National Journal of Clinical Orthopaedics

ISSN (P): 2521-3466
ISSN (E): 2521-3474

www.orthoresearchjournal.com
2018; 2(4): 170-174
Received: 11-08-2018
Accepted: 15-09-2018

Dr. Dhruv Sharma
Senior resident doctor.
Department of orthopedics. B.J. Medical College, Ahmedabad, Gujarat, India

Dr. Krunal Soni
Senior resident doctor.
Department of orthopedics. B.J. Medical College, Ahmedabad, Gujarat, India

Correspondence
Dr. Dhruv Sharma
Senior resident doctor.
Department of orthopedics. B.J. Medical College, Ahmedabad, Gujarat, India

To assess the functional results of surgical management of distal humerus fractures in adults involving the articular surface

Dr. Dhruv Sharma and Dr. Krunal Soni

Abstract
Introduction: Distal humerus fractures are uncommon injuries that account for fewer than 2% of all adult fractures. The complex shape of the elbow joint, the adjacent neurovascular architecture, and the sparse soft tissue envelope combine to make these fractures difficult to treat. Acceptable results have been reported in most patients treated by open reduction and internal fixation. Restoration of painless and satisfactory elbow function after a fracture of the distal humerus requires anatomic reconstruction of the articular surface, restitution of the overall geometry of the distal humerus, and stable fixation of the fractured fragments to allow early and full rehabilitation.
Aim: To assess the functional results of surgical management of distal humerus fractures in adults involving the articular surface.
Materials and Methods: Adult Patients having Distal humerus fractures were admitted to SSG Hospital attached to Baroda Medical College were taken up for study after obtaining their informed written consent. This is a prospective study from 2010 to 2012. All patients were treated surgically with open reduction and rigid internal fixation. After discharge, patients were advised to report for follow up after 6 weeks and 12 weeks and thereafter every 3 months. The results were assessed 3 & 6 months after the procedure. The functional assessment of the patient was done per – Mayo elbow performance score.
Results and Discussion: In our study, as per the Mayo Elbow performance score five function were taken into account, excellent results were achieved in 13.33%, good results in 66.67% and fair results in 13.33% of the case and poor in 6.67%. The complications like superficial infection in 1 (3.33%) patient, Radial Nerve Palsy in 1 (3.33%) patient, non-union in 1 (3.33%) patient, were noted.
Conclusion: Open reduction internal fixation should be done as early as possible. Delay in open reduction internal fixation with delayed soft tissue dissection leads to increased chances of elbow stiffness due to periarticular fibrosis.

Keywords: distal humerus, surgical management, fractures in adults

Introduction

Distal humerus fractures are uncommon injuries that account for fewer than 2% of all adult fractures. The complex shape of the elbow joint, the adjacent neurovascular architecture, and the sparse soft tissue envelope combine to make these fractures difficult to treat. Acceptable results have been reported in most patients treated by open reduction and internal fixation.

Restoration of painless and satisfactory elbow function after a fracture of the distal humerus requires anatomic reconstruction of the articular surface, restitution of the overall geometry of the distal humerus, and stable fixation of the fractured fragments to allow early and full rehabilitation.

Depending upon the amount of communition and displacement, open reduction and internal fixation with Y plate, 1/3 tubular plate, reconstruction plate, Cancellous screws, `K' wire and double tension band wiring can be done individually or in combination.

The aim of the present study is to evaluate the functional outcome of surgical management of distal humerus with intra articular extension in adults.

Aim: To assess the functional results of surgical management of distal humerus fractures in adults involving the articular surface.

Materials and Method

Source of Data

Adult Patients having distal humerus fractures were admitted to SSG Hospital attached to Baroda Medical College were taken up for study after obtaining their informed written consent. This is a prospective study from 2010 to 2012.

Method of collection of Data (Including sampling procedure if any)

Collection of data for patients presenting with fracture of Distal humerus was as follows: -History by Verbal communication, Clinical examination, both local and systemic, Radiological examination routine and other imaging modalities, Investigation baseline and others, Fracture anatomy assessed with X-rays, Diagnosis – Clinical and Radiological, Informed written consent will be taken for Surgical procedure, Surgery – Open reduction and Internal fixation.

The patients fulfilling the following inclusion as well as exclusion criteria were included in the study:

Inclusion Criteria: Male and Female Adult patients with closed distal humerus fracture involving the articular surface who have given their consent for the procedure, Patients who are medically fit for surgery.

Exclusion Criteria: Patients medically unfit for surgery, Patients not willing for surgery, Patients below 18 years of age, Compound fractures are not included.

In general condition of the patient, the vital signs were recorded. Methodical examination was done to rule out fractures at other sites. Local examination of injured elbow revealed swelling, deformity and loss of function. Any nerve injury was looked for and noted. Palpation revealed, abnormal mobility and crepitus. Distal vascularity was assessed by radial artery pulsations, capillary filling, pallor and paresthesia at finger tips. Radiographic study was done taking AP and lateral x-ray of the involved elbow. The patient was taken for surgery after routine investigations and after obtaining fitness towards surgery. The investigations were as follows: Hb%, Urine for sugar, FBS, Blood urea, Serum creatinine, and ECG, Chest X-ray. All patients were treated surgically with open reduction and rigid internal fixation. Patients treated surgically were done so in routine operation theatre as soon as possible. Most of the patients were operated within 8 days of admission. All the patients were put in lateral position with arm supported and forearm hanging. In all patients, a posterior trans-olecranon approach was used to give better exposure of the articular surface.

Operative Procedure

Type of anesthesia: General anesthesia was used in 2 cases and brachial block in 28 cases. Pneumatic tourniquet was used in all cases. Painting and draping of the part was done. The distal end of the humerus was approached using trans-olecranon approach. Elbow was exposed posteriorly through an incision beginning 5cm distal to the tip of the olecranon and extending proximally midline of the arm 8cm above the tip of the olecranon. Reflected the skin and subcutaneous tissue to either side carefully to expose the olecranon and triceps tendon. The ulnar nerve is isolated and fascia over the flexor carpi ulnaris is longitudinally splint over 6cm to enhance the nerve mobility. Then gently retracted from its bed with a moist tape. Distal end of the humerus is exposed through Trans olecranon approach. Prior to performing the olecranon osteotomy, the proximal ulna was predrilled with 3.2mm bit and then partially tapped for a 6.5mm AO cancellous bone screw. An intra-articular olecranon osteotomy was made in a shallow V or Chevron fashion in the center of the olecranon sulcus that is approximately 2cm from the tip of the olecranon. The location was best identified by elevation of the anconeus muscle on the olecranon to directly visualize the articular surface. A sponge was placed from lateral to medial and used as a counter traction of the osteotomy created with thin bladed oscillating saw and completed with a thin bladed osteotome. The osteotomized olecranon fragment was elevated proximally leaving a margin of the triceps tendon on either side to suture upon completion of the surgery. (The exact nature of the intra-articular fracture pattern gets revealed itself only at this juncture). The fracture hematoma was cautiously removed.

Fragments of the humerus were assembled in 3 steps –

i. Reduction and fixation of condyle together.
ii. Fix the medial or lateral epicondylar ridge to the humeral metaphysis, if it is fractured.
iii. Reassembled condyles are fixed to the humeral metaphysis.

Reduction and fixation of the condyles: Condyles were reduced and held with a bone holding clamp. Reduced condyle was provisionally fixed with Kirschner wire. AO cancellous screw was inserted across the reduced Condyles. Reduction and fixation of the condyles to metaphysis. Reduction and temporary stabilization of the medial and lateral columns was done by using crossed Kirschner wire. Medial and lateral pillars were reconstructed using countered 3.5mm reconstruction plate and screws. To enhance the mechanical strength the plates were placed as closed to 90° to each other as possible. The stability of the internal fixation was tested by putting the elbow through a range of motion. The olecranon osteotomy was reduced under direct vision and held with reduction clamp. Two 2mm k wires were introduced from the tip of the olecranon. Periosteum was stripped from the shaft of the ulna distal to the osteotomy site and transverse hole was drilled approximately 3-5cm distal to osteotomy site. A No.18 stainless steel malleable wire passed through thin transverse hole and crossed over the posterior surface of the olecranon in a figure of eight manner and then passed around the k-wires and tightened. At the completion of the fixation the elbow was again put through a range of motion to test the security of the internal fixation. The tourniquet was let down and hemostasis carefully secured over a large suction drain the wound was closed in layers. Pressure bandage was applied and limb immobilized with above elbow POP Posterior above Elbow slab.

After treatment

Patients were instructed to keep the limb elevated and move their fingers and elbow joint. Suction drain was removed after 24-48 hours. Wound was inspected after 3-4 days postoperatively. Antibiotics and analgesics were given to the patient till the time of suture removal. Suture/staples were removed on the 11th postoperative day and check X-ray in anteroposterior and lateral views were obtained. Later patients were discharged with above elbow POP Posterior above Elbow slab and advised to perform shoulder and finger movements. Patients were advised to remove posterior slab and do intermitted elbow movements exercise and not to lift heavy weight or exert the affected upper limb.

Follow-up

After discharge, patients were advised to report for follow up

after 6 weeks and 12 weeks and thereafter every 3 months. The results were assessed 3 & 6 months after the procedure. At follow up a detailed clinical examination was done and patients were assessed subjectively for the symptoms like pain, swelling and restriction of joint motion.

Patients were instructed to carry out physiotherapy in the form of active flexion-extension and pronation-supination without loading. The functional assessment of the patient was done according to – Mayo elbow performance score.

Results and Observations

The study consists of Adult Patients having distal humerus fractures involving articular surface who are admitted to SSG Hospital, Vadodara attached to Baroda Medical College after obtaining their informed written consent. This is a prospective study from 2010 to 2012.

Table 1: Age Group

Age Group	No. of Patients	Percentage
18 to 20	5	16.66%
21 to 30	9	30%
31 to 40	6	20%
41 to 50	6	20%
51 to 60	4	13.33%
Total	30	100%

Table 2: Sex Incidence

Sex	No. of patients	Percentage
Males	25	83.33%
Females	5	16.67%
Total	30	100%

Table 3: Occupation

Occupation	No. of Patients	Percentage
Student	6	20%
Farmer	4	13.33%
housewife	2	6.67%
Labourer	18	60%

Table 4: Mode of Injury

Mode of Injury	No. of Patients	Percentage
Road Traffic Accidents	19	63.33%
Fall	11	36.67%
Total	30	100%

Table 5: Side Involvement

Side	No. of patients	Percentage
Left	14	46.67%
Right	16	53.33%
Total	30	100%

Table 6: Type of Fracture

Fracture Type	No. of Patients	Percentage
Type 3	16	53.33%
Type 4	14	46.67%
Total	30	100%

Table 7: Type of Fixation

Type of Fixation	No. of Patietns	Percentage
Anatomical Plate	24	80%
3.5DCP + 1/3 Tubular Plate	6	20%
Total	30	100%

Table 8: No. of Columns Fixed

No. of Columns	No. of Patietns	Percentage
One	3	90%
Two	27	10%
Total	30	100%

Table 9: Average Injury to Surgery Interval

Injury to Surgery Interval	No. of Patients	Percentage
One	0	0%
Two	1	3.33%
Three	0	0%
Four	1	3.33%
Five	16	53.33%
Six	4	13.33%
Seven	6	20%
Eight	1	3.33%
Nine	1	3.33%
Total	30	100%

Table 10: Average Time Taken in OT

Time Taken in OT	No. of Patients	Percentage
1 hr	0	0%
1.5 hrs	12	40%
2 hrs	11	36.67%
2.5 hrs	6	20%
3 hrs	1	3.33%
Total	30	100%

Table 11: Average Hospital Stay

Hospital Stay (In days)	No. of Patients	Percentage
0 to 5	1	3.33%
5 to 10	0	0%
10 to 15	16	53.33%
16 to 20	13	43.33%
Total	30	100%

Table 12: Complications

Complications	No. of patietns
Superficial Infection	1
Non Union	1
Radial Nerve palsy	1

Table 13: Pain Intensity

Pain Intensity	No. of Patients	Percentage
None	28	93.33%
Mild	2	6.67%
Moderate	0	-
Severe	0	-
Total	30	100%

Table 14: ARC of Motion

ARC of Motion	No. of Patients	Percentage
Arc > 100 degree	0	-
Arc 50 to 100 degree	15	50%
Arc < 50degree	15	50%
Total	30	100%

Table 15: Stability

Stablilty	No. of Patients	Percentage
Stable	29	96.67%
Moderatelly Instable	0	-
Grossly Instable	1	3.33%
Total	30	100%

Table 16: Function at Final Follow Up

Funcations	No. of Patients	Percentage
Comb Hair	19	63.33%
Feed	21	70%
Hygine	28	93.33%
Don Shirt	2	6.67%
Don Shoe	14	46.67%
Total	30	100%

Table 17: Grading of Results

Results	No. of Patients	Percentage
Excellent	4	13.33%
Good	20	66.67%
Fair	4	13.33%
Poor	2	6.67%
Total	30	100%

Discussion

In our study 24 cases of intercondylar fractures of distal humerus were treated with two Anatomical plates and 6 cases of intercondylar fractures of distal humerus were treated with combinations of 3.5 DCP & 1/3 Tubular Plate. Our experience with these methods of fixation has given favorable results. The findings, the end results and various other data have been analysed and compared in the following discussion.

Age Incidence

In our study fractures were commoner in the 2nd and 3rd decade with average age being 35 years (18-60).

In the studies conducted by M. Broad ford Henley *et al* [1], Kun-Chuang wang, *et al* [2] and Liu. DiP. *et al* [3], following observations were made.

Table 18: Age incidence

Study	Average age
Kun-Chuang wang, *et al.*	47 yrs
M.Broadford Henley *et al* (1987)	32yrs
Liu DIP.et.al (2010)	39 yrs
Our study	35 yrs

Sex

In our study there were 25 male patients (83.33%) and 5 female patients (16.67%).In the studies conducted by Liu. DiP. et. Al [3] & Ozer H. et. Al [4] following observations were made-

Table 19: Sex

Study	MALE	FEMALE
Liu DIP.et.al (2010)	12(57.14%)	9(42.86%)
Ozer H.et.al(2006)	11 (54.54%)	05(45.46%)
Our study	25 (83.33%)	5(16.67%)

Mechanism of Injury

In our series 36.67 of the cases were due to direct fall and 63.33% of cases had road traffic accident.

In the studies conducted by Liu DIP.et.al [3] & Kun-Chuang Wang, *et al*[2] following observations were made:

Table 20: Mechanism of injury

Study	RTA	Direct fall
Liu DIP.et.al (2010)	28.57%	71.43%
Kun-Chuang Wang(1994)	70%	30%
Our study	63.33%	36.67%

Side Involvement

We accounted about 53.33% incidence of fractures in right side and 46.67% of the fracture in left side, which is also comparable to other studies.

In the studies conducted by M.Broadford Henley *et al* [1] and Kun-Chuang wang, *et al* [2] following observations were made:

Table 21: Side involvement

Study	Rt. side	Lt. Side
M.Broadford Henley *et al.* (1987)	45%	55%
Kun-Chuang wang, *et al.* (1994)	70%	30%
Our study	53.33%	46.67%

Type of fractures: (Riseborough Radin Classification)

In our series we accounted no cases of fractures of RR type I and RR type II, 53.33% fractures of RR type III and 46.67% fractures of RR type IV. Our study is comparable to the studies conducted by the authors as in table.

Table 22: Type of fracture

Study	RR Type I	RR Type II	RR Type III	RR Type IV
M.Bradford *et al* (1987)	3(9%)	4(12%)	14(43%)	12(36%)
Our study	-	-	16(53.33%)	14(14.67%)

Type of Fixation

In this series 24 (80%) patients were fixed with Anatomical plates and 6 cases (20%) patients were fixed with 3.5DCP + 1/3 Tubular Plate.

In our series in 3(10%) Patients One coloumn was fixed and in 27(90%) patients both the coloumn were fixed.

Injury to Surgery Interval

In our study average injury to surgery interval was found 4.44 days with maximum of 16(53.33%) days and minimum of 1(3.33%) day.

Duration of Surgery

In our study Average duration of Surgery was 1.93 hours with maximum of 3 hrs and minumum of 1 hr.

Hospital Stay

53.33% patients were discharged within 15 days after suture removal, adequate mobilization and proper instruction. 43.33% patients were discharged after suture removal within 16-20 days. The Average duration of Hospital stay was 14.73 days (15 days).

Assessment of Pain

In our study, 28(93.33%) patients did not complaint of any pain and only 2(6.67%) patients complained of mild pain at final follow-up.

Arc of Motion

In our study, 15(50%) patients could move their elbow with an arc of 50-100 degrees and 15 patients could move their elbow with an arc of less than 50 degrees. None of the patients could move their elbow with an arc of more than 100 degrees.

Stability

In our study, elbow joint of 29(96.67%) patients was stable and of only 1(3.33%) patient was grossly unstable at final follow up.

Funcational Assesment at Final Follow up

In our study, as per the Mayo Elbow performance score five

function were taken into account, out of which 28(93.33%) patients could do daily hygine work by themselves. 19(63.33%) patients could comb their hair by themselves, 21(70%) patients could feed by their own. 14(46.67) patients could Don their shoes by their own and only 2(6.67%) patients could Don their shirts by their own.

Functional Outcome

In our study functional outcome based upon Mayo [5] Elbow Performance Score is excellent in 4 patients (13.33%), good in 20 patients (66.67%), fair in 4 patients (13.33%), poor in 2 patients (6.67%).

Our study is comparable to the studies conducted by Teng-Le Huang. *et al* [6], K. Reising *et al* [7] & Ibomcha Singh *et al* [08]

Table 23: Functional outcome

Study	Good/ Excellent scores (based on MEPS)
Teng-Le Huang –et-al (2004)	87.5%
I Ibomcha Singh *et al* (2004)	81.8%
K. Reising *et al* (2009)	85%
Our study	80%

Complications

In our series we had a case of superficial infection which resolved with appropriate antibiotics.

One case of Radial Nerve Palsy was noted which was treated conservatively with radial nerve palsy splint. Even at 8 months of follow up patient could not attain full finger and wrist movements.

One patient had fracture non union in which 3.5 DCP & 1/3 Tubular Plate were removed and internal fixation with two Anatomical reconstruction plate with artificial bone grafting was done and was called for regular follow up. At the end of 6 months of revision surgery the patient scored 85 which is graded as Good as per Mayo Elbow Performance Score

In the study Soon JL *et al* [9] reported 4% superficial infection 7% of neuropraxia, 5% of implant failure, 2% of non union and 4% incidence of Heterotropic ossification.

Table 24: Complication

Study	Superficial Infection	Radical Nerve Palsy	Non union	Heterotropic ossification	Implant failure	Ulnar neuropraxia
Soon JL *et al*	6.66%	NIL	6.66%	NIL	NIL	13.33%
Our study	3.33%	3.33%	3.33%	NIL	NIL	NIL

Our results are comparable to the work reported in the literature.

Conclusion

In this study carried out in 30 distal humerus fractures we came to the following conclusions:

- Open reduction internal fixation should be done as early as possible. Delay in open reduction internal fixation with delayed soft tissue dissection leads to increased chances of elbow stiffness due to periarticular fibrosis.
- For a successful internal fixation of closed distal humeral fracture, it is necessary to maintain anatomic and stable reconstruction of the articular surface and of both humeral columns using two parallel/ $90\text{-}90^0$ plates. Operative treatment with rigid anatomical internal fixation should be the line of treatment for all grades of Riseborough Radin[10] Intercondylar fractures, more so in young adults as it gives best chance to achieve good elbow function.
- Early Vigorous, active physiotherapy is a must for good results. Stable fixation allows early, active and aggressive postoperative mobilisation.

References

1. Henley Bradford M. Intra-articular distal humeral fractures in adults. Orthop Clin North Am. 1987 ; 18(1):11-23.
2. Kun-Chuang Wang, Hsin-Nung Shih, Kuo-Yao Hsu, *et al*. Intercondylar fractures of the distal humerus: routine anterior subcutaneous transposition of the ulnar nerve in a posterior operative approach. J of Trauma. 1994; 36(6):770-773.
3. Liu D, Li P. investigate the method and clinical effect of double-plating fixation in treatment of distal humerus fractures. Orthopedic Center, the First Hospital of Xinjiang Medical University, Urumchi Xinjiang, 830054, P.R. China: Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi. 2010; 24(6):680-2.
4. Ozer H, Solak S, Turanli S, Baltaci G, Colakoglu T, Bolukbasí S. Arch Orthop Trauma Surg. 2006; 126(8):574.
5. Holdsworth BJ, Mossad MM. Fractures of the adult distal humerus. J Bone Joint Surg Br. 1990; 72:362-365.
6. Teng-Le Huanga, Fang-Yao Chiua, Tien-Yow Chuangb, Tain-Hsiung Chen. Surgical treatment of acute displaced fractures of adult distal humerus with reconstruction plate Injury, Int. J Care Injured. 2004 35:1143-1148.
7. Reising K, Hauschild O, Strohm PC, Suedkamp NP. Stabilisation of articular fractures of the distal humerus: Early experience with a novel perpendicular plate system Injury. 2009; 40(6):611-617.
8. I Ibomcha Singh, Sanjib Waikhom. Indian Journal Of Orthopedics. 2004; 38(2):110-112.
9. Soon JL, Chan BK, Low CO. Surgical fixation of intra-articular fractures of the distal humerus in adults 2004; 35(1):44-54.
10. Riseborough EJ, Radin EL. Intercondylar T fractures of the humerus in the adults. J Bone Joint Surg Am. 1969; 51:130-138.