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Management of Type-A Extra-articular Supracondylar Fracture Humerus using various Treatment Modalities

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Abstract

Introduction: *Supracondylar Fractures of humerus in adults have traditionally presented a treatment challenge for the orthopedic surgeons. The combination of anatomic complexity, multifragmentary comminution, and a short distal segment, often in the setting of osteoporotic bone, renders these fractures difficult to treat successfully and often make a full restoration of function uncertain.[1]The objective of the current study was to evaluate and compare various treatment modalities used in the management of Type-A Extraarticular Supracondylar Fracture of Humerus.*

Material and Methods: *This randomized, interventional study was conducted on 30 patients of Type-A Extraarticular Supracondylar Fracture of Humerus using various treatment modalities with following aims and objectives:-*

1. *To achieve stable internal fixation.*
2. *To study the functional outcome of the patient by assessing union rate, range of movement.*
3. *To assess specific and general complications encountered with the procedure, if any.*

Results: *Patients were followed up at regular intervals (3 weeks, 6 weeks, 12 weeks and 6 months) for any complications, requirement of analgesics and physiotherapy. Fracture union was assessed clinically and radiologically. Elbow function on the operated side was evaluated and compared with the normal side as per Mayo elbow score.[2] Results were analysed statistically using chi-square test and ANOVA test.*

Conclusion: *The best treatment modality in our study was Bicolumn fixation with dual plating in adults as it provides more rigid fixation than a single LCP. Fracture types in which anatomy can be restored properly, precontured plates were used and Fractures in which anatomical reduction was not possible, Reconstruction plates were used for bicolumn fixation. Attaining correct alignment, rotation, and length without disrupting the soft tissue attachments to the communited fragments often leads to successful healing.*

Keywords: *Type-A Extraarticular Supracondylar Fracture Humerus, various treatment modalities, Bicolumn Fixation, Mayo Elbow Score.*

Introduction

In this modern era of industrialization, Agricultural Mechanization and increased vehicular traffic, trauma of different kinds including fractures, are increasing in frequency and severity. While patients want minimal hospitalization for sake of busy and competitive lifestyle and advent of modern techniques in orthopaedics.

Distal humeral fractures have a bimodal age distribution, affecting the young (high energy) or the elderly (low energy), Peak incidence being noted in males aged 12–19 years and in females aged 80 and older. The most common mechanism of injury is axial loading of the distal humerus (by a simple fall) followed in frequency by road traffic accidents and sports injury.[3] Fractures of the distal humerus account for approximately 2–6% of all fractures and about 30% of all elbowfractures.[4]

Although fractures of the distal humerus account for only 2% of adult fractures, traditional methods of treatment are associated with a significant number of poor results.[5]Improved outcomes have been reported with surgery for distal humerus fractures. The principles set out by AO- ASIF group, including anatomic articular reduction and rigid internal fixation, allow for rapid healing and early postoperative range of motion. The last decade has seen advances in the understanding of elbow anatomy, improvements in surgical approaches, new innovative fixation devices and an evolution of post operative rehabilitation protocols.[6]

Numerous classification schemes have been devised to categorize and discuss supracondylar fractures based on fracture pattern, degree of displacement, comminution, and rotation.[7]

The most commonly referenced classification system for adult distal humerus fractures was advanced by Muller. Known as the Orthopedic Trauma Association classification (Müller AO Classification), this scheme categorizes these fractures anatomically.[8]

Type 13 A – Extraarticular fracture

Type 13 B – Partial articular fracture

Type 13 C – Complete articular fractures

Non-operative treatment (immobilisation in a cast, traction, or 'bag of bones') often results in either a united fracture with joint stiffness and poor function or nonunion of the fracture with a painful pseudarthrosis.[1]

Closed reduction in flexion is difficult and almost always fails.[9]Closed reduction in flexion and percutaneous fixation using a Kirschner wires[10] is possible under radiological control particularly in children, but are difficult to hold the bony fragments in adults.

Skin traction (Dunlop) has given stiffness and malunion in almost two-thirds of the cases so treated.[11]

Skeletal traction through the olecranon has resulted in non-union, infection of the pin track and skin necrosis[12] among other difficulties, and requires three to six weeks confinement to bed which is an inconvenience to an active adult and a serious hazard to an elderly person.

Older techniques recommended a single DCP plate fixed on the posterior humeral surface. Many newer techniques advised the use of a pre contoured plate centrally placed on the posterior humerus with a flare extending distal and lateral for added fixation.[13]The use of locked plates has also been described.[14]

Plates applied on distal humerus at right angle to each other create 'Girdar like affect' which strengthens fixation construct. Plates should end at different levels on humeral shaft to minimize the 'stressriser' effect. Each plate should have at least 3 bicortical screws proximal to metaphyseal comminution.[15]Every screw should pass through a plate, should be as long as possible, should engage a fragment on the opposite side that is also fixed to plate, should engageas many articular fragments as possible. As many screws as possible should be placed in the distal fragments. Plates should be applied such that compression is achieved at the supracondylar level for both columns. Plates used must be strong enough and stiff enough to resist breaking or bending before union occurs at the supracondylar level.[16]

Material and Methods

A randomized, interventional study was carried out using different treatment modalities with supervised physical therapy programme for the management of 30 patients of extra-articular supracondylar humerus fracture, presenting to orthopaedics department in our institute. Fractures

were classified according to AO fracture classification.

Patients Selection

Inclusion Criteria

1. Extra-articular supracondylar humerus fractures (AO Type A).
2. Patient more than 10 years of age.

Exclusion Criteria

1. Open fractures, badly contaminated.
2. Fracture in paediatric patients less than 10 years of age.
3. Supracondylar fractures with compartment syndrome needing fasciotomy.
4. Supracondylar fractures with vascular injury needing vascular repair.
5. Refusal to provide informed consent.

The patients were evaluated pre-operatively with detailed history, clinical and radiological examination. Routine pre-operative investigations were done in all cases and medical fitness for surgery ascertained. Primary treatment in the form of splint age of limb, analgesics, anti-inflammatory drugs and intravenous fluids in multiple injuries were given.

Posterior approach for exposure of distal humerus was used in all cases. For fixation of fractures various modalities of fixation utilized were:

1) Reconstruction plates
2) LCP Extra-articular Distal Humerus Plate
3) Bicolumn fixation
4) Precontoured Medial LCP
5) Precontoured Lateral LCP
6) V-Y plate
7) Kirschner Wire Fixation: Closed reduction and stabalization of fracture using percutaneous K-wires or open reduction and fixation with K-wires.

Standard precautions and physiotherapy given post-operatively. Patients were followed up at regular intervals (3 weeks,6 weeks,12 weeks and 6 months) for any complications, requirement of analgesics and physiotherapy. Fracture union was assessed clinically and radiologically. Elbow function on the operated side was evaluated and compared with the normal side as per Mayo elbow score.[2] Results were analysed statistically using chi-square test and ANOVA test.

Observation and Results

Age Incidence

Extra-articular fractures of the distal humerus occurred in all age groups but were more common in younger age group from 21-30 years.

Sex Incidence

There was more number of males than females who sustained extra-articular fractures of the distal humerus with a male female ratio of 3:2.

Mode of Injury

Most of the fractures are the result of Road side accidents.

Side involved

Left humerus was found to be more commonly involved in the extra-articular fractures of the distal humerus.

Type of fracture: Open or Close

28 (93%) patients had closed fractures and 2 patients those with open fractures, one was of Grade I and one patient of Grade II according to Gustilo Anderson classification of open fractures.

Associated injuries and Medical Illness

Associated injuries were present in 4 out of 30 patients (12%). 7 out of 30 cases had associated medical illness. 2 had diabetes mellitus type-2, 3 had hypertension and 2 had both the illness.

Time elapsed between injury and surgery

Most of the patients were operated within 2-3 days of injury.

Fracture type

Most of the fractures were of A2 type as per AO system of classification.

Treatment Modalities

1 elbow was treated conservatively. 29 elbows were operated. Kirschner Wire Fixation was done in 7 patients within age group of 10-16 years. Common treatment modality used in this study was Bicolumn fixation in which 8 patients were treated with One Reconstruction and One Pre contoured Lateral LCP and 4 were treated with Two Reconstruction plates. Distal Humerus Extra-

articular LCP was used in 2 patients and 3 patients were treated with LCP alone. V-Y plate and Cancellous screw were used for 1 case each. One case was treated with DCP with periprosthetic stress fracture. 40% of the operated patients were fixed with dual plates and 23% of the operated patients were fixed with Kirschner wire.

Post-operative complications

5 (20%) patients suffered transient Ulnar Nerve Neurapraxia in the early post-operative period. No patient suffered from iatrogenic vascular injury.

Final Functional Outcome

Among 30 patients, according to Mayo Elbow Performance Score, Good results was achieved in 54% patients and 30% have excellent outcome.

The mean Mayo Elbow Performance score of the study is80.69±7.38.Chi square test was applied to all treatment modalities except K-Wire as K-wiring was done only in children (age group-10-16years). Statistically significant results (p-.041) were obtained when all other treatment modalities were compared by Chi square test.

Of Four treatment modalities, viz; DP, DHEALCP, LCP, RPS analyzed by ANOVA, DP had highest mayo score though the difference was not statistically significant ($p>0.05$). However, significant number of patients ($p<0.05$) showed 'Excellent' parameters in DP treatment modality as confirmed by Chi-Square test.

Discussion

Supracondylar extra-articular fractures of humerus are difficult to treat and are fraught with complications. ORIF is recommended as ideal treatment option for extra-articular fracture distal end humerus. The personality of fracture, associated soft tissue damage, neurovascular status and functional demands of patient can influence treatment outcome. The ultimate aim of ORIF is painless, functional and stable elbow joint. Through this study, we have tried to make clinico-radiological analysis of various fracture patterns of distal humerus and analysis of ORIF by various treatment modalities.

The low incidence of females in our study was probably because of less incidence of road traffic accidents in females due to less outdoor activities. Most of the fractures of distal humerus were the result of high velocity trauma.

We have used the classification of AO system of classification as we found it to be the most comprehensive of all classifications.

No matter what the modality of treatment is used, final outcome of painless, functional range of motion at elbow causing no disability is important with sound radiographic and anatomic union. In the present study, average flexion achieved at the elbow was 125.2 degrees with a range from 75 degrees to 140 degrees. 21 patients had a flexion beyond 100 degrees (70%). The average loss of extension was 16.5 degrees with a range of 10 degrees to 35 degrees. 20 patients had a mild pain not limiting their activities of daily living. 1 patient had a major disability so that he could not work as proper fixation was not achieved. The results were graded according to *Mayo Elbow Performance Score* and good results were achieved in 16 (54%) patients and 9 (30%) had Excellent outcome. 4 (13%) had fair results and 1 (3%) had poor outcome.

The distribution of cases in 9 groups according to the treatment modalities used is not equal and matched, because theme of the study is to discuss the different treatment modalities in distal third humerus extraarticular fracture though the results have been compared between different modalities for results.

Conclusion

The best treatment modality in our study was bicolumn fixation with dual plating in adults as it provides more rigid fixation than a single locked plate.

Fracture types in which anatomy can be restored properly, Pre contured plates were used and the fractures in which anatomical reduction was not possible, Reconstruction plates were used for bicolumn fixation. Attaining correct alignment, rotation, and length without disrupting the soft

tissue attachments to the communited fragments often leads to successful healing. In the group operated using oblique metaphyseal locking plate , there was no failure but stability of medial pillar was less as the oblique portion stabilises only the lateral column. Patients between 10-16 years of age presenting with supracondylar fractures should be managed with percutaneous K-wires for better Mayo score and to reduce the chances of cubitusvarus deformity.

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