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A case series of chronic elbow dislocations treated with open reduction without formal reconstruction or augmentation of ligaments using collateral approach

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Abstract
Elbow joint serves important functions for the purpose of carrying out routine activities. Chronic dislocations of this joint block the smooth functioning of the elbow joint, thus hampering patient's self-care and making day to day tasks difficult to perform. Chronic elbow dislocation is defined as a dislocation that has remained unreduced for 2 weeks. The extensive soft-tissue fibrosis and contractures along with skeletal changes that develop during this time usually prevent successful closed reduction.

A total of 3 patients with chronically dislocated elbow joints were enrolled in the case series and were managed with the similar technique of open reduction of delivering out the distal humerus out and reduction without any formal reconstruction or augmentation of any of the ligaments by the same surgeon in the same hospital set up followed by the same post operative rehabilitation protocol.

All the patients achieved considerably good, stable and painless elbow joint with significant improvement in range of motion as compared to pre operative one. The outcomes were measured using mayo elbow score (MEPS).

Conclusion: This technique of treating elbow joint dislocation is very effective and gives patient a clinically stable, painless and mobile elbow joint. The results were evaluated with the Mayo elbow performance score (MEPS) which showed a considerable improvement in post-surgery score as compared to pre surgery one.

Keywords: chronic, elbow, dislocation, reconstruction, collateral, stable

Introduction

The elbow joint is the second most common joint to dislocate after Shoulder joint in the adult population [1]. Chronic elbow dislocation is defined as a dislocation having chronicity of more than 2 weeks without undergoing reduction at any point of time in between [2]. Posterior or posterolateral dislocations comprised a major chunk of total elbow dislocations of 80 to 90% [3]. 50 to 60 % of these were purely dislocations without any accompanying fracture. Early closed reduction of simple elbow dislocation has good prognosis and produce acceptable results [4-5].

It is uncommon to have chronically dislocated elbow cases as they present soon after having the trauma causing it. Majority of chronic unreduced elbow dislocations have been reported where traditional quacks, bone setters have been consulted or cultural nonmedical solutions were sought instead of visiting to a hospital. This adds to the damage to the skin and soft tissues which has already been affected by the primary cause making treatment even tougher. Chronicity of dislocation causes development of extensive intra-articular fibrotic tissue accompanied with contracture of the ligaments, joint capsule along with surrounding muscles (especially triceps). Ulnar nerve may also be involved due to direct injury caused to it by dislocation or its entrapment in the developing fibrosis inside and outside the dislocated elbow joint. Associated fractures may also be present which are to be identified by keen observation of radiographs or performing advanced radiological investigations. The role of triceps lengthening or primary collateral ligament reconstruction remains a topic [2].

Usually, treatment typically involves open reduction with various methods of stabilization. The patients in this case series were operated with open reduction using collateral approach without formal reconstruction of any ligament yet giving a painless and stable elbow range of motion. The results were evaluated with the Mayo elbow performance score.

Chronic unreduced elbow dislocation presents with following features

1. Gross deformity
2. Pain ranges from minimal to significant depending on the duration since dislocation.
3. Variable motion ranging from 0 to 40 degrees in one third of patients, more than 40 degrees of arc of motion in one third while remaining patients having complete ankylosis of the dislocated joint.

Anatomy

The elbow has both static and dynamic stabilizers that maintain the stability of the elbow joint throughout the arc of motion. The Primary static stabilizers of elbow instability are bone articulations with the surrounding ligaments as follows:

1. The Humeroulnar articulation.
2. The lateral collateral ligament (LCL).
3. The medial collateral ligament (MCL)

The secondary constraints become important when the primary static constraints to elbow instability are damaged. These are as follows:

1. The radial head.
2. The common flexor and extensor origins.
3. The elbow joint capsule

The dynamic stabilizers comprise of the muscles that produce compressive forces across the elbow joint to maintain joint stability (especially the triceps, brachialis and anconeus). An elbow is stable if its three primary constraints are intact. The radial head becomes a critical stabilizer when the coronoid is fractured.

A chronically unstable or dislocated elbow often results when injury to the coronoid, radial head, or collateral ligaments was either not appreciated or inappropriately treated at first setting.

Methods and Materials

All the cases in this series presented to the hospital after a minimum span of 2 weeks after dislocating their elbow and failing to relocate it anytime in between. The patient presented with restriction of movements predominantly painless and visible deformity at the affected elbow joint. The pre operative active as well as active assisted range of motion in sagittal plane (flexion and extension) was duly noted using Goniometer comparing with the normal elbow joint. The outcome of patients was measured using Mayo elbow performance score (MEPS).

Approach

A collateral approach to elbow was taken. Through lateral incision an interval over the lateral supracondylar ridge, proximally between the Brachialis, brachioradialis and extensor origin anteriorly with triceps brachii posteriorly, curving posteriorly to the radial head distally was developed (Figure 1). Anterior flap of muscles and the posterior flap of complete thickness of triceps and scar tissue was elevated off the bone. Posterolateral dissection upto the complete exposure of radial head was done while preserving the articular cartilage of humerus and radial head.

Through medial incision, an interval was created between Flexor-pronator group of muscles anteriorly and triceps brachii posteriorly, followed by complete thickness elevation of flaps (Figure 2). Ulnar nerve was mobilised anteriorly, starting proximally from medial intermuscular septum to distally upto its branch supplying to Flexor carpi ulnaris (FCU) muscle. Through posteromedial dissection, all the scar tissue was dissected to expose the articular surface of olecranon.

Through medial window, the distal humerus was delivered out and a complete check of articular surface was done. Heterotrophic ossification was removed, if any present. The articular surface of radial head as well as olecranon was examined and was cleared of any scar tissue. The distal humerus was reduced and articular congruity was checked medially as well as laterally.

A tunnel was drilled into the lateral and medial epicondyle using 2.7 mm drill bit and a full thickness single layer closure was done anchoring the soft tissue to the bone on both the sides. No formal reconstruction or augmentation of ligaments was done.

Post operative rehabilitation Protocol.

1. Immobilization of the operated elbow was done in a Above elbow plaster slab in 90 degrees of flexion for initial 3 days after surgery for managing pain.
2. From 3rd day post op, Flexion above 90 degrees was started.
3. Extension started from post op day 14.
4. Tab. Indomethacin started prophylactically for Heterotrophic ossification for 1 month.

Case 1

A 22 years old male, right hand dominant, gardener by profession sustained Left sided elbow dislocation after falling from bike in a road traffic accident. A single attempt of closed reduction was given but failed. Patient presented to our hospital 5 months after sustaining the fall with the only chief complaint of restriction of joint movement leading to inability to do routine activities, not associated with pain at the time of presentation. Patient was operated with the above explained approach and rehabilitation protocol was followed strictly.

Patient had pre op range of motion of 15 to 45 degrees with near normal supination pronation arc of motion, achieved a good post op 5 weeks flexion extension range of motion of 45 to 120 degrees with near normal supination pronation arc of motion with improved stability. The pre-operative mayo elbow performance score was 65 which increased to 75 post 5 weeks of surgery.

Case 2

A 11 years old female child, right hand dominant, presented to hospital in November 2019 with right sided posterolateral elbow dislocation, 3 months after sustaining fall over her right elbow. The chief complaint of patient being painless restriction of movement at right elbow joint at the time of presentation causing hinderance in performing her routine activities. Patient was operated by the above explained approach and followed the rehabilitation protocol.

Patient had a pre operative range of 30 to 50 degrees with supination pronation arc of degrees which achieved a good, stable and painless range of motion of 30 degrees to 120 degrees of flexion without any reconstruction or augmentation of any ligament with improvement in supination pronation arc of motion weeks post op. The pre

operative mayo score (MEPS) was 45, which improved considerably to 90 after 2 years of follow up.

Case 3

A 38 years old male, right hand dominant, delivery boy by profession presented to hospital in June 2020 after sustaining fall over his left elbow 4 weeks earlier. The chief complaint of the patient was restriction of joint movement with associated with pain. Patient was operated by the above explained approach and followed the rehabilitation protocol. Patient had a pre operative range of 30 to 60 degrees of flexion and near normal supination and pronation which improved to a good, stable and painless, normal range of 0 to 130 degrees at weeks post op with near normal supination pronation arc of motion. The pre operative MEPS improved from mere 30 to post operative MEPS of 100 after 18 months post-surgery.

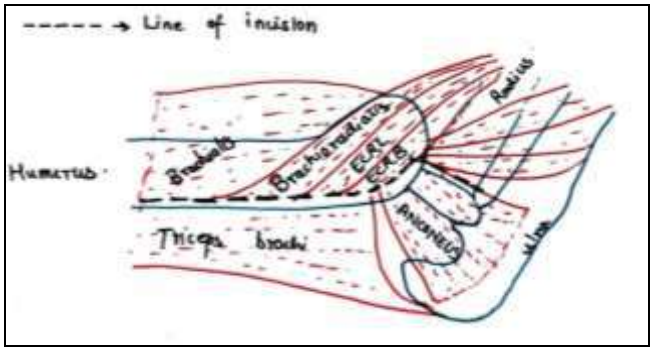

Fig 1: Lateral incision

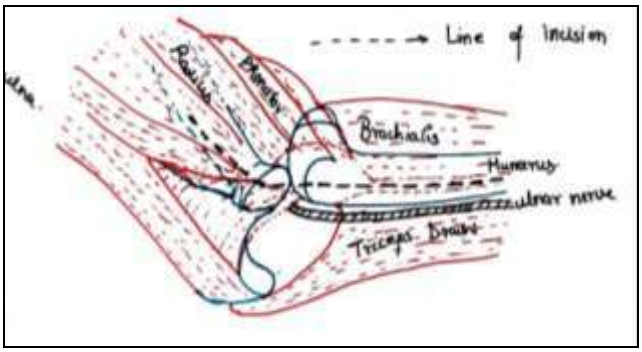

Fig 2: Medial incision.

Discussion

All the patients showed increase in flexion extension range of motion with preserved supination pronation to near normal, and provided a painless and mobile, stable elbow.

This technique of treating chronic cases of elbow dislocation is very effective and has shown a considerable increase in the post-surgery Mayo elbow performance score (MEPS) as compared to pre surgery score. Additional merits of this technique are:

- No formal reconstruction of ligaments is required.
- Surgery is less time consuming.
- It is cost effective.
- Provides better view of articular surfaces thus ensuring better clearance of any scar tissue and congruent reduction.
- Any heterotrophic ossification if present, can be cleared easily.
- Preserves extensor mechanism of elbow (Triceps muscle.)

While chronic elbow dislocations are rare in the developed world, they are still problem in developing countries due to ignorance, missing of dislocation and inefficient medical setup. A chronically dislocated elbow joint poses variety of challenges typically contracture of triceps muscle and collateral ligaments with fibrosis of the joint capsule possible ulnar nerve entrapment, and fibrosis of the articular surface and olecranon fossa. These soft tissue abnormalities must be addressed. Restoring functional elbow range of motion by obtaining concentric reduction of the joint surfaces along with preserving of elbow stability is the main goal of surgical intervention. Surgeons have become aggressive in treating the chronic elbow dislocation operatively. When considering surgical intervention for chronic elbow dislocations, patient age and injury chronicity were earlier the controversial factors. There are several older studies that report poor outcomes in patients with an elbow dislocation for greater than three months, and suggest treating these patients either non-operatively or surgically with elbow arthroplasty [6]. In addition to the current study, more recent studies have demonstrated good functional outcomes in patients with elbow dislocation greater than three months duration.

In a study by Duane Anderson *et al.* [7] in 2017 in chronic elbow dislocation cases, mean preoperative flexion/extension arc was 8 degrees (range, 0-30 degrees). Mean flexion/extension arc of motion at final follow-up was 101 degrees (range, 50-140 degrees, standard deviation of 26 degrees). Mean postoperative extension was 31 degrees (range, 0-75 degrees) and mean postoperative flexion was 132 degrees (range, 95-150). The mean postoperative MEPS was 93 with range of 70-100 degrees and the mean SOD score was 9 with range of 6-10 degrees. 31 of 32 patients (97%) had good or excellent outcome as measured by MEPS. Without any reconstruction of ligament, all the patients had stable and painless elbow.

Mahaisavariya *et al.* [8] reported mixed results in two patients with an elbow dislocation for 60 weeks where the patients' final range of motion was 30° and 100°.

Naidoo [9] reported functional elbow range of motion of greater than or equal to 100° in 9 of 23 patients (39%) who underwent open reduction greater than 3 months (range, 4 months to 4.5 years) after initial injury. Previous reports suggest that open reduction for chronic elbow dislocation in adults is associated with poor results and that should be kept reserved for paediatric population. Based on this case series, open reduction can be kept as option of treatment for patients irrespective of their age or the length of dislocation.

A total of 5 of 23 cases in Naidoo's [9] series had developed heterotopic ossification requiring excision. The collateral ligaments are the most common sites of heterotrophic ossification after dislocation but rarely restrict the elbow movement. Heterotopic ossification is also seen to occur in the anterior capsule of brachialis which can be responsible in severe restriction of flexion-extension arc of motion. Although after dislocation, three fourth of cases show some degree of ossification, only 5% Heterotopic ossification show limitation of motion. Naidoo found the articular surfaces were found to be reasonably well preserved and covered with a membrane often, which on histologic examination proved to be granulation tissue. This membrane of granulation tissue should be carefully excised while protecting any underlying viable cartilage.

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