IF : 4.547 | IC Value 80.26 VOLUME-6, ISSUE-6, JUNE-2017 • ISSN No 2277 - 8160

Original Research Paper Orthopaedics

PARATRICEPITAL APPROACH FOR FIXATION OF DISTAL HUMERUS FRACTURES IN ADULT

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ABSTRACT

BACKGROUND: Distal humerus fractures most commonly managed by surgical approaches that disrupt the extensor mechanism of elbow. Paratricepital approach for distal humerus fracture fixation has been done by orthogonal or parallel plate construct that allows excellent healing of fracture, motion arc of elbow more than 100 degree, and maintains of extensor mechanism strength.

Material and Methods: 30 cases of distal humerus fractures are fixed by paratricepital posterior approach. Bicolumner fixation done by elevating and retracting the triceps of the distal humerus keeping triceps insertion undisturbed by orthogonal or parallel plate construct. Early active-assisted range of motion initiated within limits of pain. Age group was 15 to 60 years. Among them 21% was type A fracture, 17% type B fracture, 33% type C1 fracture and 29% type C2 fracture. More than 60% of cases have 1 year of follow up. Radiograph and functional evaluation was done by MEPS (Mayo Elbow Performance Score), DASH (Disability of Arm Shoulder and Hand) questionnaire.

Results: All thirty fractures healed primarily. The median arc of elbow motion was 105 degree (range 70 to 140 degree).Average MEPS was 91 points (range 65 to 100) indicating excellent scores,

Conclusion: Treatment of distal humerus fracture in adults by paratricepital posterior approach results in excellent healing, a mean flexion extensor arc more than 100 degree, maintains of almost normal elbow extensor strength compared with contra lateral normal elbow.

KEYWORDS : .Distal humerus fracture, Paratricepital approach

Introduction:

Complex intraarticular distal humerus fractures are a considerable challenge to even the most experienced surgeon[1] Distal articular humerus fractures are preferably treated by open reduction and internal fixation[2]. The surgery is technically demanding and an adequate exposure of the distal humerus articular surface is important for the surgery. The olecranon osteotomy approach has been the gold standard amongst surgical approaches for fracture fixation of the distal articular surface of humerus[2, 3, 4]. It is the most commonly used surgical approach and provides good visualisation of the fracture[4].

Complications of this approach include hardware migration and prominence, delayed union and non-union[5,6]

Surgical approaches to elbow joint that dissociate the triceps from olecranon have distinct disadvantages like triceps avulsion, triceps weakness, wound healing problem etc. Such complications necessitate more surgery and predispose to infection[7]. To avoid these complications an extensor mechanism sparing paratricipital posterior approach to distal humerus through midline posterior incision was suggested by **Schildhauer et al**[8].

The bilaterotricipital approach (triceps sparing or triceps-on) was first reported by **Alonso-Llames** in **1972**.This approach involves creation of surgical windows along medial and lateral side of triceps muscle and tendon without disrupting its insertion on olecranon[9].

The paratricipital approaches have several advantages: complications of olecranon osteotomy can be avoided, triceps tendon insertion not disrupted, allows early range of motion. This approach also preserves innervations and blood supply of anconeius muscle[9,10] which provides dynamic posterolatrral stability of elbow. Finally if further exposure required paratricipital approach can be converted to olecranon osteotomy and if further proximal exposure is required for associated fracture shaft humerus, lateral side paratricipital approach can be converted into the Gerwin et al [11] approach .The disadvantage of paratricipital approach is the limited visualisation of articular surface of distal humerus, therefore this approach is usually inadequate for fixation of type C3 fractures. The several advantages of this approach certainly indicate its use for AO/OTA types A2, A3, B1, B2 and possibly C1 and C2 fractures[8,12]

The aim of our study is to prospectively evaluate the results of paratricipital approach in terms of adequacy of exposure of distal humerus for fixation of different types of distal humerus fractures, and ultimately the functional outcome of elbow.

The specific objectives are -

a). To determine adequacy of exposure of distal humerus in respect to dissection of soft tissue and extensor mechanism of elbow, for fixation of different types of distal humerus fracture in AO/OTA classification.
b) Time taken for surgery
b) Rate of complications
c) To evaluate post- operative range of motion& functional outcome by Visual analogue score for pain and Mayo elbow performance score (MEPS) [13,]

Materials and methods:

A study of 30 cases of supracondylar and intercondylar fracture of humerus was conducted in the Department of Orthopaedics surgery, Medical College, Kolkata between January 2011 to June 2012.There were 17 of female patient and 13 were male. Left elbow was involved in 21 cases and right were involved in 9 cases. Most common mode of injury was road traffic accident(66.67%), then fall from height(20%), then simple fall(13.33%).Injury-operation interval of <1 week was 56.67%. Among all patients 33% of fractures were type C1,29% of fractures were type C2 ,others are type A and B fractures.63.33% of patients had >12 months of follow-up. 29.17% of patients had range of motion of >120, 54.17% of patients had ROM 90-120 degree, 16.66% of patients had ROM of <90 degree.

INCLUSION CRITERIA :

Displaced supracondylar and intercondylar fracture of distal humerus in age group 15-80 years.

EXCLUSION CRITERIA:

a) Undisplaced distal humerus fracture which can be managed conservatively
b) Open fracture of distal humerus
c) Patients with medical co morbidities, not fit for anaesthesia

Surgical Technique:

Anesthesia - Regional anesthesia

Position of the patients – Patient were positioned in lateral decubitus with a bolster placed between arm and chest and the entire upper extremity draped free.

All cases were operated with tourniquet applied over upper arm. If operative time exceeded more than 1hrs 45mins tourniquet was deflated.

Surgical Exposure – Posterior approach to distal humerus was followed

Surgical steps:
Bony landmarks are marked including olecranon process, subcutaneous border of ulna, medial and lateral epicondyles.

Incision – A posterior mid-line longitudinal incision was made over lower arm and extended distally beyond the elbow joint. Just above the tip of olecranon the incision was curved laterally. It was continued 5 cm distal to tip of olecranon.

Fig 1: Posterior Midline Longitudinal skin Incision.

***Superficial surgical dissection*: -** Deep fascia incised in the mid line and full thickness skin flaps are developed. These are kept as thick as possible, with deep plane consisting of triceps fascia and epitendon proximally and forearm fascia and ulner periosteum distally. Apo neurosis of the triceps exposed. Ulnar nerve palpated on the back of medial epicondyle. Fascia over the ulnar nerve incised to expose the ulnar nerve. When more proximal exposure of humerus was required ulner nerve was followed further until it pierces the intermuscular septum coming from the anterior compartment. Distally it was released from cubital tunnel and dissected to its first branch. Articular branch of the ulnar nerve may be sacrificed.

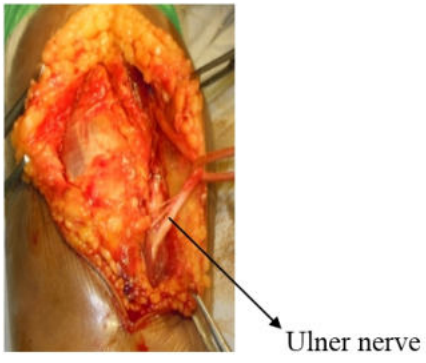
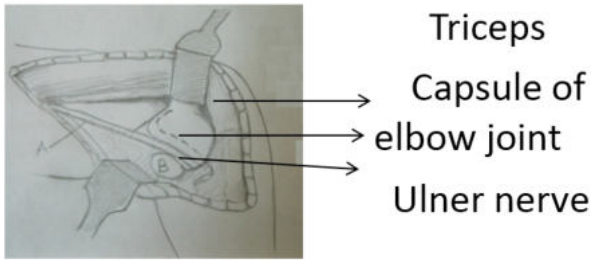
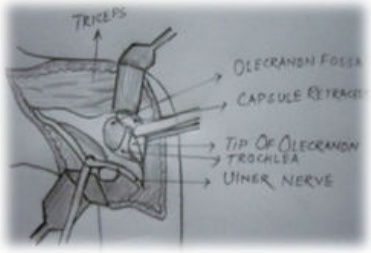
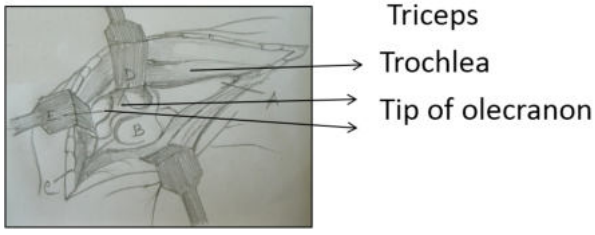


Fig 2: Full thickness skin flap developed. Ulner nerve exposed.







Deep surgical dissection: Dissection was continued to lateral and medial triceps borders at their respective interfaces with posterior aspect of intermuscular septum. The distal lateral dissection was continued anterior to the anconeus muscle, allowing the muscle to be elevated along with the triceps and preserving its neurovascular supply The posterolateral humeral shaft approached by elevating the triceps and anconeus muscle from posterior periosteum and by retracting it medially. Medial paratricipital dissection along with posterior border of intermuscular septum exposed the posteriomedial aspect of distal humerus. The intra-articular fat pad was excised. This provided Visualization of the entire posterior articular surface, comprising roughly 50% of the overall articular surface of the distal part of the humerus Retracting triceps muscle medially and laterally exposes both column. Trochlea can be visualized by flexing elbow more than 90 degree . A sponge or 0.25-in (0.6cm)

Penrose drain was placed into the ulno-humeral joint to allow distraction of the joint by pulling distally on the olecranon via the sigmoid notch to aid in Visualization and facilitate the reduction through ligament taxis.

The distal part of the humerus was anatomically reduced with direct Visualization posteriorly and indirectly with fluoroscopy. The intact sigmoid notch was used as a template for reduction.

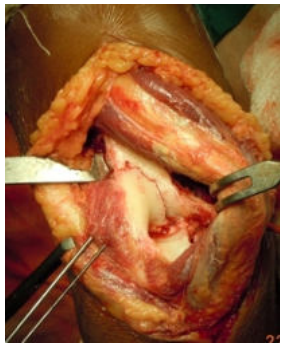
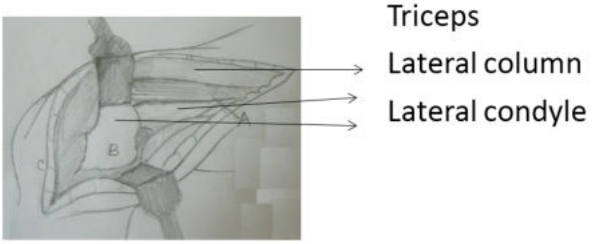


Fig 3: Retracting triceps medially laterally to expose distal humerus with articular surface



Techniques of Fracture Reduction:

- Articular fragments are reduced and provisionally fixed with guide wire.
- Definitive fixation of intraarticular part is done by 4 mm cannulated cancellous screws
- Care must be taken not to narrow the trochlea with a lag screw when there is bone loss.
- Once intraarticular part is fixed, intercondylar fracture is converted into supracondylar fracture.
- This is provitionally fixed with kirschners wire and converted with definitive fixation with either parallel plate or orthogonal plate contruct
- Fixation stability and motion arcs were assessed prior to closure.

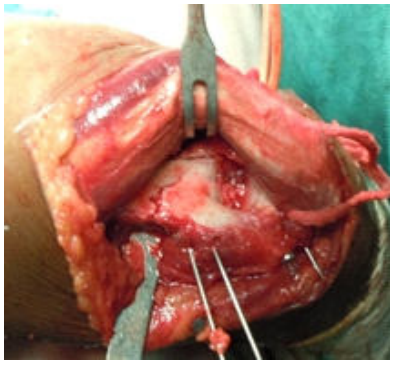


Fig 4: Fracture provitionally fixed with k wires

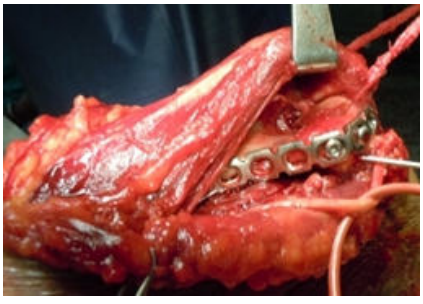


Fig 5: Fracture fixation done with plates and screws.

Technical Objective for Fixation of Fractures:

- Every screw should pass through a plate.
- Each screw should engage a fragment on the opposite sides that is also fixed to a plate.
- As many screw as possible should be placed in distal fragments.
- Each screw should be as long as possible.
- Each screw should engage as many articular fragments as possible.
- Plate should be applied such that compression is achieved at the supracondylar level for both columns.
- Plates used must be strong and stiff enough to resist breaking or bending force before union occurs at the supracondylar level [14]

Closure:

- The Ulner nerve was not anteriorly transposed in any case.
- Implants were covered with soft tissue to prevent Ulner neuritis.
- Triceps attached with intermuscular septum.
- A negative suction drain was given.
- Bulky dressing around elbow done.

After Treatment:

- Plaster of Paris back slab applied.
- Drain was removed at 48 hrs
- Out of 30 cases, 6 cases were operated under tourniquet control in rest tourniquet had to be released intraoperatively as operative time exceeded more than 1hrs 45mins.
- Blood loss in cases operated with tourniquet – measured by collected blood in suction drain.
- In 24 cases tourniquet had to be removed intraoperatively.
- Blood loss in such cases measured with numbers of mops required during surgery plus collection in drain - (one wet mop = 200 ml of blood approx)
- Wound inspection was routinely done on 5th postoperative day.
- Suture removal was done on 14th postoperative day.

Postoperative Rehabilitation:

The patients are put through active elbow motion of flexion and extension, pronation and supination within limits of pain at 5th postoperative day.

Follow up:

Patients were reviewed every 2 weeks for first 2 months, every month for next 6 months and then every 3rd month and were assessed on:

- Time taken for functional recovery
- Range of motion
- Any specific complaints
- Time taken for fracture healing.
- Functional outcome by Mayo Elbow Performance Score(MEPS)

Final follow up was done one month before the conclusion of the study and various scoring system and classification were used to analyze the results. Results were analysed statistically using SPSS software system.

RESULTS:

All 30 patients were reviewed clinically and radio graphically. Follow up ranged from 18 months to 6 months, with an average of 12.6 months. 19 patients had an excellent result, 10 had good and one poor.

Time taken for functional recovery:

Functional recovery is interval between injury and time of return to normal daily activities. Average time being 101.8 days**.**

Range of Motion: The median arc of elbow motion was 105^{0} (range 70^{0} to 140^{0}). Arc of motion >120^{0} seen in 29.17% of patients, arc 90^{0}-120^{0} present in 54.17% of cases, arc <90^{0} seen in 16.66% of cases.

Mayo Elbow Performance score (MEPS): Average score is 91, indicating excellent result.

Disability of Arm, Shoulder, and Hand (DASH) questionnaire: Mean score was 32.36.

STRENGTH OF TRICEPS: According to MRC grading mean strength was 4.84(Max.5, Min.0)

Complications:

Symptomatic hardware (23.33%)
Flap necrosis (6.66%)
Superficial skin infection (13.33%)
Tourniquet palsy (10%)
Ulner nerve neuropraxia (20%)

DISCUSSION:

30 patients with distal humerus fractures treated with paratricepital posterior approach and fixation done with either orthogonal or

parallel plate construct. In this study fracture was most common in female patients(56.67%).Left elbow most commonly involved (70%),Minimum age of the patient of this study was 15 years, maximum was 85 years. Mean age of this fracture was 32.89 years. Most common mode of injury was road traffic accident (63.33%). Most of this patients were operated within 1 week of injury(56.67%).Delaying of intervention in others is due to treated elsewhere by quacks .or due to time taken for management of other more serious life threatening injuries. Among all patients 33% of fractures were type C1,29% of fractures were type C2 ,others are type A and B fractures.63.33% of patients had >12 months of follow-up. 29.17% of patients had range of motion of >120, 54.17% of patients had ROM 90-120 degree, 16.66% of patients had ROM of <90 degree. Follow up ranged from 18 months to 6 months, with an average of 12.6 months. 19 patients had an excellent result, 10 had good and one poor. Fuctional recovery is interval between injury and time of return to normal daily activities. Average time being 101.8 days**.** Average MEPS score is 91, indicating excellent result. Most common complication is symptomatic hardware (23.33%). Others are Flap necrosis(6.66%),Superficial skin infection (13.33%), Tourniquet palsy(10%),Ulner nerve neuropraxia(20%)

Associated injuries were # distal radius (10%),# acetabulam (3.33%), U/L # shaft ulna(3.33%), closed head injury(26.67%),closed abdominal injury(6.67%).

So in conclusion, treatment of distal humerus fracture in adults by paratricepital posterior approach results in excellent healing, a mean flexion extensor arc more than 100 degree, maintains of almost normal elbow extensor strength compared with contra lateral normal elbow. This approach can be an alternative to other triceps detaching approach, were the complications are more. Though this approach can be easily used for fixation of type A,B,C1, C2 fractures according to AO classification, fixation of type C3 and multifragmentary fractures by this approach can be problematic where there need a lot of research.

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