



CONSTRAINED HINGED ELBOW ARTHROPLASTY IN AN BONY ANKYLOSED ELBOW WITH NON UNION SUPRACONDYLAR FRACTURE HUMERUS: A CASE REPORT

Orthopaedics

Dr Arun Rajamanickom	Assistant Professor, Vinayaka mission's kirupananda variyar medical college and hospital, salem-Tamilnadu.
Dr Nagesh Sangolgi*	Postgraduate, Vinayaka mission's kirupananda variyar medical college and hospital, Salem-Tamilnadu. *Corresponding Author
Dr Athipathi	Postgraduate, Vinayaka mission's kirupananda variyar medical college and hospital, Salem-Tamilnadu.
Dr Chiranjeevi K P	Postgraduate, Vinayaka mission's kirupananda variyar medical college and hospital, Salem-Tamilnadu.

ABSTRACT

Ankylosis of elbow is a very difficult case to treat. Now Total elbow arthroplasty (TEA) in managing ankylosis at elbow has evolved much in the recent times and is also most common surgical procedure used in the management of advanced bony ankylosis, rheumatoid arthritis, posttraumatic arthritis, osteoarthritis, and difficult fracture around elbow joint in elderly patients.

- TEA for ankylosed elbows in elderly patients with nonunion supracondylar fracture is a good surgical option to restore adequate function of elbow joint. Total elbow prostheses have progressed over the time and now include the constrained, semiconstrained, and modular
- Other joints in the extremity should be carefully examined, as well as the elbow's mobility and function, in order to construct a complete pre- and post-operative management plan that considers the upper extremity's whole range of motion..
- However, long-term complications, including infection, aseptic loosening, instability, and periprosthetic fracture, remain a challenge. Complication rates, reoperation rates, and survivorship of modern prostheses are discussed. Technical pearls and pitfalls are discussed.

KEYWORDS

Elbow >Distal Humerus Fracture >Ankylosis >nonunion >Arthroplasty >constrained hinged prosthesis

INTRODUCTION

The fracture of distal humerus is relatively not a common injury, as it accounts for about 2% among all the fracture^[1]. The total prevalence among adults is around 5.7 cases per 100,000 per year^[1-3]. The mechanism of fracture distal humerus has a bimodal age distribution, similar to any other extremity fracture, with the first peak in the younger population following high-velocity injury (most commonly associated with road traffic accidents or related to sports injury), and the second peak in osteoporotic bone of elderly patients following low-velocity injury, which often results due to fall. By 2030.

Despite advancements in surgical implants, such as the precontoured anatomical locking plate for open reduction and internal fixation (ORIF), non-union at the distal humerus is more likely^[11-12] than at the proximal humerus (4%) and less than 2% for the diaphyseal.^[2] occurrence of nonunion after treatment of distal humerus fracture with internal fixation is between 8% to 25% of the time, even after a greater grasp of surgical aims and concepts to consider in order to improve internal fixation.

Occasionally selected patient who undergo nonoperative treatment for fracture at distal humerus also presents with ankylosis and nonunion. A challenge is faced in treating ankylosis with nonunion of distal humerus for orthopaedic surgeon from advent of surgical fracture care.

The main objective of this article is to evaluate the patients who presents to orthopaedic surgeon for ankylosis of elbow joint with nonunion of fracture at distal humerus, and describe the relative indications of total elbow arthroplasty^[6], and to summarize the outcomes reported in studies, published in different studies from time to time, and to help in providing technical pearls to have a easy approach to face the challenging complications.

Case Presentation:

History : A 60 year old female was referred to our opd with complains of deformity and instability over left elbow joint since 15 year. Patient had a h/o fall on outstretched hand 15 year ago and developed pain which was sudden in onset, gradually progressive in nature, non-radiating, aggravated on movement relieved on rest and medication, with no diurnal variation, with no sensory loss, and was treated with native treatment in the form of oil bandage for 3-4 weeks and pain subsided. Since then, the pain has subsided and the injury has been neglected. As a result, the patient has been unable to use her left hand for

daily activities and has resorted to using it only for personal hygiene.

There is no history of diabetes, hypertension, rheumatoid arthritis, or tuberculosis in the patient.

The patient has never had any previous surgery for this condition.

She came to see us for elbow deformity treatment and to regain reasonable elbow and hand function.

Physical examination:

Patient in sitting position both the upper limb on examination table.

On inspection no swelling, scar, sinus, or dilated veins seen, a fixed flexion deformity 60°-70° at elbow was noted. On palpation elbow joint was not warm, non-tender to touch, there was no sensory loss and the power of muscle (according to MRC grading) i.e flexion of finger was 3/5; wrist and those of elbow flexors was 2/5. The motor power of left fingers, wrist and elbow extensors were 2/5. Supracondylar ridge was irregular and thickened when compared to opposite side. Three point bony relation was maintained. Brachial artery pulsations was felt with good volume. There was a abnormal mobility at supracondylar region at antero-posterior and lateral. Elbow movements were fixed, muscle wasting was present.

Neurological examination :- No neurovascular deficit.

Imaging studies:

The radiographs taken revealed that her elbow joint was completely ankylosed with atrophic nonunion of the supracondylar fracture along with malunited distal humerus fracture with ankylosed elbow joint. Computed tomography (CT) scans confirmed the radiographic findings with grossly rotated distal humeral condylar fragment with significant gap at the fracture site and marked disuse osteopenia.

Sequential radiograph with computed tomography (CT) scans should be taken and reviewed periodically. All information about the initial injury and the quality of primary treatment taken is to be noted. A nonunion complicating a well-performed surgery before should be looked in for local and systemic infections, malnutrition, comorbidities and lack of appropriate follow-up.

Moreover inadequate fixation is also a most common cause of nonunion.^[13,14] In current days the role radiological imaging plays a very major role in detecting ankylosis, nonunion pattern, and assess the

bone stock and know about posttraumatic arthritis or associated malunion of articular surface.

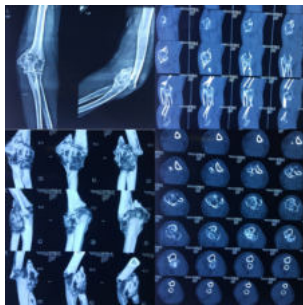


Fig1: Pre-operative radiographic images, X-ray and CT images. Showing bony ankylosis between olecranon process of ulna and trochlea of humerus, nonunion at distal humerus, diffuse osteoporosis, a displaced fracture, gross distortion of elbow joint and elbow arthritis.

Management : Decision making

Patients with a well-established ankylosis with nonunion at the distal humerus can be managed in a variety of ways. Nonoperative therapy can be continued, open reduction and internal fixation can be planned, or total elbow arthroplasty can be performed. This process of decision making to prescribe the treatment plan for each patient might be highly intricate.

For low-demand persons who are able to cope with their nonunion, conservative management is a very acceptable alternative, especially when the danger of medical problems, permanent nonunion, or infection is particularly high. A custom-made orthosis to offer elbow stability may be beneficial for some patients. The majority of patients in our practice, however, do not find conservative management appealing.

A case of ankylosis with nonunion with osteoporosis is well managed with total elbow arthroplasty, as it requires a less postoperative rehabilitation and is technically easier and, then an internal fixation as the patients postop rehabilitation takes more time as patient already reduced bone stock and damaged articular surface so any internal fixation will not have a better outcome than Total Elbow Arthroplasty.

Surgical approach

We chose complete elbow arthroplasty of the left elbow due to ankylosis with significantly deformed morphology of the distal humerus, inadequate bone stock, bone gap at the non-united fracture, severe elbow deformity, and stiffness. The elbow was approached posteriorly by a "Bryan-Morrey triceps reflecting approach" under general anaesthesia, and the fracture site was identified. Between the shattered ends of the bone, there was severe fibrosis, which had to be removed. The distal humeral condylar fragments were discovered to be highly misaligned, osteoporosed, destructed, and unsuitable for osteosynthesis. As a result, the distal humeral bone pieces, as well as the proximal olecranon, were removed. This gap was reconstructed by using constrained elbow prosthesis. The humeral and ulnar shaft were prepared by reaming their shaft for constrained prosthetic replacement. The medullary canal was reamed on both sides and a trial prosthesis was inserted and the range of movements was checked and was satisfactory and then the final prosthesis designed by Dr. Bakshi's sloppy hinge elbow of size 13mm*7mm length was inserted which is uncemented with ROM of 10°-160° and thus achieved a stable mobile joint. Through wash given and then triceps was reconstructed.

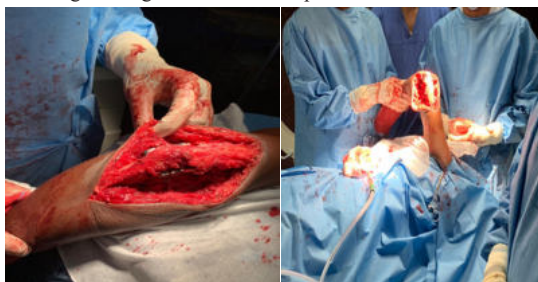


Image 2a: intra-op images showing implant, triceps muscle, and

elbow in full extension Fig 2b: showing intraoperative flexion at 90°.



Fig3: Post-Op Xray showing adequate fixation.

For three days after surgery, the patient was administered i.v. third generation cephalosporin and aminoglycoside. At the time of discharge, the antibiotics were changed to oral and continued for two weeks until the sutures were removed. The limb was immobilised for two weeks before physiotherapy was used to recover movement and function in the elbow and hand. The post-operative treatment was uneventful and satisfactory. The prosthesis was well-placed on the post-operative X-ray.

The patient had a considerable improvement in the post-operative Mayo elbow score of 95 compared to the pre-operative score of only 40 [15] at the 12-month follow-up, which is an outstanding outcome. Apart from a dramatic improvement in her cosmetic look, the patient can now perform many of her everyday duties with her left hand, which she could not do before.

DISCUSSION

There has been several case series reported of TEA for ankylosed elbows [4,7-9]. In a report by Figgies et al [4] a 19-patient case series of Total Elbow arthroplasty using the linked implants to treat ankylosed elbows in patients with a various condition that have also included Rheumatoid Arthritis. Out of 19 cases, 4 cases have been evaluated as excellent, with 11 as good, with 3 as fair, and 1 as a failure. The failure occurred soon after a infection occurred around the operative site leading to removal of implants. And the authors stated evaluation of functional limitations of patient should be done the outset and this should include a concurrent evaluation of other upper extremity joints. In a report by Mansat et al. [8] a 14 patient cases series, 4 of which were evaluated as excellent, 4 evaluated to be good, 1 evaluated to be fair, and 5 were poor. In a report by Peden et al. [9] a 13 cases series: 5 of which evaluated as excellent, 3 evaluated to be good, 4 evaluated to be fair, and 1 was poor. According to these reports, functional ability restored in most patients postoperatively was sufficient enough that they could perform activities of daily living (ADL) normally.

In our case study, the patient was very satisfied with the surgical outcome and stated that her ADLs were better than she had been preoperatively. In the previously stated reports, the arc of range of motion achieved at the elbows was mostly good. Figgie et al. [4] reported that the mean arc of motion improved from 0 degrees preoperatively to 80 degrees (range, 35 to 115 degrees of flexion) at an average 5.75 years after the operation. Mansat et al. [8] reported that the mean increase in the arc of flexion was 60 degrees (range, 5 to 115 degrees), with a mean increase of 33 degrees in flexion and 27 degrees in extension. Peden et al [9] reported that the improvement in range of motion at the elbow measured at 1 year after the operation was maintained for all patients after a 12-year follow-up. In our study, the average arc of motion was 100 degrees (range, 30 to 150 degrees) at the most recent examination. Improvement in the range of motion of the elbow improves the ADL for patients with Ankylosis.

Most common complications following Total Elbow Arthroplasty are ulnar nerve problems, aseptic loosening, infections, subluxation, dislocation, elbow instability, intraoperative fracture, fracture of the prosthesis, and ectopic bone formation [10]. When performing Total Elbow Arthroplasty for an ankylosed elbow, special care and precautions should be taken to prevent ulnar nerve problems, infection, instability, and an intraoperative fracture [4,8-10]. Occurrence of infection is not typically frequent, but complications are severe if it does occur. The only case to fail in the previous study reported by Figgie et al. [4] was due to a deep infection, and because of noncompliance the patient

was not a suitable candidate for arthroplasty. Mansat et al.^[8] reported that a deep infection developed in one elbow of two patients with post-traumatic stiffness. One patient had two previous operations prior to the arthroplasty, and the other patient had been operated on four times before. Revision surgery was required in both the patients. In another previous report, 3 patients had deep perioperative infections that required an average of four additional operations^[9]. Neurogenic symptoms, especially those pertaining to ulnar nerve disorders, were a relatively common complication after TEA. It was reported that some patients with moderate neurogenic symptoms preoperatively had complete relief after ulnar nerve decompression and transposition, while other previously asymptomatic patients developed ulnar nerve symptoms; however, no pain was attributed to the ulnar nerve^[8].

In cases, if patient develops ulnar nerve symptoms after undergoing Total Elbow Arthroplasty then revision surgery (neurolysis) can be done. A kinking or compression of the ulnar nerve can occur after Total Elbow Arthroplasty for ankylotic elbows^[4], perioperative procedures to manage the ulnar nerve should be employed. In previous reports, linked implants have been recommended in order to maintain the stability of elbows over the full course of the period during which they are observed^[8,9]. Our cases had received linked implants and we did not encounter complaints regarding symptoms caused by elbow instability.

A Intraoperative fracture is one of the most severe complications and all necessary steps are taken to avoid it during this type of operation. Peden et al.^[9] reported that two cases had a fracture of the lateral humeral epicondyle which resolved uneventfully and the ulnar component was malpositioned causing a perforation of the posterior cortex in another case. Mansat et al.^[8] reported that two patients sustained a fracture associated with a loose component. We noted that the original border between the humerus and ulna was sometimes difficult to identify intraoperatively and this can inadvertently contribute to a fracture when opening up an ankylotic joint.

CONCLUSIONS

In conclusion, patients with ankylotic elbows with nonunion of distal humerus end total elbow arthroplasty is a good surgical option to restore adequate range of motion and elbow stability. For the sake of a good outcome, it is necessary to evaluate other joints in the extremity in order to properly evaluate the mobility and function of the elbow and to prepare a comprehensive plan of pre- and post-operative management that takes into consideration the full motion of the upper extremity. "Thus converting an unstable elbow joint into stable mobile joint."

REFERENCES:

1. Rockwood CA, Bucholz RW, Court-Brown CM, Heckman JD, Tornetta P. Rockwood and Green's Fractures in Adults. Vol 1. Philadelphia: Lippincott Williams & Wilkins, 2010.
2. Browner BD, Jupiter JB, Krettek C, Anderson PA. Skeletal Trauma: Basic Science, Management, and Reconstruction. Vol 2. Fifth ed. Philadelphia: Elsevier, 2015.
3. Robinson CM, Hill RM, Jacobs N, Dall G, Court-Brown CM. Adult distal humeral metaphyseal fractures: epidemiology and results of treatment. *J Orthop Trauma* 2003;17:38–47.
4. Figgie MP, Inglis AE, Mow CS, Figgie HE. Total elbow arthroplasty for complete ankylosis of the elbow. *J Bone Joint Surg Am.* 1989; 71: 513–520.
5. Palvanen M, Kannus P, Niemi S, Parkkari J. Secular trends in distal humeral fractures of elderly women: nationwide statistics in Finland between 1970 and 2007. *Bone* 2010;46:1355–1358.
6. Distal humerus nonunion: evaluation and management by Frédéric Vauclair1, Patrick Goettli1, Ngoc Tram V. Nguyen2, Joaquin Sanchez-Sotelo2 *EOR | volume 5 | May 2020* DOI: 10.1302/2058-5241.5.190050
7. Kraay MJ, Figgie MP, Inglis AE, Wolfe SW, Ranawat CS. Primary semiconstrained total elbow arthroplasty. Survival analysis of 113 consecutive cases. *J Bone Joint Surg Br.* 1994; 76: 636–640.
8. Mansat P, Morrey BF. Semiconstrained total elbow arthroplasty for ankylosed and stiff elbows. *J Bone Joint Surg Am.* 2000; 82: 1260–1268.
9. Peden JP, Morrey BF. Total elbow replacement for the management of the ankylosed or fused elbow. *J Bone Joint Surg Br.* 2008; 90: 1198–1204.
10. Voloshin I, Schipert DW, Kakar S, Kaye EK, Morrey BF. Complications of total elbow replacement: a systematic review. *J Shoulder Elbow Surg.* 2011; 20: 158–168.
11. Sproul RC, Iyengar JJ, Devic Z, Feeley BT. A systematic review of locking plate fixation of proximal humerus fractures. *Injury* 2011;42:408–413.
12. Gotschalk MB, Carpenter W, Hiza E, Reisman W, Roberson J. Humeral shaft fracture fixation: incidence rates and complications as reported by American Board of Orthopaedic Surgery Part II candidates. *J Bone Joint Surg Am* 2016;98:e71
13. Sanchez-Sotelo J. Distal humeral nonunion. *Instr Course Lect* 2009;58:541–548.
14. Helfet DL, Kloen P, Anand N, Rosen HS. Open reduction and internal fixation of delayed unions and nonunions of fractures of the distal part of the humerus. *J Bone Joint Surg [Am]* 2003;85:33–40.
15. Campbell operative orthopaedics 14th edition by Frederick M Azar and James H Beaty page no 640.