removed to facilitate reduction). Radiocapitellar and ulnotrochlear reduction was achieved by manipulation.

Three patients had associated fractures around the elbow. One had a 4-month-old malunioned medial condyle fracture, which was left untreated. Another with a 3-month-old dislocation had a fracture of the radial head, which was excised and the olecranon reduced. The third was treated in another hospital for radial head and ulnar shaft fractures; the radial head was excised and the ulna plated. The patient...
subsequently dislocated his elbow inside the splint. The latter injury was undetected due to lack of follow-up in that hospital. This patient was treated with open reduction and Kirschner wire fixation 4 months post dislocation.

Elbows of all 10 patients became floppy due to cutting of the capsule and the ligaments. After reduction, in 8 patients the olecranon was transfixed to the distal humerus in 90° flexion of the elbow using two 1.5-mm Kirschner wires (Fig. 2), and in 2 others both the radius and ulna were transfixed with one Kirschner wire each (Fig. 3). The fascia was closed over the radial head but the ligaments were not reattached to the bone. The triceps was lengthened using a Speed V-Y muscleplasty technique. The wound was closed in layers over a suction drain. A posterior above-elbow plaster of Paris slab was applied after the dressings. Our procedures and findings were in accordance with other authors.1,3,6

Drains were removed after 48 hours and the Kirschner wires were removed 2 weeks later, at which time active movements of the elbow were initiated. Thereafter, assisted exercises on a continuous passive motion machine were begun. The elbow was supported on an arm sling between exercises. Depending on individual progress, use of the sling was discontinued after 6 weeks to 3 months. This early phase of rehabilitation was important and demanded maximal effort by both the patient and physiotherapist.

The Mayo Elbow Performance Index10 was used to assess subjective, objective, and functional characteristics before and after the operation and at the final follow-up. This scoring system has 4 parameters: 45 points are given for a pain-free elbow, 20 points for normal elbow movement, 10 for a stable elbow, and 25 for performance of 5 activities of daily living. Stability of the elbow is rated as stable (no apparent varus/valgus instability), moderate (<10° varus/valgus instability), or gross (≥10° varus/valgus instability). Depending on the score, results were rated as excellent (90–100), good (75–89), fair (60–74), or poor (<60).

The follow-up radiographs were evaluated for articular alignment and post-traumatic arthrosis using the rating scale by Broberg and Morrey.11 The absence of any radiographic arthrosis was defined as grade 0, slight joint narrowing as grade 1, moderate

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Sex/age</th>
<th>Injured side</th>
<th>Mode of injury</th>
<th>Duration of dislocation (months)</th>
<th>Associated fracture</th>
<th>Range of movement</th>
<th>Mayo Elbow Performance Index10</th>
<th>Follow-up (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M/40</td>
<td>L</td>
<td>Fall</td>
<td>6</td>
<td>Medial condyle</td>
<td>10º (10º–20º)</td>
<td>80</td>
<td>18</td>
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<tr>
<td>2</td>
<td>M/13</td>
<td>R</td>
<td>Fall</td>
<td>4</td>
<td>-</td>
<td>40º (10º–50º)</td>
<td>100</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>M/35</td>
<td>L</td>
<td>Fall</td>
<td>4</td>
<td>Fixed in 20º of flexion</td>
<td>20º (20º–0º)</td>
<td>75</td>
<td>14</td>
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<tr>
<td>4</td>
<td>M/45</td>
<td>R</td>
<td>Fall</td>
<td>4</td>
<td>Ulnar shaft and radial head</td>
<td>40º (0º–40º)</td>
<td>40</td>
<td>18</td>
</tr>
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<td>5</td>
<td>F/16</td>
<td>L</td>
<td>Traffic accident</td>
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<td>-</td>
<td>10º (10º–20º)</td>
<td>80</td>
<td>12</td>
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<tr>
<td>6</td>
<td>M/25</td>
<td>R</td>
<td>Fall</td>
<td>4</td>
<td>-</td>
<td>10º (10º–20º)</td>
<td>40</td>
<td>11</td>
</tr>
<tr>
<td>7</td>
<td>M/20</td>
<td>R</td>
<td>Traffic accident</td>
<td>5</td>
<td>-</td>
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<td>95</td>
<td>28</td>
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<td>8</td>
<td>F/65</td>
<td>L</td>
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<td>2</td>
<td>-</td>
<td>30º (20º–30º)</td>
<td>100</td>
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<td>9</td>
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<td>L</td>
<td>Fall</td>
<td>6</td>
<td>-</td>
<td>20º (15º–35º)</td>
<td>100</td>
<td>28</td>
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<tr>
<td>10</td>
<td>M/42</td>
<td>R</td>
<td>Fall</td>
<td>2.5</td>
<td>Radial head</td>
<td>15º (15º–30º)</td>
<td>145º (50º–95º)</td>
<td>90</td>
</tr>
</tbody>
</table>

Table: Patient characteristics and outcomes

![Figure 1](image) Intra-operative view of the elbow joint: the fibrous tissue inside the olecranon (A), the fibrous tissue covering the radial head (B), and the ulnar nerve being isolated (C).
joint space narrowing with minimal osteophytosis as grade 2, and severe degenerated changes with loss of the joint space as grade 3.

RESULTS

The mean operating time was 73 (range, 45–94) minutes. The patients were followed up for a mean of 19 (range, 11–28) months. Based on the Mayo Elbow Performance Index, at the final follow-up, 8 patients had satisfactory outcomes (5 excellent, 3 good) and 2 had poor outcomes; the mean score was 89. Five patients had no pain, 3 had mild pain during repetitive elbow movements or weight lifting, and 2 had moderate pain. The mean pain score was 35 (range, 15–45). At the final follow-up, no patient had any sign of instability; the mean score was 10. Six achieved a flexion range of 100° to 130°, one achieved 90°, and one achieved 80° (Table). The mean arc of flexion was 100° (range, 40°–130°) with a mean maximum flexion of 115° (range, 55°–140°) and a mean fixed flexion deformity of 13° (range, 10°–20°).

All patients achieved a supination-pronation arc of ≥100°; the range of supination was always less than that of pronation. The mean supination-pronation arc was 140°. All but one patient regained a functional range of movement, most activities of daily living could be accomplished with the range of elbow flexion of 80° to 100°. Eight patients had no difficulty in performing the functional tasks.

Although no significant correlation was noted between the range of movements achieved and the duration of unreduced dislocation, patients treated earlier had a greater range of movements than those treated later. The 3 patients with associated fractures had a range of movement of 45° to 90° only. Regarding the 2 with ulnar nerve neuritis, one recovered fully within 9 months, while in the other the disability persisted after 2 years. One patient gradually lost movements of his elbow due to myositis ossificans, and at 18-month follow-up his range of elbow flexion was 45° (80° extension to 130° flexion) and a supination-pronation arc of 110°. He had moderate pain on performing daily activities but the elbow was stable. All patients had radiographic ulnohumeral and
radiocapitellar alignment. Three patients had evidence of mild joint space narrowing and osteophyte formation (grade 1 arthrosis), one had severe (grade 3) changes with a loss of joint space, and one had severe degenerative changes with myositis ossificans on the anterior aspect of the elbow.

Complications included: pin site infections (n=2), treated by oral antibiotics and dressings; a gaping wound on removal of stitches (n=1), treated by daily dressings and a secondary intervention within 10 days; and joint swelling with mild tenderness (n=2) at one year.

DISCUSSION

Most cases of old unreduced dislocations of the elbow are found in rural areas of this country, where qualified doctors are lacking and traditional bonesetters easily available. Such patients are often neglected and maltreated before being seen by a specialist in a city hospital.

Most of these dislocations are caused by a fall on the outstretched hand with the elbow incompletely extended and the forearm pronated—the best posture to absorb the shock.\textsuperscript{12-14} This may explain why all patients had a better pronation than supination. Most surgeons recommend closed reduction for elbow dislocation up to 3 weeks post injury. After 3 weeks, soft tissue contractures and localised osteoporosis make closed reduction hazardous in that manipulation may fracture the bone or damage the articular surface.\textsuperscript{1-3} Most authorities advise open reduction for elbow dislocation up to 3 months; total elbow arthroplasty; excisional arthroplasty, or arthrodesis is advised thereafter.\textsuperscript{1,5,6} Arthrodesis is not well accepted by patients and is appropriate only for those engaged in heavy labour. Though total elbow arthroplasty may provide a better range of movement, it has a limited life span and is cost-prohibitive and not applicable in children with open epiphyses.

When unreduced dislocation lasts 6 months to a year, changes occur in articular surfaces and thus surgical reduction is not advised after 3 months.\textsuperscript{6,7} Excision arthroplasty is recommended after 2 months of dislocation.\textsuperscript{5} In our study, open reduction achieved

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**Figure 3** Patient 9: a 42-year-old woman with 6-month-old unreduced posterior dislocation of the left elbow: (a) the elbow has fixed flexion deformity of 15° and range of flexion of 20°. (b) Lateral and (c) anteroposterior radiographs showing posterior and medial dislocation of the olecranon. (d) Postoperative radiographs showing fixation of the radius and ulna with Kirschner wires to the distal part of the humerus. (e) At 28-month follow-up, the patient has functional range of elbow flexion of 105°.
a fair outcome and a useful range of movement even up to 6 months post injury. Our findings are consistent with those of another study that achieved favourable results by open reduction even up to 2 years after neglected dislocations.2 Healthy articular cartilage was found in 23 patients with neglected elbow dislocation one month to 2 years post injury; open reduction was recommended irrespective of the time since dislocation.3 We found unhealthy articular cartilage at many places and in some it peeled off easily.

In 15 children with unreduced elbow dislocation for 3 weeks to 4 years post injury, 3 had useful elbow movement without an operation.5 Conservative treatment was therefore recommended for children aged up to 16 years, who presented 3 weeks to 2 months after injury.5 None of our patients had such a good range of elbow movement preoperatively.

Incarceration of the medial epicondyle in the joint occurred more often in children as a traction injury and less commonly in adults.15 A computed tomography scan for all patients with fracture dislocations was advised to detect coronoid and radial head fractures.16 Replacement of the head with a prosthesis and fixation of the coronoid is advised to prevent redislocation.16 External or internal fixation is needed to stabilise the joints.16 Two of our patients underwent open reduction and radial head excision for the associated radial head fracture without coronoid fracture and their elbows remained stable.

The presence of concomitant fractures is associated with poor functional results.6 In our study, patients with associated fractures achieved less range of movement than those without. One patient with ulnar shaft and radial head fractures achieved a 45º range of flexion, another with a radial head fracture achieved 80º, and another with a medial condyle fracture achieved 90º. Most activities of daily living can be performed with a 100º flexion arc and a 100º supination-pronation arc; such an elbow was termed ‘useful’.4 All our patients were within this range and could perform activities of daily living. Some of these activities can be accomplished even with a less range of elbow movement, due to compensatory movements of adjacent joints. Our patients with a range of flexion of 80º could perform most activities of daily living except those requiring extreme flexion such as reaching the occiput. No radiohumeral horn was found in any of our patients, but was present in individuals treated elsewhere.7

Mahaisavariya and Laupattarakasem17 recommended open reduction without triceps lengthening to achieve better results in elbow flexion in patients who had a dislocation for one to 3 months. However, in another larger study with patients having elbow dislocation for one to 60 months, the same authors performed triceps lengthening in 22 out of 24 patients.18 In our study, triceps lengthening helped achieve reduction; the older the dislocation, the more the need for triceps lengthening. This allowed reduction without putting undue pressure on the already compromised articular cartilage. As 7 of our 10 cases had elbow dislocation for more than 3 months, triceps lengthening was necessary. Other open reduction methods include splitting of the triceps, but this causes a greater degree of postoperative muscular contracture and elbow flexion restriction. Unlike the Mahaisavariya et al.’s study,18 we did not repair the collateral ligament after reduction to avoid any unduly tight joint reduction. In their study, patients were sent to the physiotherapist for assisted flexion exercises for 2 weeks and aggressive physiotherapy thereafter. We advised only active elbow exercises for an initial period of 2 weeks. In their study, flexion contracture increased by a mean of 30º from 10º preoperatively to 40º postoperatively, but in all patients the flexion contracture remained unchanged at follow-up. None of our patients felt pain on lifting heavy weights, while some of theirs experienced elbow pain attributed to flexion contracture.

Our rehabilitation programme included 2 weeks of active physiotherapy after removal of the Kirschner wires to prevent myositis ossificans. Passive and assisted elbow movements were allowed once the inflammation had settled. Regular follow-up and a strict physiotherapy regimen is of utmost importance. Arafiles19 performed open reduction with tendon graft stabilisation to create a medial collateral and intra-articular cruciate ligament, with exercises starting 6 days postoperation. We have no experience with this method. Their patients achieved a mean arc of flexion of 105º. Valgus-varus instability of 33º was reported in patients who underwent tricepsplasty, but it was only 4º in those whose aponeurosis was kept intact. Tricepsplasty was performed in all our patients who had a mean flexion contracture of 10º and none of our patients had instability. Some authors recommend open reduction and hinged external fixation without V-Y plasty of the triceps bow to facilitate early rehabilitation and better stability.19,20 We have no experience with this method.

CONCLUSION

Open reduction for late-presenting unreduced elbows, followed by a supervised physiotherapy can restore elbows to a functional, stable and painless
REFERENCES