

Outcome and Evaluation of Olecranonplasty using Delayed Absorbable Suture Materials of Olecranon Fracture: A Novel Repair Method

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Abstract

Original Research Article

Background: Olecranon fractures are common injuries that require surgical intervention. This study evaluates the use of delayed absorbable suture materials in Olecranonplasty, a novel repair technique. To assess the outcomes and assessment of olecranon plasty, a new repair technique, for olecranon fracture stabilization with olecranon plasty. **Objective:** The study aims to assess the functional and radiographic outcomes of patients who underwent this novel repair method. **Methods:** This prospective cross-sectional study included 14 patients with a reduction of the olecranon that was Department of orthopaedic surgery, Adhunik Sadar Hospital, Natore, Rajshahi, Bangladesh, from January 2020 and July 2021 without joint ankylosis, myositis ossificans or nerve injury. The surgical management not only included open reduction of the elbow joint but also elongation of the triceps aponeurosis, collateral ligament repair along with stabilization of the elbow joint. The results were analyzed using the Mayo Elbow score and the range of motion at 3 months and results were compared with the function of the patient's elbows before surgery. **Results:** Among the 14 included patients, there were 9 men and 5 women. The mean age of the patients was 27.8±8.3 years. The average ROM increased from 37.0°±25.8° to 99.7°±23.3° of flexion in the postop follow-up. Whereas the extension lag changed from 15.5°±14.6° to 19.6°±18.3°. The mean Mayo score increased from 47 in the preop period to 87 in the postop period. **Conclusion:** The results of this study show that when functional outcomes after 3 months are compared to preoperative status, good results can be attained with relatively minimal risk. Based on these results we recommend that neglected elbow dislocation should be managed by surgical intervention even if the dislocations are old.

Keywords: Olecranon Fracture; Neglected elbow dislocation; Olecranon plasty.

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INTRODUCTION

These patients may appear with elbows that are almost fixed in a position that is insufficient for performing the tasks required in everyday life, such as flexion, extension, pronation, or supination [1]. An unreduced elbow poses a challenge to the orthopaedic surgeon especially in developing countries. This is because patients still go to the local bone setters for the management of dislocation with the risk of being managed by wrong manipulations and massages [2]. The bonesetters generally immobilize the elbow in extension which leads to contracture and shortening of the triceps muscles and the collateral ligaments.

This results in a non-functioning elbow that surgically is very demanding to treat and the functional outcome is usually not satisfactory. Many surgeons recommend open reduction for late-presenting cases

[3]. The postoperative functional outcome decreases with the increase in the time elapsed [4]. The surgical management incorporates open reduction of the elbow joint, elongation of the triceps aponeurosis, collateral ligament repair, and stability of the elbow joint. [5]. Our study aimed to study the outcome of surgical management of such neglected dislocation of elbows and to compare the outcome to the studies done before.

MATERIALS AND METHODS

Study Population

This prospective cross-sectional study was conducted between January 2020 and July 2021. Seventeen patients reported during the study period to the Department of orthopaedic surgery, Adhunik Sadar Hospital, Natore, Rajshahi which 3 were excluded from the study (1 heterotrophic calcification and 2 due to fracture dislocation and nerve palsy). All the patients had received treatment from local bone setters or

quacks in the form of massages, manipulations and splinting. The main cause of concern for the patient was elbow stiffness and the inability of the patient to perform the activities of daily living. In all the cases the three-point bony relation was disturbed between the olecranon, medial and lateral epicondyle. Cases with nerve involvement, fractures near the elbow and heterotrophic calcification were excluded from the study whereas all the remaining cases were included in the study. After informed consent radiography of the affected elbow was taken (Figure 1). The preoperative range of motion was evaluated along this is a clinical score based on pain, ROM, stability and basic functions with the score ranging from 10-100. The clinical grading of the result based on the score is >90 is excellent, 75-89 is good, 60-74 is fair and <60 is considered poor. After all the preoperative workup, the patients were operated under general anaesthesia.

Operative Procedure

During surgery, the patient was placed in a lateral decubitus posture. The affected arm with a tourniquet was supported by a pad with the forearm and hand hanging. A posterolateral approach was used over the elbow and extended midline proximally. After superficial dissection, the ulnar nerve was identified and

tagged. Triceps aponeurosis was raised from the olecranon by sharp dissection whereas; the fibres of the triceps muscle were split from about 7.5 cm proximal to the elbow along the midline (Figure 2). Sub-periosteal dissection of the distal humerus was done. With the distal humerus mobilized the joint was reduced after clearing the olecranon fossa under vision (Figure 3). Any callus or hypertrophic calcification if found was excised and removed. Due to extensive soft tissue clearance the elbow was found to be unstable.

The joint was reduced and a 2mm K-wire was passed from the olecranon to the distal humerus with the elbow at 90° (Figure 4). The periosteum and the triceps muscle were then sutured back to the posterior aspect of the humerus. The proximal part of the triceps aponeurosis was then closed with each other so that the flap was attached distally to elongate the triceps aponeurosis (Speeds Olecranon plasty) [6]. This was followed by direct collateral repair. Anterior transposition of the ulnar nerve was done to avoid any strain on the ulnar nerve. Closure was done and the patient was given an above-elbow POP slab. radiographies were read by author 1; all operations were done by authors 1 and 2 whereas the pre and postoperative analysis was done by author 3.



Figure 1: Preoperative radiography of an Olecranon Fracture



Figure 2: Intraoperative image of the triangular flap of triceps aponeurosis with the base attached to olecranon

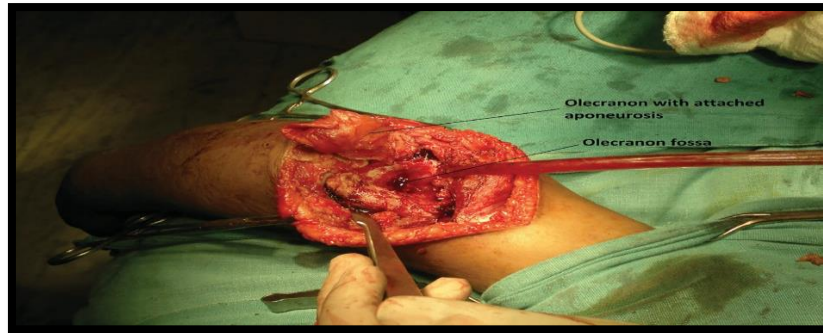


Figure 3: Intraoperative image of the triceps aponeurosis lifted and olecranon along with olecranon fossa exposed and cleared of the debris

Follow-up and Outcome Measures

On day 21 after surgery, the K-wires were removed and gradual movement with intermittent splint removal began. This was continued till 6 weeks postoperatively when night splinting was used allowing gentle mobilization without heavy weight lifting during the day. A strict and supervised exercise routine was followed for 2-3 months. The patients were evaluated using the Mayo Clinic Elbow Performance Index at the end of 3 months. A Radiographic was done to check

the condyle-radius and olecranon-humerus alignment immediately after an operation and at the time of removal of the K-wire. Range of motion (flexion, extension and range of motion were registered preoperatively and at follow-up. Posttraumatic arthritis and articular alignment were measured with the help of the Broberg and Morrey scale [7]. No radiological arthrosis=Grade 0, slight narrowing=Grade 1, moderate narrowing with minimal osteophytes=Grade 2 and severe degeneration=Grade 3.

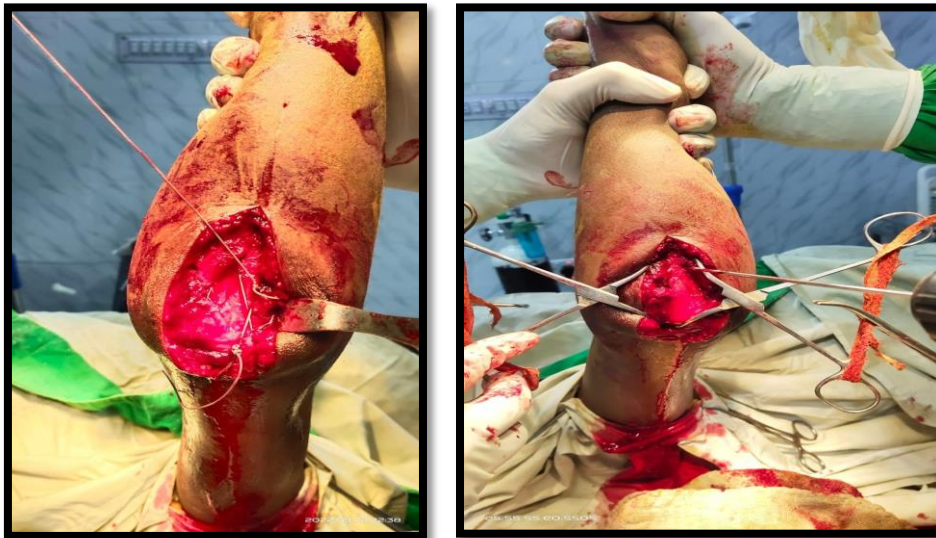


Figure 4: Intraoperative and Image intensifier images of olecranon plasty into the distal humerus after reducing the dislocation

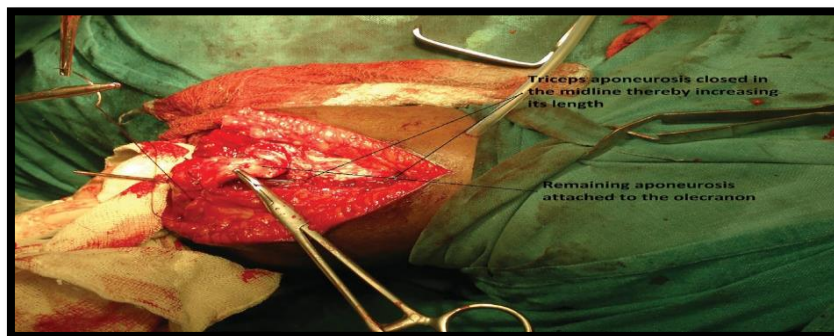


Figure 5: Intraoperative image of the triceps aponeurosis lengthening using Speed's Olecranon plasty

Statistical Analysis

All the statistical analysis was performed utilizing the statistical package for social sciences (SPSS ver. 20.0). The data are presented as mean±SD and proportions as appropriate. The parametric variables were compared using the independent t-test and the proportions were compared using the chi-square test. A two-sided p-value of less than 0.05 was considered statistically significant.

RESULTS

Among the 14 included patients, there were 9 (64.3%) men and 5 (35.7%) women. The mean age of the patients was 27.8±8.3 (ranging from 21 to 34) years. The right hand of all patients was the dominant hand and 33% of dislocations were seen in the dominant arm. The baseline characteristics of the patients are summarized in Table 1. The follow-up period was 3 months. In one (7.1%) patient in the immediate postoperative period subluxation of the reduced joint was seen. This was managed by a revision surgery with closed reduction and stabilization with 2 K-wires. Pin track infection was seen in 3 patients who were managed with antibiotics and regular dressings and they healed without any problem and the postoperative management did not vary (Table 2). None of the patients could flex their elbows more than 65°. The average ROM at the time of admission was found to be 37.0°±25.8° (10° to 65°) in flexion and 15.5°±14.6° (0° to 30°) in extension lag. The patient's preoperative

Mayo Clinic elbow performance assessment showed an index score of 47.3±10.3 (range of 35 to 53).

Postoperative

Making a significant contribution to a joint was observed in the immediate postoperative period of one patient who had undergone reduction and stabilization of the joint with a single K-wire. To provide extra stabilization another K-wire was passed through the distal humerus to the radial head and neck after the reduction of the radial head as this joint subluxation was attributed to the radio capitellar instability (Figure 6). Postoperative Mayo's score was an average score of 87 with a minimum of 65 and a maximum of 100 with 7 excellent results, 2 good results, 2 average results and 1 poor result. The poor result was seen in the case of grade 2 arthrosis. Average flexion was 99.7°±23.3° (75° to 120°) and the average extension deficit was 19.6°±18.3° (0° to 40°). There were no complaints or findings of any instability seen in the cases. There was no correlation between the age of dislocation and the improvement in the range of motion. The functional outcome data are presented in Figure- 7. The mean flexion and Mayo's score improved significantly ($p<0.05$), whereas the improvement of the mean extension deficit was not statistically significant. According to the Broberg and Morrey scale, radiographic glenohumeral and radiocapitellar alignment was achieved in all the cases. Eight cases had grade 0 arthrosis, five had grade 1 arthrosis and one had grade 2 arthroses.

Table 1: The baseline characteristics of 14 patients with neglected elbow dislocations were included in the current study

Variable	Value	%
Age	27.8±8.3	
Duration of Month	6.3±1.8	
Gender		
Men	9	64.3
Women	5	35.7
Job		
Household	5	35.7
Manual labourers	5	35.7
Student	4	28.6
Mechanism of Injury		
Road traffic accident	7	50.0
Household injuries	4	28.6
Fall	2	14.3
Assault	1	7.1
Type		
Posterolateral	10	71.4
Posteromedial	3	21.3
Pure Posterior	1	7.1

Table 2: Complications of open reduction and Olecranon plasty in 14 patients with Olecranon Fracture

Complication	No. of cases
Pin track infection	3 (21.4%)
Deep Infection	0 (0.0%)
Hardware Failure	0 (0.0%)
Myositis ossificans	0 (0.0%)
Nerve Injury	0 (0.0%)
Vascular Injury	0 (0.0%)
Post reduction subluxation	1 (7.2%)

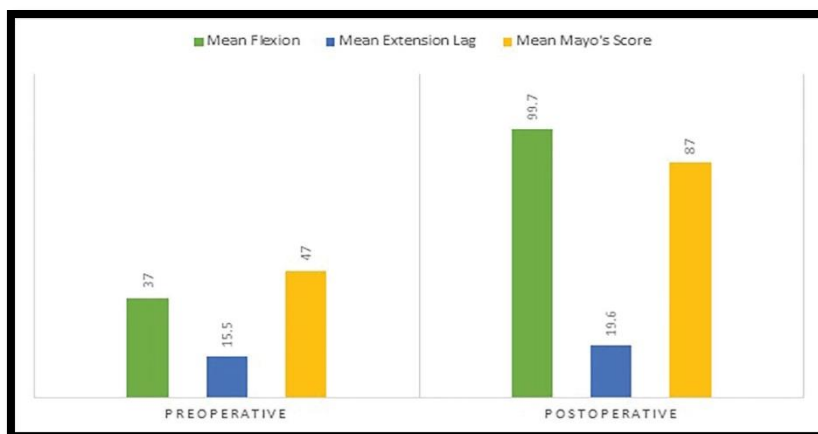


Figure 7: Preoperative and postoperative comparison of the various clinical outcome variables. The mean flexion and the Mayo’s score were statistically significant whereas the mean extension lag was statistically not significant. (p<0.05)



Figure 8: Post-operative Outcome

Table 3: Summary of results from present and earlier studies regarding the functional outcome of Olecranon plasty in neglected elbow dislocation

Authors	Brce, C <i>et al.</i> , [8]	Morrey, B <i>et al.</i> [9]	Speed J. <i>et al.</i> [6]	Allende, G., <i>et al.</i> [4]	Broberg, M. A. <i>et al.</i> [7]	Current study
Extension deficit	94.5 ⁰	13	40.4	55	40	19.6
Flexion	53 ⁰	115	116	112	122	99.7
Range of motion	41.5 ⁰	102	75.6	67	82	80.1

DISCUSSION

According to the Mayo score, the patients in this trial had a positive outcome, with improved mobility. The thought behind performing open reduction in all the cases was a fear of provoking a

fracture by manipulating a dislocation after 3 weeks. There are also soft tissue contractures associated with neglected dislocations which increase the forces on the joints leading to degeneration and pain [1]. There have been concerns about surgical intervention as it was

initially thought that the functional benefit was limited [10] but recent papers have shown good outcomes following open reduction and stabilization surgeries [6]. The outcome generally depends on the age of dislocation and the patient's ability to bear pain [3].

In this study, the mean duration of dislocation was 6.3 months and the age was 21.8 years the functional outcome was good which goes in favour of surgical management in the form of open reduction for all the patients irrespective of the age or the duration of the dislocation. There are different views concerning indications for surgery for elbow flexion as Martini *et al.*, [3] find 89-90 degrees functionally acceptable whereas other authors consider this as an indication for surgery [11].

In cases where the dislocation is less than 6 months old generally, there is very little difficulty in reducing the dislocation as the ligaments and tendon contracture is minimum [10]. However, in this study, we resorted to lengthening the aponeurosis in all the patients. If the dislocation is more than 6 months, then according to the literature [12] the dislocations are not to be managed surgically if the range of motion is up to 90°. However, in our study none of the patients had a range of motion up to 90° and hence, had problems in performing activities of daily living and hence, all the patients were managed surgically. The posterior approach was used as it is easier and also provides a good exposure to do the Olecranon plasty with the ulnar nerve transposition. The joint can also be reduced under the vision and also can be checked for any irregularities. Also, with a combined approach, there are 2 scar marks whereas in this there is only 1 scar mark.

In case of shortening of the triceps aponeurosis, there are procedures described for the lengthening of the aponeurosis. Among these, the Olecranon plasty described by Speed [6] was used in this study. The Olecranon plasty may lead to more pain in the postoperative period along with an extension lag and a decrease in the power of the elbow [10]. But still, it is a very easy procedure and provides the adequate length of the triceps aponeurosis along with good exposure required for the good reduction of the elbow joint. If the elbow dislocation is less than 6 months, then it can generally be reduced with the help of traction. However, in this study, the authors found elbow reduction and stabilization after Olecranon plasty to be much easier rather than otherwise. Although, one predicting factor for plasty is the preoperative flexion range. Elbows stuck in extension have more shortening of the triceps aponeurosis compared to elbows immobilized in flexion. Greatly retracted or long-standing dislocations require repair of the collateral ligaments. This can be done by many methods including Arafiles [13], direct repair, intra-osseous sutures or bone tunnel sutures. These procedures give the advantage of extra stability which can cause a

decrease in the immobilization time of the elbow. In this study, the collaterals were repaired either directly or by intraosseous suture as no augmentation was thought to be required. K-wires and the above elbow slab were used to immobilize the elbow to provide soft tissue healing. Prolonged immobilization was avoided to prevent further ankylosis of the joint as it was seen that with an increase in the duration of immobilization, there was an increase in the extension deficit along with a decrease in the functional range of the joint. A comparison table has been given comparing the outcome of the study with the outcome of other studies (Table 3). It shows that the results of this study were comparable to other studies found in the literature.

This study is significant as has been able to study the outcome and efficacy of a single surgical technique in a rare and harassing condition in a sizeable sample size. However, there were a few limitations in the study. The dislocations were not studied with a CT scan that could have ruled out or disclosed minor coronoid fracture fragments or other articular injuries. The study has a small follow-up period and hence, joint arthrosis cannot be ruled out (mainly due to the patients being lost to follow-up after 3 months). The sample size is low and hence, further studies are required if any sort of guidelines are to be made.

CONCLUSION

All cases of untreated dislocation can be treated surgically by open reduction and stabilization. This gives good functional results when compared to the preoperative status at pretty low risk. Hence, it should be preferred over non-operative treatment.

Conflicts of Interest: None declared.

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