



The results of conservatively treated simple elbow dislocations

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Objectives: Closed reduction followed by short-time immobilization is the generally accepted treatment for simple elbow dislocations. However, the number of studies concerning the results of this method is limited. In this study, the clinical and radiographic results of conservatively treated simple elbow dislocations were retrospectively evaluated.

Methods: The study included 21 patients (16 males, 5 females) who underwent closed reduction and immobilization for simple elbow dislocations. Simple dislocations were defined as non-fracture dislocations and dislocations accompanied by minor avulsion fractures that did not require additional surgery or immobilization. The mean age of the patients at the time of injury was 35 years (range 16 to 59 years). All the patients had posterior dislocations. Eleven patients (52.4%) had minor avulsion fractures. Following closed reduction, a plaster splint and hinged brace were used in four (19.1%) and 17 (81%) patients, respectively. Incremental active and passive motions were started at the end of the first week in patients in whom a brace was used. The mean duration of brace use was 27 ± 16 days. Patients using a plaster splint were immobilized for three weeks. The patients were assessed clinically with respect to range of motion, instability, and neurologic findings after a mean follow-up period of 34 months (range 12 to 99 months). Functional assessments included the Mayo Elbow Performance Score (MEPS) and the Broberg-Morrey Functional Rating Index (BMFRI). Standard elbow anteroposterior and lateral radiographs were examined for concentric reduction and signs of degeneration and heterotopic ossification.

Results: Compared to the normal side, the degrees of flexion, extension, flexion arc, and pronation were significantly decreased in dislocated elbows ($p < 0.05$), while the degrees of supination and rotational arc were similar. There was no muscular atrophy. Four patients (19.1%) had residual instability and six patients (28.6%) had mild to moderate neurological complaints that were primarily related to the ulnar nerve. Three patients complained of mild pain, and one patient complained of moderate pain at rest. Radiographic assessment showed mild degeneration in three patients (14.3%), and mild to moderate heterotopic ossification in 14 patients (66.7%). Patients with and without heterotopic ossification did not differ significantly with respect to the values of joint range of motion. The mean MEPS and BMFRI scores were 96.9 and 97.7, respectively. The scores of both systems were excellent in 20 patients (95.2%) and moderate in one patient (4.8%). The majority of the patients (81%) reported complaints about their elbows including sensation of stiffness in the elbow, pain during strenuous work or sports activities, and limitation of movement. Only four patients (19.1%) reported a feeling of full recovery.

Conclusion: Although closed reduction with short-term immobilization is a universally accepted method for simple elbow dislocations with excellent functional scores, it is associated with significant limitations in joint movements and a great majority of patients do not consider themselves fully recovered.

Key words: Dislocations/therapy/complications; elbow joint/injuries; joint instability.

Even though the elbow is a very stable joint because of the perfect alignment of the bones and the support provided by collateral ligaments and muscles, elbow dislocations account for the second most frequent type of dislocations coming only after shoulder joint dislocations.^[1,2] Compared to fracture-dislocations that present many difficulties in terms of treatment approach and whose outcomes are not very good, conservative treatment is generally advocated in simple elbow dislocations with some exceptions.^[3,4] After the classic article by Mehlhoff et al.^[5] in 1988, there have been a limited number of studies on the outcomes of conservative treatment of simple elbow dislocations and current studies generally focus on the comparison between conservative and surgical methods.^[6,7]

The aim of this retrospective study was to evaluate the outcomes of conservative treatment of simple elbow dislocations from a clinical and radiographic perspective.

Patients and methods

The records of patients who presented to the emergency unit with a simple elbow dislocation between 2000 and 2008 were reviewed, and these patients were invited for a control visit to determine their current status by physical examination and X-rays. Simple dislocations were defined as non-fracture dislocations and dislocations accompanied by minor avulsion fractures that did not require additional surgery or immobilization. Minor fractures included cortical separations up to 1-2 mm in the medial and lateral epicondyle and 1-2 mm fractures involving the coronoid process. A total of 32 patients with fracture-dislocations of the elbow presented to the emergency unit within this period, of which 26 patients had simple elbow dislocations. Five patients could not be reached and the remaining 21 patients (16 males, 5 females) were included in the study group. The mean age of the patients at the time of injury was 35 years (range 16 to 59 years). Patients' age, gender, dominant hand, any accompanying minor fracture and its localization, and type and duration of fixation were recorded. At final controls, the patients were asked if they had any pain, and those who had pain were asked to rate their pain on a four-point severity scale (none, mild-moderate, severe, unbearable). They were also questioned about their level of daily and sport activities.

On physical examination, the elbow was checked for deformity and for any sensitivity on palpation. In addition to sensory and motor neurological examination, elbow range of motion including flexion, extension, pronation and supination were determined, flexion and rotational arcs, carrying angles, and arm diameters were measured. Findings of these measurements were compared with those of the contralateral elbow. Patients who had any pathology or a history of injury or surgery in the contralateral arm were excluded from the study. Valgus, varus, and rotatory instability tests were made for determination of permanent instability.

Radiographic assessments were made on bilateral direct X-rays of the elbow (anteroposterior and lateral) for the presence of degeneration, free fragments in the joint, heterotopic ossification and its localization, and widening of the joint space. Widening of the ulnohumeral joint space on lateral radiographs (drop sign) was assessed as radiographic subluxation (Fig. 1). Clinical evaluations were made using the Broberg-Morrey Functional Rating Index and the Mayo Elbow Performance Score and the results were classified as excellent, good, moderate, and poor.^[8,9] The mean follow-up period was 34 months (range 12 to 99 months). The results were evaluated with the paired t-test, paired sample t-test, and Mann-Whitney U-test using the SPSS 10.0 software.



Fig. 1. Widening of the joint space on the lateral radiograph was considered to be a "drop sign" and accepted as a finding of rotational instability.

	Dislocated side (n=21)	Normal side (n=21)	<i>p</i>
Flexion (°)	131.5±7.7	136.2±4.3	0.022
Limitation of extension (°)	0.5±8.4	5.3±4.2	0.001
		(hyperextension)	
Flexion arc (°)	131.0±13.3	142.0±6.4	0.001
Supination (°)	88.6±3.2	88.7±3.5	0.335
Pronation (°)	84.1±9.3	87.7±3.6	0.044
Rotational arc (°)	172.7±11.2	175.9±4.8	0.225

Results

All the patients had posterior dislocations. Eleven patients (52.4%) had minor avulsion fractures that accompanied elbow dislocations and did not require additional surgery or immobilization. Following closed reduction, a plaster splint and hinged brace were used in four (19.1%) and 17 patients (81%), respectively. Incremental active and passive motions were started at the end of the first week in patients in whom a brace was used. The mean duration of brace use was 27±16 days. Patients using a plaster splint were immobilized for three weeks.

The range of motion of dislocated and normal elbows is shown in Table 1. There were significant differences between the two sides with respect to the degrees of flexion, extension, flexion arc, and pronation, whereas the degrees of supination and rotational arc were similar.

Three patients complained of mild pain and one patient complained of moderate pain at rest. While muscular atrophy was not observed, one patient

(4.8%) had valgus deformity, four patients (19.1%) had crepitation during elbow movements, and six patients (28.6%) had neurological complaints that were primarily related to the ulnar nerve. These neurological complaints included occasional numbness and tingling in the fourth and fifth fingers, and sensitivity over the ulnar groove. Paresthesia was associated with the median nerve dermatome in two patients. Electromyographic examination was not performed for neurological complaints. Instability examinations showed permanent varus-valgus instability of up to 5 degrees in four patients (19.1%). The mean diameter of dislocated elbows was 27.4±3.5 cm and the mean carrying angle was 14.5°, compared with the corresponding values of 27.6±3.2 cm and 14.4° in the unaffected elbows.

	Broberg-Morrey Functional Rating Index	Mayo Elbow Performance Score
Motion	39.1±1.4	20.0±0.0
Force	19.7±1.5	24.8±0.9
Pain	34.1±4.4	42.9±7.2
Stability	4.9±0.4	9.5±1.5
<i>Total</i>	97.7	96.9



Fig. 2. Heterotopic ossification is seen in the lateral collateral ligament and anterior capsule on the follow-up radiographs of a 23-year-old male patient. Despite the scores of 99.4 and 100 from the Broberg-Morrey Functional Rating Index and the Mayo Elbow Performance Score, respectively, the patient reported early tiredness during physical activities.

	Heterotopic ossification present (n=14)	Heterotopic ossification absent (n=7)	<i>p</i>
Flexion (°)	132.6±7.1	129.1±8.8	0.400
Limitation of extension (°)	1.4±6.5	4.1±11.1	0.287
	(hyperextension)		
Flexion arc (°)	134.0±1.0	125.4±17.9	0.197
Supination (°)	88.9±2.9	87.9±3.9	0.636
Pronation (°)	83.4±10.3	83.4±7.9	0.913
Rotational arc (°)	172.3±13.0	171.3±6.7	0.322

The mean Mayo Elbow Performance Score was 96.9 and the mean Broberg-Morrey Functional Rating Index score was 97.7. The scores of both systems were excellent in 20 patients (95.2%) and moderate in one patient (4.8%).

Radiographic assessment revealed mild degeneration in three patients (14.3%) and heterotopic ossification in 14 patients (66.7%) primarily involving the lateral collateral ligament (Fig. 2). Patients with and without heterotopic ossification did not differ significantly with respect to the values of joint range of motion (Table 3).

The majority of patients (81%) reported complaints about their elbows, the most common complaints being sensation of stiffness in the elbow, pain during strenuous work or sports activities, and limitation of movement. Only four patients (19.1%) reported a feeling of full recovery (Table 4).

Discussion

Despite the presence of studies advocating the necessity of primary repair for elbow dislocations accompanied by generalized osteochondral defects or for instable elbow dislocations,^[10-14] conservative approach is the generally accepted treatment for simple elbow dislocations.^[3,5-7,15-17] There seems to be no difference between the results of studies comparing conservative and surgical treatment.^[6,7] Our study also showed that closed reduction and short-term immobilization resulted in excellent clinical scores in simple elbow dislocations. However, it was observed that the majority of patients had minor complaints including sensation of stiffness in the elbow and pain occurring during heavy work and sports activities.

The bony structure making up the elbow joint ensures stabilization of the joint together with the coronoid process, joint capsule, collateral ligaments and support from peripheral muscles.^[18-21] Anatomical realignment of the radius head, coronoid process, and proximal ulna is of great importance in preventing post-traumatic persistent instability.^[22] It is known that the structures forming the joint such as the anterior and posterior capsules, collateral ligaments, brachialis muscle, and joint cartilage are damaged during dislocations, even if there is no fracture.^[5,6,11,14,23-25]

O'Driscoll et al.^[18,26] stated that the lateral collateral ligament was damaged during dislocations, capsuloligamentous injury progressed from lateral to medial, and insufficiency of the lateral collateral ligament might cause instability. The flexor and extensor muscles are also injured to varying degrees. Josefsson et al.^[6] examined patients under anesthesia during closed reduction for elbow dislocations and observed that all elbows had instability to some extent, and they reported that surgical treatment was also associated with injury to the collateral ligaments and joint capsule.^[6] Mehlhoff et al.^[5] found that 35% of patients had mild instability following elbow dislocation, which

	<i>n</i>	%
Neurological complaints (numbness, tingling, hyperesthesia)	6	28.6
Difficulty in sports or high physical activities	12	57.1
Feeling of joint stiffness	3	14.3
Tenderness on the medial epicondyle	2	9.5



Fig. 3. (a) Anteroposterior and (b) lateral radiographs of a 26-year-old male patient. Despite normal appearance of the former, the latter exhibits “drop sign”. The patient had excellent clinical scores, but had a complaint of numbness in the ulnar nerve dermatome.

they thought was associated with incomplete healing of the medial collateral ligament. Several studies also demonstrated that the lateral collateral ligament complex was avulsed from the lateral epicondyle in more than 75% of patients with elbow dislocations.^[10,14] Therefore, it can be expected that the avulsed ligament and capsule will not heal with equal tension upon post-reduction fixation and early motion, and thus minor instability will occur. In some patients, this is observed as posterolateral rotatory instability. Widening of the joint space observed on the lateral X-rays of many patients (drop sign) brings to mind the presence

of rotational instability (Fig. 3). While this condition does not pose a problem in ordinary daily activities, it may cause complaints during heavy work and sports activities. The medial collateral ligament is the most important supporting structure in the elbow against valgus loading,^[18-20,27] and it is known that as loss of function increases, contact area on the medial joint surface decreases, pressure per unit area increases, predisposing the joint to degeneration.^[28,29] We think that disruption of joint kinematics secondary to microinstability may lead to degeneration and pain.

As demonstrated in previous studies,^[5,17,30,31] we observed significant decreases in the range of motion of the elbow joint compared to the contralateral side. Previously, long-term immobilization was recommended for the conservative treatment of simple elbow dislocations,^[20,32-34] however, Mehlhoff et al.^[5] demonstrated that extended immobilization did not improve joint stability and was associated with worsening limitation of joint motion and pain. Therefore, the emphasis today is placed on early active and passive motion within a safe range.^[30,35,36] In our study, limitation of motion still remained despite a very short immobilization period and incremental movement exercises. Josefsson et al.^[17] observed a relationship between limitation of motion and the development of heterotopic ossification. In our study, heterotopic ossification was observed in 14 patients (66.7%); yet, patients with and without heterotopic ossification did not exhibit significant differences in the range of motion.



Fig. 4. Heterotopic ossification and degeneration are observed on the (a) anteroposterior and (b) lateral radiographs of a 52-year-old male patient at the end of a 20-month follow-up. Although there was a remarkable difference of 27 degrees between the flexion arcs of the two elbows and the patient had difficulty during heavy work, his clinical scores were excellent with 97 and 100 from the Broberg-Morrey Functional Rating Index and the Mayo Elbow Performance Score, respectively.

Complications seen at final follow-ups of our patients included limitation of joint motion, sensation of stiffness, and complaints of increasing pain during physical activities, which we thought was associated with minor instability. In addition, the rate of complaints related with the ulnar nerve was notably high (28.6%). On the other hand, the mean Mayo Elbow Performance Score was 96.9, and the mean Broberg-Morrey Functional Rating Index score was 97.7. While both systems include a detailed evaluation of daily activities of the patients, they do not consider their performance in challenging physical activities and sports activities. In addition, limitation of movement, which makes daily activities difficult for the patients, and loss of stability are not sufficiently influential in these systems. Therefore, measurements performed by using both assessment systems cannot fully reflect the success of treatment methods (Fig. 4).

Our study has some limitations. First of all, the number of patients included in our retrospective study was limited and the results were not derived from a specific age range. Although our treatment program comprised closed reduction and short-term immobilization, the patients did not have a standard rehabilitation program and, therefore, we experienced difficulties in the assessment of treatment results.

In conclusion, despite the initiation of early motion, patients still have significant limitations in joint movements. Although closed reduction with short-term immobilization is an accepted method for the treatment of simple elbow dislocations with excellent functional scores, a great majority of patients do not consider themselves fully recovered. Prospective studies comparing surgical and conservative methods are warranted for a treatment method that will yield excellent results.

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