

Experience of surgical management of acute and chronic post-traumatic elbow instability. A retrospective study

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Abstract

Background: The elbow is the second most commonly dislocated major joint in adults. Elbow dislocation can lead to acute or chronic instability. There are different surgical options and functional outcomes in both cases. The purpose of this study is to assess the functional outcomes and the postoperative complications of these two groups.

Methods: We retrospectively reviewed the functional outcomes of cases of acute and chronic post-traumatic elbow instability that were surgically managed between 2013 and 2016 in adult population. All patients were assessed radiographically and clinically using the Mayo Elbow Performance Score and The Disabilities of the Arm, Shoulder and Hand Score at six months follow-up.

Results: Four male patients were included, two in each group of acute and chronic instability. In Three cases the medial and lateral collateral ulnar ligaments were reconstructed using semitendinosus allograft. In one case the repair of both collateral ligaments was performed using suture anchors. Two acute coronoid fractures were managed by using the lasso-type technique and one nonunion treated with two cannulated screws. The mean post operative Mayo Elbow Performance Score were 95 for the acute instability group and 85 for the chronic instability group. The mean Disabilities of the Arm, Shoulder and Hand post operative scores were 5,8 and 18,3 for the acute and chronic instability groups respectively. There was one case of ulnar neuropathy that resolved spontaneously at two months follow-up. All patients had a reduced and concentric elbow in control radiographs at six months follow-up.

Conclusions: Both groups presented satisfactory results after being managed by different surgical techniques.

Keywords: Elbow instability, elbow dislocation, collateral ligaments.

Introduction

The elbow is the second most commonly dislocated major joint, after the shoulder, in adults. In the pediatric population is the most commonly dislocated joint [1]. Elbow instability may be classified as either acute or chronic. There is no clear time limit described in the available literature. Elbow dislocations can also be classified as simple or complex. Simple dislocations are the ones that present only with variable involvement of ligament lesions. On the other hand, complex patterns have associated fractures of the distal humerus or proximal radius or ulna [2]. Complex dislocations present with worse functional outcomes, thus, it is very important to identify these two scenarios. The elbow is highly stable in nature due to

its static and dynamic constraints. There are three primary static stabilizers: the ulnohumeral articulation, the anterior bundle of the medial collateral ligament (AMCL) and the lateral collateral ligament complex (LCL). The secondary static stabilizers are the radiocapitellar articulation, the common flexor and extensor tendons and the joint capsule. The muscles that cross the elbow are the dynamic stabilizers [3]. As long as the ulnohumeral joint, the AMCL and the LCL remain intact, the elbow will be stable [4]. The purpose of this study is to assess the functional outcomes and complications of surgical management of acute and chronic post-traumatic elbow instability.

diagnosed with acute or chronic symptomatic post-traumatic elbow instability treated with surgery were included in this study. All patients with incomplete clinical records and with the presence of an associated radial head fracture ("terrible triad injury" of the elbow as described by Hotchkiss in 1996 [5]) were excluded. Demographic information (age and sex), mechanism of injury, instability pattern, operative characteristics (surgical approach and reconstruction techniques) were retrieved. Patients underwent evaluation with radiographs in three planes and functional assessment using the Mayo Elbow Performance Score (MEPS) [6] and The Disabilities of the Arm, Shoulder and Hand (DASH) [7] score at six months follow-up. The scores were also measured on the healthy contralateral elbow for comparison at the same time. Because there is not a clear definition between acute vs chronic elbow instability in the available literature, at least to our knowledge, the senior authors (WL and JAC) decided to put the time limit at four weeks from the traumatic event based on their experience. The research needed to conduct the present study was approved by the ethics committee

Material and Methods

Data covering the period between January 2013 to December 2016 was obtained from the registry at our institution. Patients 18 years old or older

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Table 1: MEPS at 6 months follow-up

	Acute Instability	Chronic Instability	Contralateral Elbow
Higher	100	90	100
Lower	90	80	100
Mean MEPS	95	85	100

extension elbow brace that started with a 60° restricted flexion with progressive 20° extension every two weeks until week eight (Fig 1). Isometric strengthening started at week ten. Strengthening exercises were progressive and at four months heavy loads were used. Activities without restrictions were allowed at six months. Radiographic control at 6 months showed a reduced and

at our institution.

Results

Four patients met the inclusion criteria. All of them males. The mean age was 32 years (25-38). The mechanism of injury of all patients was falling on an outstretched hand. Two patients were referred to office within four weeks from the elbow dislocation. All patients presented pain with activities of daily living especially when lifting any kind of weight with the injured elbow. Range of movement was limited in all patients to an arc of approximately 45° to 120° mainly because of pain and the sensation of instability with more extension. Diagnostic maneuvers performed included valgus stress test at 30° of flexion, varus stress test and the lateral pivot shift test described by

O’Driscoll[8]. They were carried out at the office and under anesthesia in the operating room. All of the clinical tests were positive for valgus, varus and posterolateral rotatory instability. The preoperative planning included imaging with radiographs and MRI in all cases. The radiographic findings included two cases of acute type 1 coronoid fractures according to the classification system described by O’Driscoll et al[9] that were managed with the suture lasso technique as described by Garrigues et al [10] and one case of coronoid nonunion in a chronic case that was treated using two 3.0 mm cannulated, small fragment, partially-threaded cortical screws. MRI showed absence of continuity of both AMCL and LCL in all patients. In one acute case the AMCL and the LCL were reinserted on the medial and lateral epicondyles respectively using one 3.5 mm suture anchor on the bare spot on each side. In the other three cases the AMCL and LCL had poor tissue quality and extensive damage. In these cases both ligament complexes were reconstructed using semitendinosus allograft through bone tunnels on the lateral side and bone tunnels and a figure-of-eight graft configuration on the medial side [11]. A direct medial approach over the medial epicondyle and a lateral approach using the Kocher interval were used in all patients[12]. The ulnar nerve was released without transposition in all patients. The clinical results of the MEPS and DASH scores of the injured and contralateral elbows at six months follow-up are summarized in Table 1 and Table 2 respectively. The same rehabilitation



Figure 3: Title Rehabilitation protocol. Legend: The rehabilitation protocol included the use of a graduated limited extension elbow brace until week eight after surgery.

Table 2: DASH at 6 months follow up

	ΑΙΟΔ ΓΕΝΙΤΙΝΩ	ΑΙΠΛΕΓΙ ΓΕΝΙΤΙΝΩ	ΑΛΛΟΝ Π Ο Ν ΛΑΙ ΛΟ
ΑΡΤΙΝ	ΤΨ	ΡΝ	ΟΨ
ΟΔΟΙΝ	Σ	ΟΤΨ	Ν
Ç ΙΙ Ε ΑΑΕΕ	ΣΨ	ΟΨΡ	ΝΤ

protocol was applied to all patients. The first two weeks the elbow was immobilized in a long arm cast. Then the rehabilitation was focused in gaining motion. The elbow was put in a restricted

concentric elbow joint of all patients and complete healing of the coronoid fractures and nonunion. One case of ulnar nerve neurapraxia was recorded in a chronic case. No other complications were reported. At six months follow-up all patients returned to their previous sports activities without restrictions, none of them were high-level athletes.

Discussion

The term “elbow instability” includes a wide variety of disorders ranging from acute simple dislocations, with good overall prognosis, to complex chronically unstable elbows with multiple associated injuries. Elbow instability is caused by multiple etiologies, including traumatic events and hyperlaxity status or even the chronic abuse of the medial stabilizers in the case of throwers[2,4]. In post-traumatic elbow instability is paramount to determine the instability pattern. There are different stress tests described in the literature[8,13,14]. Some maneuvers like the lateral pivot shift test are difficult to elicit in the awake patient, thus, it is important to consider the examination under anesthesia[15]. All cases reported in this study were males around their third decade of life, with fall with an outstretched hand as mechanism of injury, which is consistent with previous reports in the literature[2,4]. The LCL is a primary stabilizer of the elbow. Failure to address its injury during surgery is a cause of recurrent instability. Surgical repair with suture anchors or bone tunnels placed at the origin of the LCL are suitable management options[16]. Posterolateral rotatory instability of the elbow was described by O’ Driscoll[8]. Sanchez-Sotelo et al described the results of 12 direct repairs and 33 ligament reconstructions with tendon autograft for posterolateral rotatory instability of the elbow at a mean follow-up

of six years. The mean post operative MEPS was 85. Better results were obtained in patients with post-traumatic etiology, those with subjective symptoms of instability at presentation and those who had augmented reconstruction using a tendon graft [17]. Anakwenze et al recently published a systematic review of the literature where they analyzed the outcomes of reconstruction of the lateral collateral ligament for posterolateral rotatory instability. Eight studies with a total of 130 patients were included. Ninety one percent of patients had good or excellent results; however, 11% of patients presented complications with 8% of recurrent instability [18]. Lin et al reported the functional outcomes of 14 patients who underwent ligament reconstruction with either palmaris or gracilis autograft. Thirteen patients had good or excellent MEPS. Results were better when only lateral instability was present [19]. Vernet et al published their results of lateral ulnar collateral ligament reconstruction in 18 patients using palmaris autograft. Mean MEPS and DASH scores were 90 and 21 respectively at 61 months follow-up. No revision surgery was required [20]. The most frequent complication of LCL surgery is recurrent instability, even in the presence of subjective satisfaction of most patients [21]. In an elbow dislocation the soft tissues disruption progresses from lateral to medial [22]. In cases of high energy involvement the AMCL can be injured. The AMCL needs to be addressed in cases where the elbow remains unstable after the repair or reconstruction of the bony and other soft tissues injuries [16]. Repair using suture anchor or bone tunnels can be performed in cases of avulsed AMCL origin [23]. Depending on tissue quality, reconstruction using autograft or allograft can be attempted. Jobe et al were the firsts to describe the reconstruction of the ulnar collateral ligament using a free tendon graft in 1986 [24]. Many modifications to this technique have been reported to improve the strength, safety and efficacy of the procedure [25]. Vitale and Ahmad reported

a systematic review of the literature of the outcome of the ulnar collateral ligament reconstruction in overhead athletes. They included 8 studies with a total of 405 patients with a minimum follow-up of one year. Overall, 83% of patients had excellent results. There was a 10% complication rate, with the most common being postoperative ulnar neuropathy which occurred in 6% of patients [26]. Cain et al reported the outcomes of ulnar collateral ligament reconstruction with free tendon graft in 743 patients with minimum two years follow-up. Eighty three percent of patients returned to previous or higher level of competition in less than one year. Complications occurred in 20% of patients, including 16% of ulnar neurapraxia and 1% that required revision surgery of the reconstruction [27]. Complications of different ulnar collateral ligament reconstruction techniques include ulnar neurapraxia (most common), superficial infection, failure of the reconstruction, medial epicondyle avulsion fracture, hematomas and heterotopic ossification [28]. Only one case of ulnar neurapraxia was reported in our study, that resolved spontaneously at six months. Coronoid fractures are rarely seen isolated. They occur in 2% to 15% of elbow dislocations. The coronoid acts as a bony buttress to prevent posterior dislocation and is the insertion site for the anterior capsule, the brachialis muscle and the ulnar collateral ligament [29]. It also plays a critical role as a varus stabilizer and may contribute more in elbow extension than in flexion [30]. Historically only large fragments of coronoid fractures were addressed by surgical fixation as well as small fragments associated with instability [29]. Terada et al reported that reduction and fixation of small coronoid fragments restored the anterior capsule integrity and reduced instability in cases of unstable elbow dislocations [31]. Garrigues et al compare the outcomes of different coronoid fixation techniques. Forty patients with terrible triad injuries were included. Twenty eight patients were managed with the suture lasso technique and 12 with open reduction and internal

fixation with screws and suture anchors. The mean DASH score was 16 and the average Broberg-Morrey score was 90. The suture lasso technique was more stable than the other techniques. Suture anchors had more prevalence of malunion and nonunion [10]. The current recommendation is to fix all coronoid fractures associated with elbow instability [29]. Postoperative complications following surgical management of post-traumatic elbow instability described in the literature include heterotopic ossification, recurrent joint instability, ulnar neuropathy, recurrent joint stiffness and elbow osteoarthritis [16]. The authors of this study emphasize that at the time of surgery the two cases of chronic instability had already signs of degenerative joint disease that included a rough articular surfaces and extensive reactive synovitis. This could explain the differences in the results of the functional scoring systems between both groups. Weaknesses of the present study include the retrospective character and the limited number of cases included. A larger number of cases could eventually show more prevalence of complications.

Conclusion

Acute and chronic post-traumatic instability present more commonly in young males around the third and fourth decades of life. Falling on an outstretched hand is the most common mechanism of injury. Different surgical techniques for reconstruction or repair of both LCL and AMCL and reduction with fixation of type 1 coronoid fractures in cases of acute or chronic post-traumatic elbow instability, followed by a stritc rehabilitation protocol, have good or excellent functional outcomes and full return to activities of daily living at six months follow-up. Clinical Relevance: This study shows that there are multiple surgical options with similar functional outcomes for the management of acute and chronic post-traumatic elbow instability. It stresses the need to determine specific management to each particular condition.

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