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A study of functional outcome of distal humerus fractures managed by locking compression plate

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Abstract
Introduction: Fractures of the distal humerus are rare and complex injuries. The complex shape of the elbow joint, the adjacent neurovascular structures, the sparse soft tissue cover combine to make treatment difficult. Distal humerus locking plates provides greater stability by permitting multiple screws in distal fragment there by overcoming some of the limitations of conventional plates.
Methodology: 20 patients of distal humerus fractures treated by distal humerus plates with a mean follow up of 6 months from January 2015 to June 2016 in adichunchanagiri institute of medical sciences and research centre and results were assessed using mayo elbow performance score
Results: The sample consisted of twenty patients with 15 males and 05 were female. The patients' ages ranged from 21-70 years with a mean age of 40.25 years. The causes of fractures were motor vehicle accident in 13 patients and fall in 07 patients. There were no sports or industrial accidents. 12 fractures involved the left side and 08 involved the right. The average number of days from injury to surgery was 3.2 days with a range of 1 to 06 days. The operative time ranged from 60 minutes to 150 minutes. Patients were followed up for 6 months. 2 patients had elbow stiffness, 1 case each of ulnar neuropathy, and superficial infection.
Conclusion: We conclude that anatomically pre-shaped distal humerus locking plate system gives promising results in terms of functional outcome, range of movement and stability of the elbow by providing stable fixation for complex distal articular fracture and facilitating early postoperative rehabilitation.

Keywords: distal humerus plates, distal humerus fractures, mayo elbow performance score

Introduction
Fractures of the distal humerus are rare injuries and account for approximately 2–6% of all fractures and about 30% of all elbow fractures. The fracture patterns being mainly distributed bimodally, differentiating between young male and elderly female patients [1].
Open fractures are common due to thin soft tissue coverage [2]. Fractures of distal humerus are among the most common problems that orthopaedic surgeons encounter for multiple reasons, including the multifaceted articular anatomy of the distal humerus with three separate articulations: the proximity of neurovascular structures, the frequent incidence of metaphyseal bone loss and significant comminution, and the common tendency of the elbow towards capsular stiffness and heterotopic ossification. Appropriate treatment should be based on a classification that describes the fracture pattern, which is easily reproducible and allows development of treatment guidelines [3, 4].
Over the past two decades, the Muller AO Classification has been the most accepted classification in the literature since it is reproducible and allows not only descriptive, but also treatment guidelines for each defined type of fracture. Historically, these injuries were treated by means of closed reduction and slinging ("bag of bones" technique) because the results of open reduction and internal fixation were very poor [5].
Given the advances in techniques of open reduction and internal fixation with the goal of anatomic restoration and early mobilization, the standard of care has shifted to open treatment of this injuries [6].
Reconstruction of the articular surface of the distal humerus and rigid internal fixation for early range of motion (ROM), is the main prerequisite to improve functional results and avoid joint arthrosis. The risk of functional impairment following a displaced distal humeral fracture

is high, and it is now generally accepted that the most favorable outcome of these intraarticular fractures is provided by surgical reconstructive procedure [7, 8]

Conventional implants and techniques have not been able to completely address the problem of implant failure and substantial stability in the small distal osteoporotic fragments [9, 10] The high failure rate is due to insufficient area for insertion of ample number of screws in a small sized distal fragment, resulting in poor stability at the bone-plate interface [11, 12]

Aims and Objectives

1. To study the outcome of surgically managed fracture of distal humerus using locking compression plate
2. To study the efficacy, technical requirements, functional results, radiological results, pitfalls, complications and outcomes
3. To re-establish the anatomy of articular surface of distal humerus and elbow joint perfectly by operative treatment with internal fixation
4. To assess the union of fractures after surgical treatment
5. To assess the range of movement of elbow joint after surgical management

Materials and Methods

Procedure: Patients with distal humerus fractures, who are admitted in Sri Adichunchanagiri Institute of Medical Sciences, B.G. Nagara, will be taken for study after obtaining their consent.The study is a clinical, prospective and observational study.

Inclusion Criteria

1. Patients aged > 18yrs
2. Patients with both intraarticular and extraarticular fractures of distal humerus
3. Gustillo-Anderson type I compound distal humerus fractures.

Exclusion Criteria

1. Patients medically unfit for surgery.
2. Patients below 18 years of age.
3. Gustillo-Anderson type II and III compound distal humerus fractures are not included.
4. Pathological fractures other than osteoporosis.

Follow UP: **follow up** of the case will be done for a period of 24 months with 6 visits (6 weeks, 3 months, 6 months, 12 month, 18 month and 24 months).

Statistical tool used to analyse the data: spss version 12

Results

Table 1: Age Distribution in Present Study (n=20)

Age Group (Years)	No. Of Patients	Percentage
18-35	9	45%
36-45	5	25%
46-55	3	15%
56-65	2	10%
>65	1	5%
TOTAL	20	100%

In the present study majority (45%) of the patients fall in the age group of 18-35 years

Table 2: Sex Distribution In Present Study (n=20)

Sex	no. of patients	Percentage
Male	15	75
Female	5	25
Total	20	100

In the present study males (75%) were the predominant victims.

Table 3: Side Involvement In Present Study (n=20)

Side	No. Of Patients	Percentage
Right Upper Limb	8	40
Left Upper Limb	12	60
Total	20	100

In the present study left upper limb was most commonly involved (60%) than the right upper limb (40%)

Table 4: Distribution of Sample by Type of Fracture (Classification)

Sl.no	Classification	No of pateints	percentage
1	AO-13C3	5	25%
2	AO-13C2	12	60%
3	AO-13C1	3	15%

In the present study out of 20 patients 12 (60%) cases were AO-C2 type fractures, 5 (25%) wereAO-C3 fractures and 3(15%) were AO-C1 fractures.

Table 5: Time of Fracture Union In Present Study (n=20)

Time Of Fracture Union	No. Of Patients	Percentage
8-12weeks	6	30
13-16weeks	11	55
16-24weeks	2	10
>24weeks	1	5
Non Union	0	0

In the present study union occurred in 55% of the patients in 13-16 weeks and 30% of the patients in 16-24 weeks

Table 6: results in present study (n=20)

Mayo Elbow Performance Score(Total Score-100)	No. Of Patients	Percentage
Excellent(>90)	15	75
Good(75-90)	3	15
Fair(60-74)	1	5
Poor(<59)	1	5

In the present study 15(75%) patients had excellent results, 3(15%) patients had good results, 1(5%) patients had fair results and 5(5%) patients had poor results.

Discussion

Our study comprised of twenty patients with distal end humerus fractures who were treated by distal humerus locking compression plates. Overall final outcome was assessed in terms of regaining the elbow function using MEPS score.

Age distribution

In our study average age was 40.25 years. Rakesh Kumar Gupta *et al* 90 in their study found that average age was 38.4 years. Singh Vet al106 in their study found that average age was 37.5 years. Kamrani set al85 in their study found that average age was 46 years. Our results are comparable with these studies

Side involvement

In our study left side 12(60) was commonly involved tan the right side 8(40) In the study conducted by Singh V *et al* 106 left side was involved in 16(59.25%) cases and right side in 11(40.7%), Schmidt-Horlohé K H *et al* 91 in their study found

involvement of left side in 21(54%) cases and right side in 18(46%), Kamrani *et al* 85 found left side involvement in 10(52.64%) and right side in 9(47.36%). Our results are comparable with these studies

Sex distribution

In our study there were 15(75%) males and 5(25%) females, which is comparable with the studies conducted by Kiran G U *et al* 107 and Riyaz sheik *et al*109 which showed 14 (70%) males and 6(30%) females and also with the study conducted by Ata Can Atalar *et al*72 which showed 14 (66.67%) males and 7(33.33%) females

Table 7: Time of fracture union

Series	Average time of union	Non union
In our study n=20	14.5 weeks	nil
Kiran G U *et al* (2017) n=20	16.4 weeks	nil
Muzaffar N *et al* (2014)[14] n=25	12.56 weeks	nil
Singh V *et al* (2016) n=27	12.8 weeks	nil

Table 8: Range of motion of elbow

Series	Mean elbow range of motion
In our study n=20	116
Imran mangi *et al* (2014) n=25	110
Schmidt-Horlohé K H *et al* (2013) n=39	105
Abishek Mishra *et al* (2015) n=20	105

Table 9: Comparative study of functional evaluation in present Study

Series	Excellent	Good	Fair	Poor
In our study n=20	15(75%)	3(15%)	1(5%)	1(5%)
Abilhek Mishra *et al* (2015) n=20	15(75%)	3(15%)	1(5%)	1(5%)
Imran mang *et al* (2014) n=25	12(48%)	8(32%)	3(12%)	2(8%)
Singh V *et al* (2016) n=27	4(14.81%)	13(48.14%)	7(25.9%)	3(11.11%)

In our study excellent results were found in 75%, good results in 15%, fair in 5% and poor results in 5% cases.

Abilhekh Mishra *et al*. [16] in their study of 20 patients found the results as excellent in 15(75%), good in 3(15%), fair in 1(5%) and poor in 1(5%)

Imran mang *et al*. [13] in their study of 25 patients found excellent results in 12(48%), good in 8(32%), fair in 3(12%) and poor in 2(8%)

Singh V. [15] *et al* 106 in their study of 27 patients found the results as excellent in 4(14.81%), good in 13(48.14%), fair in 7(25.9%) and poor in 3(11.11%)

Our study is closely comparable with these above mentioned studies.

Conclusion

Distal humerus fractures are complex fractures and represent 2% of all fractures. Despite being uncommon, distal humerus fractures pose the greatest challenge in terms of surgical fixation and absolute anatomical reduction. Good functional outcomes are expected with articular surface restoration, reconstruction of elbow joint and early rehabilitation Thus locking compression plate is an optimal tool for distal humerus fractures, it provides rigid fixation in the region of distal humerus where thin cortices, poor bone stock and articular comminution makes fixation difficult In our series we treated 20 patients of distal humerus fracture with open reduction and internal fixation with distal humerus plates and functional outcome is good to excellent in 90% patients.

From the experience of our study we find that early open reduction and rigid internal fixation with dual plates in orthogonal fashion followed by early post-operative mobilization are to be recommended for the management of fractures of the distal humerus

To conclude locking compression plate is an important armamentarium in treatment of fractures of distal humerus, especially when fracture is severely comminuted and in situations of osteoporosis. However a more comprehensive study with longer follow-up periods is essential to throw more light into the advantages, complications and possible disadvantages of the use of locking compression plate with special attention to the long term outcomes

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