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, 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

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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 instability 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 humeral 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. Nagar, 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. Gustilo-Anderson type I compound distal humerus fractures.

**Exclusion Criteria**

1. Patients medically unfit for surgery.
2. Patients below 18 years of age.
3. Gustilo-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

| 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 patients | 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%) were AO-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: Mayo Elbow Performance score (Total score-100)**

| 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 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 all106 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 than 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-Horlohe 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)
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 al109 which showed 14 (70%)
males and 6(30%) females and also with the study conducted
by Ata Can Atalar et al72 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-Horloh K H et al (2013) n=39 | 105                      |
| Abilhek 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 mangi 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.
Abilhek Mishra et al. 10 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 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

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