



Modified medial approach for chronic elbow dislocation: a novel surgical approach with good functional outcome

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ABSTRACT

Background : Chronic elbow dislocation is defined as untreated elbow dislocation for longer than 2 weeks. Goal of treatment is stable reduction of elbow joint and facilitation of early elbow motion for optimal end result. Known operative methods is the Kocher posterolateral approach. which can accumulate hematoma, and longer time needed to identify Ulnar nerve. Therefore, we would like to introduce the new modified medial elbow joint incision approach.

Methodology: This study utilized a cross-sectional review of patients with surgical treatment of simple chronic elbow dislocation. Questionnaires were taken using Oxford Elbow Score, Mayo Elbow Performance Index, and Disability of Arm, Shoulder, and Hand Questionnaire to assess current elbow status

Result : Utilizing Oxford elbow score, the analytic group score value ranged from 21-46, while control group's score value were 37-42 (P-value <0.0001). Mayo Elbow Performance Index score, from the analytic group, scored ranges from 45 - 82. the control group, a mean value of 85 were scored (P-value <0.0001), the DASH score revealed total mean value of 8.3 in the analytic group, compared to score 6 in the control group (P-value = 0.0468). The range of motion is increased in total flexion and extension from both groups (P-value <0.0001)

Conclusion: Modified medial elbow approach provides faster method of identifying ulnar nerve, requires less skin flap for closure and less space for blood accumulation. Modified medial elbow approach provides good functional outcome with no complications related to ulnar nerve reported in this study.

Keywords: Chronic elbow dislocation, Kocher posterolateral approach, Medial elbow joint approach, Stable reduction of elbow joint, Ulnar nerve

INTRODUCTION

Chronic elbow dislocation is the second major joint dislocation most often found in adults ^(1, 2) with an incidence rate of up to 5.2 cases / 100.000 population annually ^(3, 4). It is a frequent problem seen in developing countries with delayed presentation and complications inflicted by traditional bonesetter intervention. ⁽⁵⁾

Elbow dislocation can be classified into 4 major groups, which are simple dislocation, complex fracture-dislocation, chronic posterolateral rotator instability, and chronic dislocation ^(2, 6-11). Chronic elbow dislocation can be identified as chronic cases for longer than 2 weeks. The majority of cases (up to 80%) are found in the posterolateral configuration. ^(8-10, 12-15)

Treatment comprises stable reduction of elbow joint and facilitation of early elbow joint movement to achieve an optimal result. This can be achieved through operation ^(2, 5-10, 13, 16-19). The most common surgical approach for the elbow is the posterolateral Kocher approach ^(2, 5, 6, 9, 10, 13, 16-19). The disadvantages of the technique, however, are the wide skin flap on both the medial and lateral side, which have the potential for blood and serous accumulation ⁽¹⁹⁾, and the longer time needed to reach and identify the ulnar nerve.

This study is to introduce a new incisional method, which is the medial side elbow approach. This new technique gives easy access to visualizing the ulnar nerve and exposing the whole structure of the elbow joint, giving maximum result without too much manipulation to the surrounding structure.



MATERIALS AND METHODS:

This study utilized a cross-sectional review of patients who have undergone surgical treatment of chronic elbow dislocation, without any other accompanying fracture, performed at tertiary medical centers in Makassar between July 2016 and March 2019, with the author performed medial approach. During the study period, as many as 12 patients were treated for chronic elbow dislocation without associated fracture. A thorough physical examination was performed, and anteroposterior and lateral radiographs were obtained on all patients before and after surgery and during follow-ups.

PATIENTS AND METHODS

The patient selection was performed from July 2016 until December 2018, and 12 patients with chronic elbow dislocation were obtained, ranging from 3 months to 6 months. All patients presented with a disability of affected elbow flexion with varied pain.

Plain radiographs were performed on the day of their examination, and all revealed elbow joint dislocation. Questionnaires were taken on each patient using Oxford Elbow Score, Mayo Elbow Performance Index, and Disability of Arm, Shoulder, and Hand Questionnaire to assess current elbow status.

Preoperative protocols were followed, including blood tests and a preoperative visit from anesthesiologists. Of the 12 patients, 4 patients were operated using the widely known Kocher Posterolateral elbow approach as a control group, and 8 patients were operated using the medial side elbow approach.

The medial side elbow approach was performed by positioning the patient with the problematic arm in 90° abductions on a table, followed by procedural aseptic and antiseptic protocol to expose only the affected shoulder to hand. The incision was performed in the medial aspect, from the distal of humerus through the proximal humeroulnar aspect. The identification of the ulnar nerve was per-

formed straight away by blunt dissection of the retinaculum/band of Osborne. Tagging of the Ulnar nerve should be performed (figure 3), and dissection was carried until periosteum was reached. Division of periosteum was done sharply, and the release of ligaments and soft tissue attachment was done subperiosteally until the medial and lateral aspect of the distal humerus and proximal radioulnar were stripped clean (figure 4). The elbow joint was dislocated, and all fibrous tissues were removed from the coronoid fossa and olecranon fossa (figure 5). Subperiosteal stripping was then performed on the radial head and olecranon in the proximal radioulnar aspect (figure 6) until the area was clean of fibrous tissue. After all, the bony structure was cleaned, the distal humerus and proximal radioulnar were realigned, and the operation field was irrigated using distilled water. Drainage tubes were placed to evacuate blood collection out of joint. The joint was positioned in maximum flexion, and the pronation and band of Osborne were stitched with 2-0 absorbable braided polyethylene suture. The surgical site was closed with a 3-0 monofilament interrupted suture. Pronation and flexion were held using a posterior long arm splint. Antibiotics were given for 3 days, and Indomethacin was given for 14 days. Physiotherapy was started as soon as the fourth day postoperatively when the wound were first cleaned and consisted of active movement without pain as wide as the subject was able to. Passive flexion and extension were trained after 14 days, and the posterior splint was removed after three weeks post-operation. .

RESULTS

Follow up was done cross-sectionally on the 3rd-month post-operative and performed using a questionnaire sheet and range of motion examination. The questionnaire used included the Mayo Elbow Performance Score, Oxford Elbow Score, and Disabilities of the Arm, Shoulder, and Hand (DASH) Score. These were chosen to reduce the bias of a single questionnaire. Both pre and post-operative

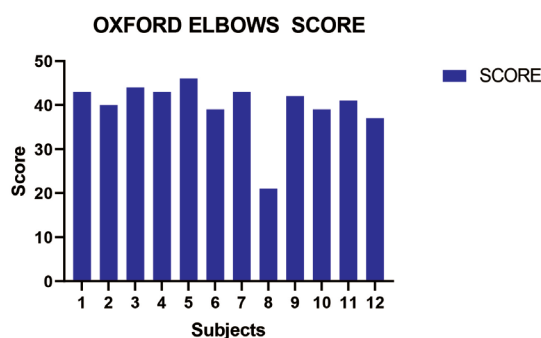


functional range of motion were also assessed and examined.

During the study, a total sample of 12 subjects was taken and divided into two groups: the control group using Kocher posterolateral approach and the analytic group using the medial side elbow approach.

Utilizing the Oxford elbow score, the result of the analytic group score value ranged from 21-46, while the Kocher posterolateral group's score value was 37-42. A P value of $P < 0.0001$ was obtained and was considered significant. The average score was 39.8, with a possible deviation of 7.9. Of the control group, 2 subjects scored above 40 and 2 subjects scored between 30-39. From the analytical group, out of 8 subjects, 6 subjects scored above 40, 1 subject scored 39, and 1 subject scored 21. The Oxford Elbow score indicated the possibility of elbow arthritis and its severity. A score between 0 – 19 indicated severe elbow arthritis, 20-29 indicated moderate elbow arthritis, 30-39 indicated mild elbow arthritis, and a score above 40 indicated satisfactory joint function.

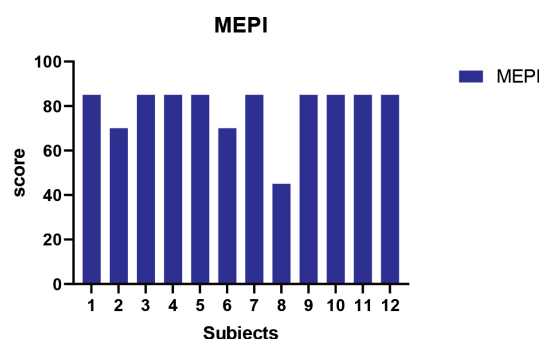
Graphic 1. Oxford Elbows Score



Utilizing the Mayo Elbow Performance Index score, out of the 8 subjects from the analytic group, 5 subjects scored 85, 2 subjects scored 70 and 1 subject scored 45. From the control group, a mean value of 85 was scored. A P value of < 0.0001 was recorded and considered significant, with a mean value of 76.63, and a standard deviation of 14.3.

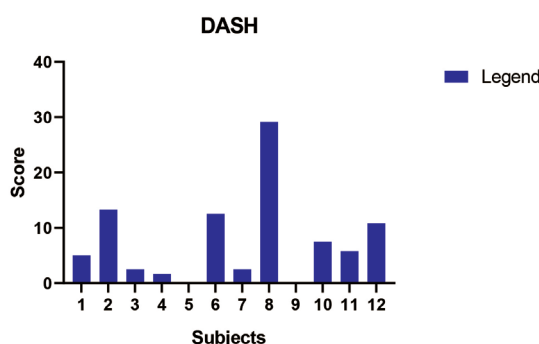
In general, a score below 60 is considered poor, between 60-74 is considered fair, 75-89 is good, and a score greater than 90 is considered excellent results.

Graphic 2. Mayo Elbow Performance Index

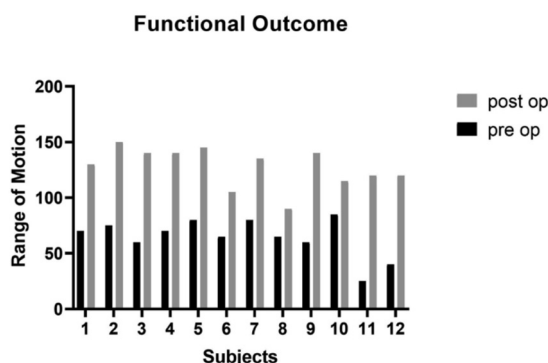


In the third questionnaire, the DASH score revealed a maximum score of 10.8 in the control group and a maximum score of 29.1 in the analytic group. The total mean value of 8.3 and a standard deviation of 9.7 in the analytic group, compared to score 6 and a standard deviation of 4.5 in the control group. A P-value of 0.0468 was obtained and considered significant, with 0 indicating no disabilities and 100 maximum disabilities.

Graphic 3. DASH Score



In this study, we measured the range of motion of each elbow undergoing open reduction, and we measured an increase in total flexion and extension both from the analytic group and control group. A P value of $P < 0.0001$ proven to be significant with mean differences of 62.92° increase in range of motion and a standard deviation of 21.8° . In comparison to the analytic group and control group, a higher proportion of flexion arch was gained in the analytic group. Nevertheless, all subjects except one gained a functional elbow range of motion.

Graphic 4. Preoperative and post-operative range of motion

DISCUSSION

Elbow joint is a trochoginglymoid joint, allowing flexion-extension as well as pronation-supination motion with 2 main articulating points, which are the glenohumeral and radiocapitellar joint. ^(2,3,20)

As a joint, the elbow is stabilized by static and dynamic structures. Static stabilizer relied on glenohumeral articulation, medial collateral ligament, lateral collateral ligament, head of the radius, origins of flexor and extensor muscles, and joint capsule. Dynamic stabilizer consisted of all the muscles passing over the elbow joint, providing a compression effect on the joint. Stability in the elbow joint is a combination of bone and ligament resistance with a carrying angle of 11-16°. ^(2,3,20,21)

The range of motion is divided into 2, the normal range of motion and the functional range of motion. In the elbow joint, the normal range of motion is 0-150° flexion, 85° supination, and 80° pronation, whereas the functional range of motion is 30-130° flexion and 50° pronation and supination. ⁽²⁰⁾

Elbow dislocation involved a posterior shift of proximal ulna and radius in relation to the humerus and the majority involved tear of the lateral ulnar collateral ligament, thus inducing a posterolateral rotatory instability, which in turn created a shift to external rotation and circumferential tear of an anatomical structure of capsule and ligaments from the lateral side to the medial side. The most common mechanism of action was a fall on an outstretched hand, resulting in valgus, supination, and axial force in the elbow joint. This, in turn, created

a chain of events from posterolateral instability to tear of the anterior and posterior capsule, leading to the pressure of coronoid under the trochlea. The destructive force traveled to the medial side and impairing the whole complex of medial collateral ligament. ^(2,3,5,6)

The main purpose of dislocation treatment is to provide a stable reduction and restore joint function as early as possible. This can be achieved via anatomical reduction of humerus, radius, and ulna articulation. In the acute case, a closed reduction technique may be proved beneficial and straightforward. In contrast, in chronic cases, an open procedure is favored due to alteration of surrounding soft tissues, namely triceps shortening, collateral ligament contracture, anterior and posterior capsule shrinkage, and wide intra articular fibrosis. Either Kocher posterolateral approach or medial and lateral dual incision approach are widely known technique, in combination with contracture release and fixation methods to maintain reduction. ^(2,3,5,6,9-19,22)

In open medial side approach to the elbow joint, the arm is positioned in 90° abduction over a table. Longitudinal incision on medial aspect of distal humerus to the proximal humero-ulnar joint is performed and identification of ulnar nerve is performed.

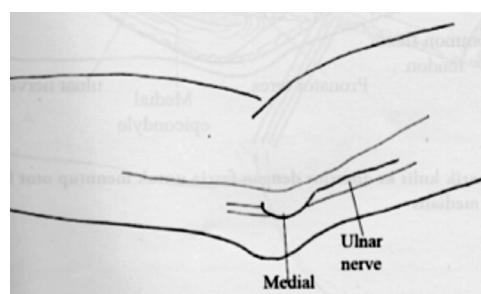
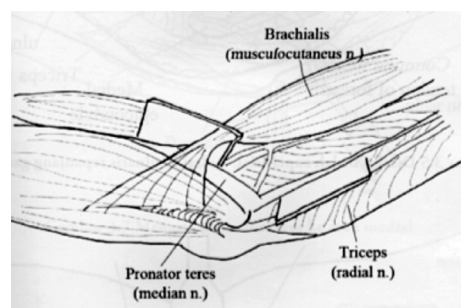
Figure 1. Anatomical landmark of surgical incision**Figure 2.** Internervous plane



Figure 3. Identification and tagging of ulnar nerve



After careful identification and tagging of the ulnar nerve, origins of flexor and pronator muscles and the anterior capsule of the joint is detached sub-periosteally using an electro-cauterization, into the lateral side.

Figure 4. Origins of flexor and pronator muscles and anterior capsule of the joint are detached sub-periosteally



Following the careful release of soft tissues, traction is performed in radiocapitellar and humeroulnar joint, thus exposing the whole distal aspect of the humerus. All fibrous tissues then thoroughly excised

Figure 5. Articular surface released from soft tissue

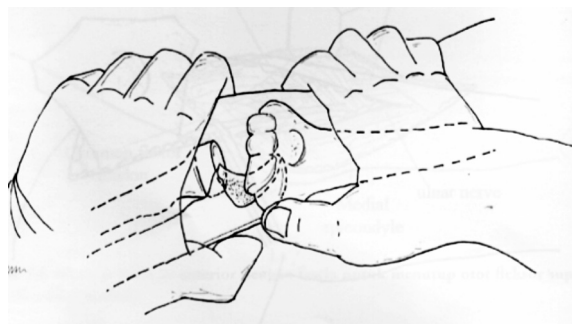




Figure 6. Visualization of radial head after being released from fibrotic tissue



Figure 7. Reduction of elbow joint



The radioulnar joint is released of soft tissues afterward. When all the joint surfaces were thoroughly cleaned, the humeroulnar joint is repositioned, and the radial head is carefully placed in front of the capitellum. After careful examination of the range of motion, the operating field is irrigated with normal saline, a drainage tube was inserted to reduce blood accumulation, the elbow joint is positioned in maximum flexion and pronation. The joint capsule and periosteum are approximated, the ulnar nerve is repositioned, and Osborne Fascia is closed with simple interrupted sutures. Elbow joint is maintained in position with a dorsally placed external support.

Figure 8. Elbow joint is maintained in maximum flexion and pronation position with dorsally placed external support



Post-operation rehabilitation and treatment were intended to preserve joint stability and function after open reduction. Antibiotics and analgesics were given according to condition and dosage. In our study, 1st generation cephalosporine and aminoglycoside were used. Indomethacin was given for 14 days to reduce the incidence of myositis ossificans, a complication that could reduce the range of motion. Passive mobilization can be initiated during wound treatment on day 4 post-operation, and it should be performed carefully as not to cause any pain, to reduce the likelihood of pain-induced myositis ossificans. Drain removal can be performed on the same day. After 14 days of operation, sutures could be removed, and wound care was no longer performed. Active and passive mobilization of the elbow joint can be performed as long as no pain is felt. After 21 days of operation, the slab can be removed, and the maximum active and passive movement of the elbow joint is encouraged despite the pain.



The full range of motion was expected to recover within two months post-operative.

During the study, 1 subject from the analytic group failed to follow the rehabilitation protocol and returned after some time with a poor outcome.

CONCLUSION

The modified medial elbow approach provides a faster method of identifying the ulnar nerve, a crucial structure to be identified in chronic elbow dislocation cases. It also requires less skin flap for closure hence less space for blood accumulation. The modified medial elbow approach also provides good functional outcome with no complications related to the ulnar nerve reported in this study.

Statement conflict of Interest

The authors declare that this article has no conflict of interest.

Ethical Committee Approval

This article has been approved by board of ethical foundation at Hasanuddin University Hospital Makassar Indonesia.

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