Assessment Of Results Of Open Arthrolysis In Post Traumatic Stiff Elbows

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Citation

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Abstract

Background: Surgical management of posttraumatic elbow stiffness has been reported with poor outcome following treatment. Elbow arthrolysis done in any age group and even very old cases yield good results. The goal of our study was to assess the outcome in improvement of the range of motion of the elbow after surgical release by a tailor-made approach to yield good result.Materials and Methods: A retrospective and prospective study was conducted between oct 2006 to oct 2008 at department of orthopaedic surgery, G.S.V.M. medical college Kanpur. This study includes 25 cases of elbow stiffness due to various types of injuries. All the cases were treated with elbow arthrolysis if there was no progress after adequate supervised conservative management except in unreduced dislocations. All the cases were followed up for a minimum period of 2 years. Overall outcome was rated with the functional scoring system by Mayo Clinic Performance Index and Krishnamoorthy et. al (1976).Results: Nineteen(76%) out of 25 patients had excellent results with a mean preoperative range of motion of 38.4°,and postoperative range of motion of 106.80° with net gain in range of motion of 68.40° (' t ' test value is 9.33, P < 0.01). One (4%) of the patient had elbow instability. In cases where release was performed from three months to six months had mean gain of 76.92°. Cases in which release was performed after six months had gain of 63.57°. The mean pre-operative Mayo Clinic Performance Index score was 66°±9.35° and mean post-operative score was 95.4°±13.38° with average gain of 29.4°. (t test value 9.005, p<.001). According to Krishnamoorthy et al functional scoring system (1976), 19 patients (76%) achieve good result and 5 cases (20%) had fair result and 1 case (4%) had poor result.Conclusions: In cases of posttraumatic elbow stiffness after a failed initial conservative treatment, early arthrolysis with sequential surgical soft tissue release yields good result than delayed surgery.

INTRODUCTION

Posttraumatic elbow stiffness is common following various elbow injuries due to late presentation and inadequate initial treatment. This results in a spectrum of cases from simple elbow stiffness with normal radiological findings to complex fracture dislocations and heterotopic ossification as viewed in X-ray. In modern era various techniques & surgeries were devised to benefit the patient of elbow stiffness. The method adopted in this study was joint debridement and arthrolysis. The goal of our study was to assess the outcome in improvement of the range of motion of the elbow after surgical release.

MATERIAL AND METHODS

A retrospective and prospective study was conducted between 2006 and 2008 on surgical release of posttraumatic stiff elbows. Twenty-five cases of stiff elbow were analyzed. All patients having elbow stiffness due to various types of injuries like road traffic accidents, domestic fall and native treatment in the form of massage and bone setting done by quacks were included in this study. After an initial active physiotherapy for three months of trauma if the patient felt gross functional disturbance because of stiffness (arc of movement was less than 100°), surgery was offered.

The study excluded Post traumatic stiffness of elbow associated with chronic debilitating illness example tuberculosis, syphilis, Diabetes mellitus, Rheumatoid arthritis, SLE and all acute painful condition of elbow or if there was any evidence of active myositis.

This study was approved by the institution review board. All enrolled patients consented to participate in the study after explanation of risks and benefits.

The final assessment of the range of motion of both flexion/extension and supination / pronation of individuals prior to and after undergoing surgical release was done at a

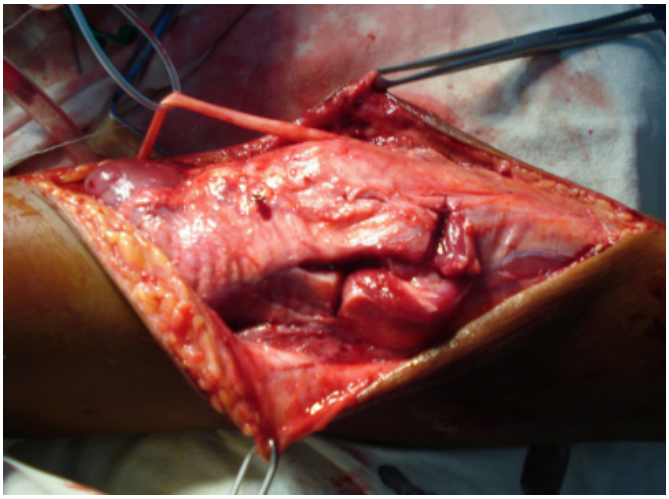
minimum period of two months after the surgery. Surgery was offered at the earliest when there was altered anatomy of the elbow, which needed to be addressed, like in maluniting fracture, non-union, dislocation and presence of heterotopic ossification without any predisposing systemic illness. A small group of patients with soft tissue injury alone were offered surgery because of no improvement with adequate physiotherapy and with severe stiffness having only a jog of movement. Such recalcitrant stiff elbows were operated. However if patient showed steady improvement in range of motion with time, on conservative measures they were excluded from study. The minimum follow-up is two years and a maximum of eleven years, with a mean of 54 months. The cases were treated either by oil massage or plaster of Paris cast or no treatment prior to presentation.. All patients were preoperatively evaluated by X-ray elbow (AP, lateral, medial oblique and lateral oblique views) and if required CT scan in few cases. All patients underwent surgical release after a thorough clinical evaluation and the appropriate procedure was decided upon. Heterotopic ossification was diagnosed based on clinical assessment by local warmth, tenderness and abnormal bony mass on palpation and on radiological assessment by islands of fluffy bone within soft tissue which later ossifies into a bone mass with spurs. The three different procedures that were used in our study were soft tissue release, removal of bony blocks and/or excision of heterotopic ossification along with clearance of the fossae around lower end of humerus.

OPERATIVE PROCEDURE

All the patients who underwent surgical release at the elbow were exposed to regional anaesthesia. The procedure that was chosen for each case was based upon the preoperative evaluation of the pre-existing pathology and its complications like extensive contracture, site of heterotopic ossification, type of fracture and unreduced humeroulnar dislocation. Patient was kept prone on the operating table with arm supported for per-operative handling and tourniquet was applied.

Here, elbow joint was approached by a posterior longitudinal incision with lazy ‘S’ at the elbow so that it does not cross the elbow at the tip of the olecranon. Subcutaneous dissection was started medially. The ulnar nerve was identified, dissected free and held with the rubber catheter. The lateral epicondyle and supracondylar ridge were then exposed and a deeper incision made to separate the triceps from the brachioradialis and forearm extensors. For the posterior exposure, the triceps was stripped subperiosteafly from the lower part of humerus. The anterior aspect of the elbow was exposed by the subperiosteal dissection of the attachments of brachioradilais and extensor carpi radialis longus from the humerus. Brachialis was also elevated subperiosteally. The radial collateral ligament was identified and divided by a ‘Z’ incision to allow for later repair[4] [figure-1]

Figure 1



The anterior capsule was identified and released from humerus under direct vision. The elbow could then be opened in a varus direction and after further stripping of the anterior capsule from the distal humerus and coronoid process. Then joint was dislocated medially. All the soft tissue that seemed to interfere with motion was released under direct vision. Bony obstacles found during the surgical exposure of the joint were excised. Any bone obstacles on the line of motion of the humero-ulnar hinge were also resected. Osteophytes were trimmed. Obliterated olecranon fossa was cleared by resecting the fibro-Osseo-cartilaginous tissue to accommodate the tip of the olecronon process and to improve the range of extension. Anteriorly, radial and coronoid fossa were cleared of fibrous or fibro-Osseo-cartilaginous tissue. Radial head excision was done if considered necessary. All the intra-articular adhesions were removed. Whenever ununited fracture existed, it was reconstructed to restore articular surface as much as possible. However, internal fixation was avoided unless essential.

After doing joint debridement, joint was relocated and elbow movements were checked. Once full or acceptable range was accomplished, lateral collateral ligament was resutured in its place and after suturing it, elbow movements were re-checked for any restriction due to suturing of the ligament.

The joint capsule was not sutured. Anterior transposition of ulnar nerve was done wherever its bed was left irregular.

On completion of debridement the tourniquet was released and haemostasis was secure meticulously. Subcutaneous tissue and skin was sutured. The triceps lengthening was not done in any case.

POSTOPERATIVE PROTOCOL

An above elbow slab was applied in 90° flexion and neutral rotation (midprone). Slab was removed on the second post operative day and active assisted exercises of elbow were started within limits of pain. At six hour interval active assisted exercises were done for 30 - 45 minutes. One movement cycle of flexion - extension was of about 45 seconds just to avoid rupture of adhesions. In between the exercises above elbow slab was applied to give rest to the elbow and keep postoperative period as pain free as possible. A catheter was inserted into the brachial plexus for analgesia during exercise sessions whenever feasible. A combination of lignocaine and bupivacaine was used for the same. The exercise done to prevent intra - articular adhesion formation. Exercises were done daily under supervision and were continued for three to four weeks. Patients were warned not to massage the elbow joint. Initially for five post-operative days, elbow was immobilized in 90 degree flexion. After that elbow was kept in the splints in extremes of flexion and extension alternatively. From one day prior to operation indomethacin 25 mg thrice daily was started$_3$. Stitches were removed on 14th day and patients were called upon the follow up at monthly interval. At each follow up patients were evaluated in terms of Pain, Stability and Range of movements i.e. flexion/ extension pronation / supination and radiologically presence of myositis ossificans and osteoporosis. All the measurements were recorded using a goniometer.

RESULTS

We included 18 males and 7 females in our study, with a mean age of 20.6 years (5-40 years).The most common mode of trauma was fall on outstretched hand(76%) followed by vehicular accident(20%).Right side(60%) is more commonly involved than left(40%). The mean time interval between injury and surgery was 17.26 months (3-120 months).majority of patients (88%) have no pain preoperatively. All 25 cases of elbow stiffness were posttraumatic, ranging from simple soft tissue injury (n = 4), fracture alone with or without heterotopic ossification (n = 17), fracture with dislocation (n = 1), dislocation alone with or without heterotopic ossification (n = 3).

In our study, majority of patients gained good range of motion following surgical release. After assessing the patients on the basis of improvements in range of motion a different type of measurement “Mayo Clinic Performance Score” was used, that scored the patients on the basis of pain, motion, stability and activities of daily living. Out of 25 patients 19 patients scored a perfect score of 100 on this test which indicated an excellent result. The mean preoperative Mayo Clinic Performance score was 66˚ and the mean postoperative Mayo Clinic Performance score was 95.4˚, with a mean improvement of 29.4 (‘t ' test value was 9.005,P < 0.01)[table-1].

Figure 2

Table 1: Post-Operative Mayo Clinic Performance Index

Score	Number of patients	Percentage
91-100	21	84
81-90	3	12
<80	1	4
Total	25	100

The mean preoperative range of motion was 38.4° (±24.73) and the mean postoperative range of motion at the time of last follow-up was 106.8° ° (±27.03), indicating a mean gain of 68.40° in the range of motion [table-2&3] (` t ` test value is 9.33, which is significant at 0.01 level, P < 0.01).

Figure 3

Table 2: Pre–Operative Arc Of Movement (Flexion / Extension)

Arc of Motion (degree)	Number of Patients	Percentage
0 – 10	5	20
11 – 20	2	8
21 – 30	7	28
31 – 40	3	12
41 - 80	8	32
Total	25	100

Figure 4

Table 3: Post – Operative Arc Of Motion (Flexion / Extension)

Arc of Motion (degree)	Number of cases	Percentage
$>90^0$	20	80
60^0-90^0	4	16
$<60^0$	1	4
Total	25	100

In patients who underwent arthrolysis from three to six months (n = 13) following the injury, the mean improvement in range of motion was 76.92° and patients who had surgery delayed for more than six months (n = 12) had a mean gain of 63.57° in the range of motions. Hence, the results of arthrolysis were better if it is performed earlier before much of damage occures[615].

In our study, most of patients (76%) achieve good result and 5 cases (20%) had fair result and 1 case (4%) had poor result according to Krishnomoorthy et.al.(1976)[table-4]

Figure 5

Table 4: Grading According To Krishnamoorthy Et Al

Grading	No. of patients	Percentage
Good	19	76
Fair	5	20
Poor	1	4
Total	25	100

Our study is a medium term result on elbow arthrolysis so we are unable to comment on the maintenance of range of motion with time though there is no fall in the score in patients who had been followed for five to eleven years.

In our study 21 cases (84%) cases had gained arc of motion >40° and 3 cases (12%) had gained arc of motion between 20-40°, only one patient (4%) had gained arc of motion 10°-20 degree. The mean gain in amplitude was 69.80°±28.67° (0°-110°).This was supported by a study of 13 patients by Weizenbluth (1989), in which > 40° increase in arc of motion was obtained by nine patients. 20-40° increase was obtained by 3 patients and there was no gain in two cases[16] [Table-5].

Figure 6

Table 5: Gain Of Amplitude

Gain of amplitude	No. of patients	Percentage
$\geq 40^0$	21	84
$20 - 40^0$	3	12
$10 - 20^0$	1	4
$\leq 10^0$	0	0
Total	25	100

In our study full range of painless, stable movement was restored in 4 patients (16%) out of 25 patients. The functional arc of 100° was gained by 18 patients (72%) and 5 patients (20%) had gained useful arc between 80°-90°.In one patient operation was considered a failure with improvement in the arc of motion only of 20° due to redislocation of elbow.

In our study pre- operatively full rotation movement was possible only in 7 patients (28%), restricted in 17 cases (68.00%) and absent in 1 case (4%). At follow up the full pronation supination was there in 23 cases (92%), restricted in 2 case (8%).Pre-operatively the mean supination was 57.80°±24.16°and mean pronation was 54.60°±22.68°. post-operatively the mean supination was 77.20°±14.00 °and mean pronation was 76.40°±14.39°. The mean gain in supination was 19.40° and mean gain in pronation was 21.80°.This was contrary to the study by Morrey (1990) who stated that there was no major change in rotation of forearm.

DISCUSSION

Most of the patients who reported with posttraumatic stiff elbow were due to inappropriate primary management like, tight bandaging, inadequate primary fixation, oil massaging and forceful manipulation of the elbow. Forceful manipulations through passive movements work against the natural healing process leading to heterotopic ossification. All the cases were treated with open arthrolysis if there was no progress after initial active physiotherapy except in unreduced dislocations.

In our study a wide age range of patients were seen. However the results of arthrolysis were not poor in any particular age [512]. This is easily seen in our study that both the youngest and oldest cases have achieved a functional range of motion of 100 degrees. Bhattacharya[1] suggested that the early response was poor in children and it improved with increasing age but he also stated that the final result was ultimately the same.

In our study full range of painless, stable movement was restored in 4 patients (16%) out of 25 patients. The functional arc of 100° was gained by 18 patients (72%) and 5 patients (20%) had gained useful arc between 80°-90°.In one patient operation was considered a failure with improvement in the arc of motion only of 20° due to redislocation of elbow. In the study of Bhattacharya$_{1}$ (1974), full range of painless, stable movement was restored in eight patients (14 percent) out of 56 patients. A useful arc of about 100°with a painless stable joint was gained in 39 patients (65%). In six patients (10%) there was a useful arc of about 80° with some pain on joint motion, or a full range with some instability. In three patients, the patients, the operation was considered a failure, with no improvement or a stiff joint.

In our study we have observed the significant gain in the rotational movements of forearm. The mean gain in supination was 19.40° and mean gain in pronation was 21.80°.This was contrary to the study by Morrey (1990)$_{9}$ who stated that there was no major change in rotation of forearm.

Our study also confirms that longer the elbow remains stiff, poorer the prognosis.

In our study the elbow joint was opened by a posterior approach, followed by subcutaneous dissection on the medial side. The ulnar nerve was dissected free and held with a rubber catheter. This provided the greatest gain in range of motion at the elbow without instability. By this approach it is possible to access all the important structures of the elbow without doing any olecranon osteotomy or triceps lengthening with reasonable post-operative stability. The continuity of triceps extensor apparatus helps in early start of range of motion active assisted exercises which helps in minimizing residual flexion deformity after release. Our study was supported by Kenya Tsuge (1972)$_{13}$ who opened elbow with an 'S' shaped postero- lateral incision starting 10 cm proximal to the lateral epicondyle, curving over the base of the olecranon and ends about 3 cm down the posterior border of the ulna. Urabaniak JR et al (1985)$_{14}$ opened the elbow by anterior bayonet skin incision, beginning proximally and laterally, curving across the elbow flexion crease and continuing distally to the medial aspect of the forearm. Bhattacharya (1974)$_{1}$, used combined medial and lateral approach. Extended lateral approach was used by Weizenbluth (1989)$_{167}$.

In our study radial collateral ligament / lateral soft tissue was divided by 'Z" incision to allow for later repair. Reconstruction of lateral collateral ligament was possible in 23 cases out of 25 cases, which improved the side to side stability and which were confirmed per-operatively by comparing stability before and after reconstruction of lateral collateral ligament.

In the immediate postoperative period patients were encouraged on active range of motion under supervision of physiotherapist. Slab was removed on the second post operative day and active assisted exercises of elbow were started within limits of pain.. The exercises were done to prevent intra - articular adhesion formation. Exercises were done daily under supervision and were continued for three to four weeks. Patients were warned not to massage the elbow joint. In our study the CPM was not used in any case. Salter R.B.$_{11}$ (1984) emphasized the role of CPM (Continuous passive motion). It seems to be painless, stimulated the healing and regeneration of articular cartilage, prevent joint stiffness and permit the normal healing of arthrotomy incision.

The limitation of our study is that it did not include infected elbow cases, and the results were not compared with the arthroscopic elbow arthrolysis. We have not compared any of our groups because of a small sample size and a lot of variables; we have only analyzed the results of individual groups and their end result.

In summary, elbow arthrolysis is a good procedure which gives a useful gain in range of motion. The aim of treatment should not be a full range of motion with resulting instability but rather a helpful functional range of motion of 100°, with reasonable degree of stability. This systematic approach and method seemed to work out well confirming the validity of our approach. Our study hence showed the benefit of joint debridement and arthrolysis in post-traumatic stiff elbow. It improves the functional arc of motion, facilitates early rehabilitation and minimizes flexion contracture and did not make the elbow unstable. We recommend this procedure in treatment of posttraumatic elbow stiffness as it restores normal elbow function.

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