ORIGINAL ARTICLE

Rationality of Open Method of Arthrolysis for Stiff Elbows - Long Term Functional Outcome

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ABSTRACT

Introduction: The stiffness of elbow joint severely interferes with functional ability of upper limb. Open arthrolysis, in young active patients were reported with inconsistent results may be due to its applications in injudiciously selected cases. The objective of this study was to analyse the pathological abnormalities of stiff elbows for their classification and appropriate planning of surgical management to get maximum benefit following the arthrolysis. **Methods:** 98 patients of ages varied from eight to 62 (mean 23.3) years with posttraumatic stiff elbows having non-functional arc less than 70o of flexion predominantly extra articular contracture with maintenance of radiological congruence of humeroulnar joint of five to 26 (mean 14.65) months duration were included . The ankylosed elbows based on their clinicoradiological assessment were divided into three groups and subjected to open arthrolysis. 84 patients were clinicoradiologically evaluated during 3.2 to 10.3 (mean 6.5) years follow up. **Results:** The patients of Group I & II having predominantly soft tissue contractures showed overall highly satisfactory and excellent results in majority. The patients of Group III having additional periarticular new bone formation with subchondral sclerosis obtained good results. The cause and duration of contractures did not seem to influence the outcome of arthrolysis. The judicious and sequential release of contracture structure is effective to regain satisfactory to elbow motion. **Conclusion:** Thus, judicious preoperative selection of stiff elbow is mandatory to obtain favorable functional outcome after arthrolysis.

Keywords: Outcome, Open Arthrolysis, Stiff Elbow, Soft tissue contracture

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INTRODUCTION

Stiffness or ankylosis of the elbow usually result from untreated, inadequately treated trauma or rheumatoid arthritis, old healed tuberculous or septic arthritis, post-burns ankylosis or some degenerative conditions. The loss of elbow motions, particularly flexion and extension, severely interferes with functional ability of the upper limb of an individual. The ankylosis of elbow may be due to extra-articular contractures of soft tissues (1) including collateral ligaments (2) or joint capsule or secondary to joint incongruity or arthritis. Here the scope of conservative management is limited and total joint replacement is not indicated in younger patients. Because of limitation of arthroscopic release in severe stiffness, the open arthrolysis was tried by several workers (3,4)) with or without hinged external fixator(5,6) Ilizarov ring fixator(7)and monolateral hinged elbow fixator (6,8). The reported results following open arthrolysis appear to be inconsistent and unpredictable. Therefore this study was done to find out critically the types of ankylosed joints which will respond satisfactorily to arthrolysis and the factors responsible for its satisfactory outcome.

MATERIALS AND METHODS

Ninety eight patients with stiff elbows having nonfunctional arc of motions were selected for studies during the period between June 1993 to July 2010. At the end of the study, 14 were lost to follow up. Among 84 patients, all had post traumatic ankylosis around elbow of which 54 following union after conservative treatment and 28 following internal fixation of fractures of distal humerus, after their union or mal union and two patients had post traumatic myositis ossificans around the elbow. Duration of ankylosis varied from five to 26 (mean 14.65) months. The ages of the patients is varied from eight to 62 (mean 23.3) years. There were 49 male and 35 females. Dominant side was affected in 60 and nondominant side in 24 patients.

The elbows with existing arc of motions less than 70º in nonfunctional arc with or without restriction

of forearm motions from mainly extra articular soft tissue contracture with maintenance of radiological congruency of humeroulnar joint who failed to recover motions after vigorous trial of all forms of conservative treatment for at least three to six months were included. On the other hand, (i) post traumatic stiffness less than three months old, (ii) Contracture of soft tissues with incongruous articular surfaces of humeroulnar and radiohumeral joints with partial obliteration of the joint space along with marginal osteophytes, (iii) New bone formation around elbow joint, (iv) Those who were on rehabilitation program for recovery of stiffness, (v) The bony ankylosed elbows were excluded. Preoperative parameters of stiff elbows are described in Table I. Pronation and Supination was found restricted in 74 patients.

The ankylosed elbows based on their clinico-radiological assessment were divided into three groups for their assessment of outcome after arthrolysis. 32 patients of group I had contractures of only soft tissues around the joint, where articular configuration and joint spaces were normal. 34 patients of group II had extra articular bony block along with contractures of soft tissues including anterior articular capsule where joints were congruous with normal articular space (Fig 1). 18 patients group III had congruous humeroulnar joints irrespective of incongruous radio-humeral joint. There are extra-articular new bone formation with marginal osteophytes and mild subchondral sclerosis with or without minimal narrowing of the joint space along with soft tissue contractures (Fig 2a).

Figure 1: Pre-operative radiograph of a 32 years old male presented with post traumatic stiff right elbow (Group II) of 30° to 80° ROM. Note extra-articular bony block with maintenance of articular congruity.

Surgical Technique

The patients were operated under brachial block anesthesia in supine position under tourniquet control. The patients having the pathology confined to either lateral or medial part of joint was operated primarily using either lateral or medial approach respectively. But in the majority the contracture was so marked that combined medial followed by lateral approach or reverse sequence was used.

Release through the medial approach: Through longitudinal 10 cm. posteromedial incision, ulnar nerve is mobilized along with the proximal attachment of flexor carpi ulnaris muscle. Medial collateral ligament which often found tight and contracted required section from humeral attachment. The humero-ulnar joint cavity is exposed by antero medial and posteromedial capsulotomy. Then intraarticular fibrous adhesions, marginal osteophytes or any new bones over anterior and medial margins of the olecranon or trochlear and, coronoid process are removed. The fibrous tissues or adhesions obscuring the olecranon and coronoid fossae are removed.

Release of contracture through lateral approach is done through kaplan's interval through fibres of extensor digitorum communis first, then through supinator muscle to expose the radio- humeral joint. The triceps is separated posteriorly from humerus. Anterolateral and

Table I: Comparison of pre and post operative elbow motion parameters (in degrees) in different groups of patients

Elbow motions parameters	Stages of evaluation with p values	Group I (Mean SD/SE value)	Group II (Mean SD/ SE value)	Group III (Mean SD/ SE value)	Mean
FFD /Max. Extension possible	Pre-operative	57.3/7.4/1.3	47.5/8/1.37	57.5/9/2.25	58.1
FFD= Fixed Flexion deformity	Post-operative	27.8/7/1.25	27.35/6/1.03	37.5/6/1.42	33.8
	P-value (Calculated) < 0.05	24.98	29.1	12.77	
Max. Flexion	Pre-operative	92.65/6/1.07	72/7/1.28	83/7/1.65	78.53
	Post-operative	120/5/0.89	113.67/5/0.86	108/6.21/1.4	
	P-value (Calculated)	18.63 (<0.05)	5.64 (<0.05)	4.63 (<0.05)	
Arc of elbow motions	Pre-operative	44.53/5/0.88	26.61/6/1.02	24.72/4/0.94	26
	Post-operative	87.96/7/1.23	82.2/7/1.16	66.11/8/1.8	68.84
	P-value (Calculated) < 0.05	31.3	39.81	52.16	

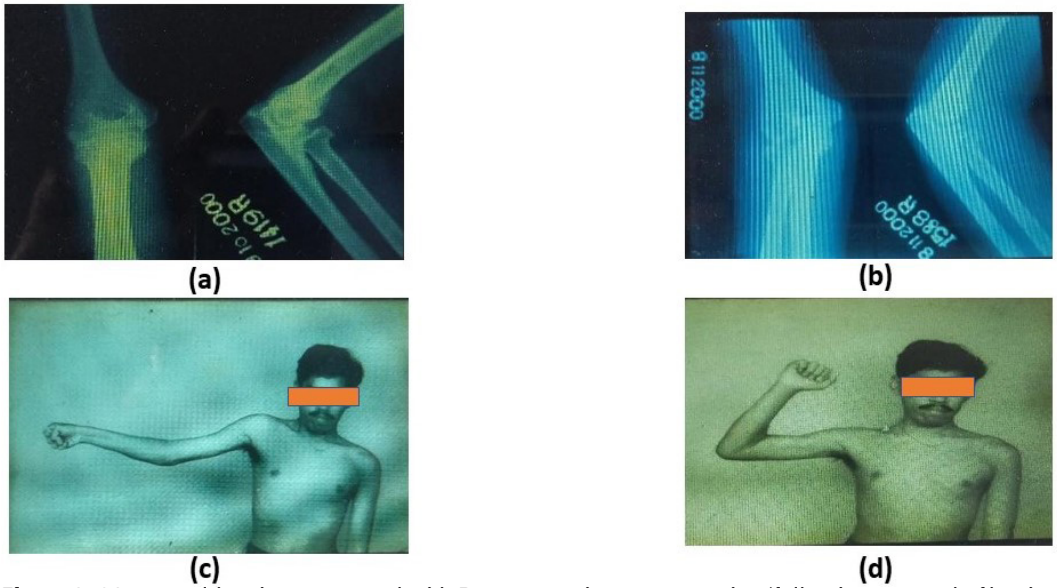

Figure 2: 29 years old patient presented with Post traumatic, post-operative (following removal of k-wires and stainless steel wire, used for tension band wiring after union of olecranon fractre) showing posterior extra-articular new bone formation with marginal ostephytes, minimal incongruity of joint spance and articular marginal sclerosis (a). Five years of follow up of same patients radiograph showing clearance of osteophyte without evidence of degeneration (b). Clinical photograph of same patient of fiver years followup (c & d) showing maintenance of 20° to 120° ROM of elbow with good result

posterolateral capsulotomy exposes radiocapitellar joint and humeroulnar joint. Once joint is exposed, the articular surfaces and fossaes are freed of fibrous adhesions. Tip of olecranon if found projected is trimmed. The radial head if found deformed or malunited causing any block by bony bump in front of the capitellum is excised.

All metal implants previously used for internal fixation of fractures if any, are removed primarily. No triceps, biceps or brachialis lengthening was required in our series. The articular cartilages were carefully examined for any adhesions which are cleared by dry gauges. Varying amount of minimal patchy to segmental erosion of articular cartilage was observed as the group advances from Group II to III.

Peroperatively when recovery of elbow motions appeared to be satisfactory on table, the wound is closed in layers after haemostasis and placement of suction drains. The lateral wound was closed first followed by medial one. The erased musculoligamentous structures were fixed with corresponding humeral condyles by drill holes using number one or two Vicryl sutures depending on muscle bulk and ages of the patients. The elbow was immobilised in a plaster slab at 30° flexion if post-procedure elbow stability was satisfactory. Following contracture release and reduction, the cases of old dislocations of elbow with stiffness were immobilized at 90° flexion using humeroulnar K wire fixation for two weeks.

Postoperative Care: Guarded passive followed by active mobilization was started from fourth postoperative day after removal of POP cast or after removal of K wire (see above) with the help of adjustable turn buckle splint. Initially elbow was placed in turn-buckle hinge splint to maintain the elbow in maximum flexion and extension alternatively for six hours till active elbow motions recovered with muscle power around elbow regained at least MRC grade (iii) in average six to eight weeks postoperatively Oral Indomethacin 75 mg daily in divided doses administered after food for four weeks. The stitches were removed at 14th postoperative day. After discharge from hospital, the patients were evaluated clinicoradiologically two weekly up to third month, then at three monthly interval up to one year, and subsequently at six monthly interval.

Ethical approval for this study was obtained from the Ethics Committee under Research Oversight Committee, Institute of Post Graduate Medical Education & Research, Kolkata, India (Ref no. IPGME&R/IEC/2020/659). Details of the patients with stiff elbow were studied by descriptive statistics whereas the parameters of stiff elbow along with their results after arthrolysis were studied by inferential statistics. The data of results of the arthrolysis were presented as univariet median with standard deviation and standard error of mean (SE)

RESULTS

Eighty four patients were evaluated for 3.2 to 10.3 years (mean 6.5 years) clinico radiologically. Overall results were evaluated according to Mayo Elbow Performance Score (9) pre and postoperatively. Radiographic evaluation was done by anteroposterior and lateral radiographs of elbow immediately after the operation followed by monthly for six months to detect any

heterotopic ossification; then at six monthly intervals for any degenerative change of elbow Fig 2 (c). The alteration of ROM before and after the operation was statistically evaluated by student's paired t-test. Postoperative alteration of ROM was shown in Table I. As per Table I, over-all gaining of main ROM of elbow was 42.80 which is very significant. Patients required supervised physiotherapeutic measures to gain the arc of motions after the operations. Preoperative range of forearm motions did not improve much postoperatively. The clinical results of arthrolysis were relatively poor in immature patients of which two patients of group III showed unsatisfactory results. The values were tested using student's paired t test with all variables keeping p value less than 0.05.

Preoperative MEPS score improved significantly in all groups of patients as seen in the patients of group I whose preoperative MEPS mean score 71.87 with SD 2.42 and SE 0.35 changed to mean 91.71 with SD 5 And SE 0.88 (calculated p value 37.75 in respect to table p value 3.65 with $P < 0.05$), in group II whose preoperative MEPS mean score 65.58 with SD 5 And SE 0.85 changed to mean 88.82 with SD 5.15 And SE 0.85 (calculated p value 2.85 in respect to table p value 2.70 with $P< 0.01$), in Group III whose preoperative MEPS score mean 68.88 with SD 3.23 and SE 0.7 changed to mean 86.11 with SD 3.66 and SE 0.97(calculated p value 17.09 in respect to table p value 3.92 ($P < 0.05$). The mean MEPS score improved from preoperative mean 68.77(range 65.58 to 71.87) to postoperative mean 88.88 (range 86.11 to 91.71). Accordingly, 31 patients (96.8%) group I showed excellent and one (3.2%) good result whereas 16 patients (47.1%) of group II showed excellent and 18(52.9%) good results and in group III five (27.8%) excellent and 13(72.2%) good results. Postoperatively the patients regained stable elbow motions which did not deteriorate with passage of time.

There was neither loss of muscles power around the elbow nor evidence of heterotopic ossification at final follow up. Supination and pronation remained almost unaltered after the operation.

Among complications, five (5.9%) patients showed superficial wound infection controlled by regular dressing and proper antibiotics. Seven (8.3%) patients showed transient ulnar nerve palsy; all recovered in three to six months postoperative period. Five (5.9%) patients showed persistent painful motions due to inadequate rehabilitation. Fourteen (16.6%) patients showed delayed recovery of elbow and forearm motions. No patient showed postoperative instability of elbow. All patients regained normal power of flexors and extensors of elbows in three to six months time.

DISCUSSION

Contracture release of stiff elbows though was described in 1944 by Wilson (10), but subsequent numbers of reports of this procedure are small and mostly on post traumatic cases.As most of the patients in our series were young with long standing elbow stiffness they were considered for arthrolysis. The factors which may influence the clinical outcome following arthrolysis have been studied and compared by different workers. These include age (11), duration of stiffness (12) initial management (13), meticulous release of contracture and use of continuous passive motions (14,15). But, no study described the clinicoradiologically detectable structural abnormality responsible for stiffness of elbow; hence we divided our stiff elbows of long duration (mean 14.7 months) in three groups, based on the above features and were studied for prognostication following open arthrolysis among them. However in our series, age has become an important factor of final outcome. In children and young adolescents, the early recovery of postoperative elbow motions followed by it's deterioration was experienced may be due to their enhanced healing potentiality of the soft tissues around the joint but poor compliance for rehabilitation. The cases of Group I needed single approach either lateral or medial, depending upon the location of elbow pathology, as suggested by Bhattacharya (16) and Glynn (17). All of group III patients required global release of contracted structures around the joint showed stability after wound repair per and postoperatively. Their, stability of elbow retained with improved articular alignment and minimally damaged articular cartilage. Postoperative alternate flexion and extension in elbow splint modified the length or cross link integrity of periarticular fibrous tissues resulting in their permanent stretching, as supported clinically by long lasting persistence of satisfactory elbow motions without late deterioration.

Thus, those patients who had only soft tissue contractures group I & II , showed excellent results with satisfactory range of elbow motions persisted till the date. But those who had periarticular new bone formation with subchondral sclerosis and articular erosion detected peroperatively especially of Group III had incomplete recovery of elbow motions. Among those, who needed peroperative K wire fixation, ultimately showed restriction of terminal range of elbow motions. Probably, they are the candidates who would require hinged external fixations to maintain the stability as well as mobility in postoperative period, as suggested by Kulkarni et al (8).

CONCLUSION

The final outcome of arthrolysis depended on soft tissue contractures around the elbow, articular incongruity, and damage of articular cartilage of which first two factors could be detected preoperatively whereas the third factors were associated with preoperative advanced grading(Group III) proved by peroperative evaluation. The cause and duration of contractures

as mentioned did not seem to influence the outcome of arthrolysis. The judicious and sequential release of contracted structure is effective to regain satisfactory elbow motions which can persist for long period without late deterioration. Most interestingly, the outcome of open method of arthrolysis of elbow correlated well with the preoperative clinicoradiological grading done in our series which can predict the planning of surgical options as well as postoperative prognosis.

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