Comparison of outcome of distal humerus fracture: Single extra articular humerus plating versus bipillar plating

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Abstract

Introduction: Distal humerus fractures are complex injuries as their management requires stable fixation and properly working adjoining joints. Management includes open reduction and internal fixation of distal humerus fractures with the use of available implants and their modification. Dual lock plating still has disadvantages of less hardware availability, their cost and also long surgical time wiht extensive soft tissue damage. The mainstay objective of this study is to evaluate the effectiveness and benefits of distal humerus fractures operated by using a single extra articular humerus plating versus bipillar plating.

Aims and Objectives: 1: Evaluation of Clinical and radiological Outcome of single extra articular humerus plating planned for distal humerus fractures. 2: Comparison of clinical outcome of single extra articular humerus plating than the bipillar plating planned for distal humerus fractures.

Materials and Methods: A retrospective clinical study was done on 40 patients with distal humerus fractures treated with single extra articular humerus plating and bipillar plating by trained single surgeon at a tertiary trauma care centre in the Department of Orthopaedics, BJ medical college, Civil hospital Ahmedabad between August 2016 and march 2018. The mean follow-up study time was approximately 13 months.

Observation and Results: All the operated patients were followed up for a mean time of about 13 months (range from 06 to 20 months). Clinical, physiological and ortho-radiological assessment was performed to observe and evaluate fracture stabilization and reduction and fracture healing and callus formation and range of movements. The Mayo Elbow Performance Score and visual analogue scale were used to asses functional outcome.

Conclusion: Proper Reduction with internal fixation still being considered the gold standard for treatment of distal humerus fractures. Extra articular plating however has better good prognostic results than bipillar plating. Early physiotherapy and early use of the elbow could improve the functional success outcome of this type surgery.

Keywords: Distal third humerus fractures, Locking plate, Plating of humerus, Extra-articular fractures of humerus.

Introduction

Fractures of distal humerus in adults comprise 2.4% of all fractures and constitute approximately 33% of all fractures of humerus, with an incidence of 6.3/100000 per year.[1] The most commonly observed mode of injury wasa simple fall from a standing height followedby road traffic accident and the most commonly observed pattern of fracture was that of an extra-articular fracture accounting for just under 40% of all distal humerus fractures and 3% of all types of fractures in adults. Modalties of maagemnt of distal humerus fractures commonly include – conservative nonoperative management like plaster cast and bracing while operative management includes plating or medullary nailing.[2,3] The main target was to achieve a stable and fully functional elbow joint. Posttreatment outcomes sometimes included pain with elbow stiffness and weakness in the limb. Operative management with intramedullary nailing is not much useful for fixation in the distal extra articular humerus fragment as it does not provide adequate stability to the joint.[4,5] Dual plating is generally accepted for management of such fracture patterns, as it provides a more stable type of fixation. This results in early range-of-motion (ROM) of the elbow. It is however associated with much soft tissue dissection and longer mean operating time, having disadvantage of development of non-union and post-operative infection.[6,7] Extra articular distal humerus plate has been one of the best option to overcome this problem. To decrease the surgical mean duration and soft tissue damage, a single extra articular distal humerus plate has been proposed for fixation.[8] The extra-articular distal humerus plate is considered the best for distal humerus fracture. Fixation of just one column of bone isenoughto provide adequate stability which therefore allows early range of motion. We have evaluated clinical, physiological, radiologicoutcome in our retrospective casestudyof extra-articular distal 1/3rd humerus fractures operated with single as well as bipillar plating.

Aims and Objectives

1. Evaluation of Clinical and radiological outcome of single extra articular humerus plating planned for distal humerus fractures.
2. Comparison of clinical outcome of single extra articular humerus plating than the bipillar plating planned for distal humerus fractures.

Materials and Methods

This randomized retrospective clinical study was conducted on 40 patients with distal extra articular

humerus fracture treated with single extra articular plating by trained single surgeon at a tertiary trauma care centre in the department of Orthopaedics, B.J. medical college, Civil hospital Ahmedabad between August 2016 and March 2018. These cases were selected for study randomly. Fracture patterns were classified on basis of AO/OTA classification of distal humerus fractures.

Inclusion Criteria:

1. Patients withextraarticular distal humerus fractures
2. Only closed fracture patient were included
3. Fresh trauma up to 2 weeks

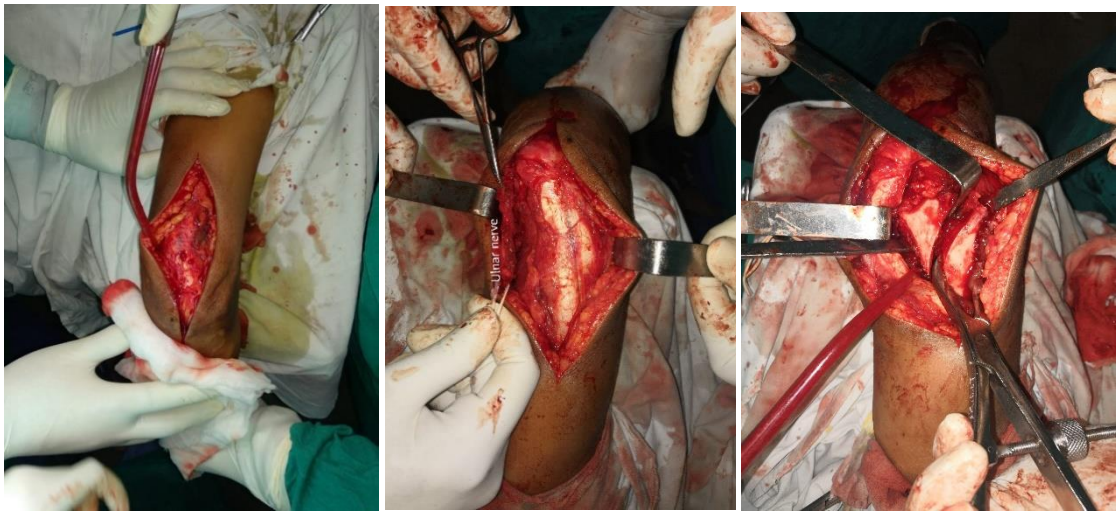
Exclusion Criteria:

1. Age less than 18 year and greater than 60 year excluded
2. Open fracture
3. Osteoporotic patients
4. Pathological fractures
5. Intra-articular fractures are excluded

40 consecutive patients with extra-articular distal 1/3rd humerus fractures presenting within 2 weeks of clinical injury who were operated with the single extra-articular distal humerus plate and bipillar between August 2016 and March 2018 were included in this retrospective study. The mean age of patients was 48 years (range 18–60 years). The mechanisms of injury included a fall when walking and from height in 28 (70%), RTA in 8 (20%), arm wrestling in 2 (5%), sports activity in 2 (5%).

The standard AO classification was used. The surgery was done without using tourniquet and the patient lying in lateral position. All the operations were done by a single operating surgeon of our department in B.J. Medical college. Posterolateral approach was used for plating. The post-operative day one passive mobilization and physiotherapy of elbow and shoulder was given once pain was decreased. Active physiotherapy and assisted exercises were allowed after the radiologically bone union seen on x-ray and clinically absence of pain over fractured site. All the patients were followed after 15 days for suture removal and later on every monthly for ortho-clinico-radiological correlation till fracture got united. Union of fracture was defined as formation of bridging callus on two radiographic antero-posterior and lateral views and clinically defined as no pain at fracture site. Clinical examination and follow up included patient satisfaction, visual analogue scale, range of motion over elbow joint, and mayo elbow performance score (MEPS) was used for functional assessment of elbow and shoulder joint. Daily activities were allowed after one month post-operation but lifting of light weight was allowed once after radiological bone union seen at fracture site.

Surgical Technique: All the patients were given lateral position on operating table with injured extremity hanging over bar making 120 degree flexion at elbow joint. patients body is stabilized by giving side supports on operating table and intraoperative c-arm visualization. Tourniquets were not used and painting and draping was done in standard fashion. Posterolateral approach was used and skin incision was done over posterolateral aspect of arm which is distally extending in between lateral epicondyle and olecranon 2.5 cm distally to elbow joint. Triceps was spited and lifted to reach fracture site.[12] Proximally, tissue in between the long and lateral headsof triceps were dissected carefully to identify, isolate and separate radial nerve. Periosteum was isolated through use of periosteum elevator andproximal and distal humerus was aligned and fracture was reduced with the use of reduction clamps and plate was placed followed by fixingthe plate with the use of locking and hcs screw.



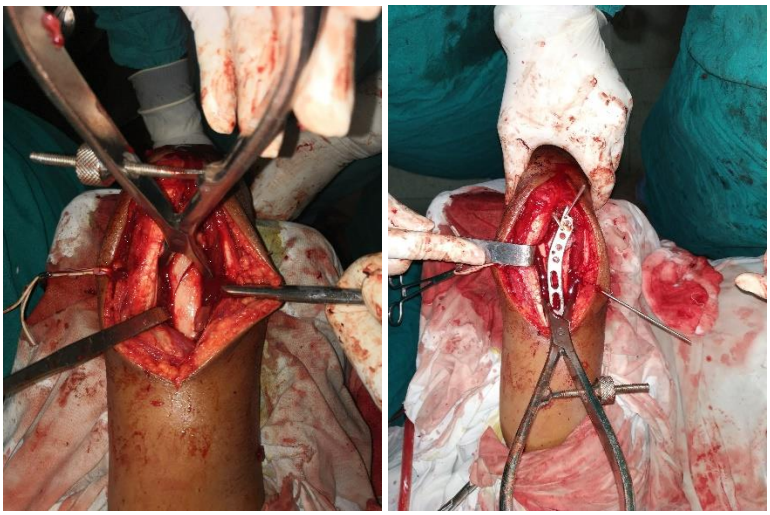


Fig. 1: Intra-operative clinical

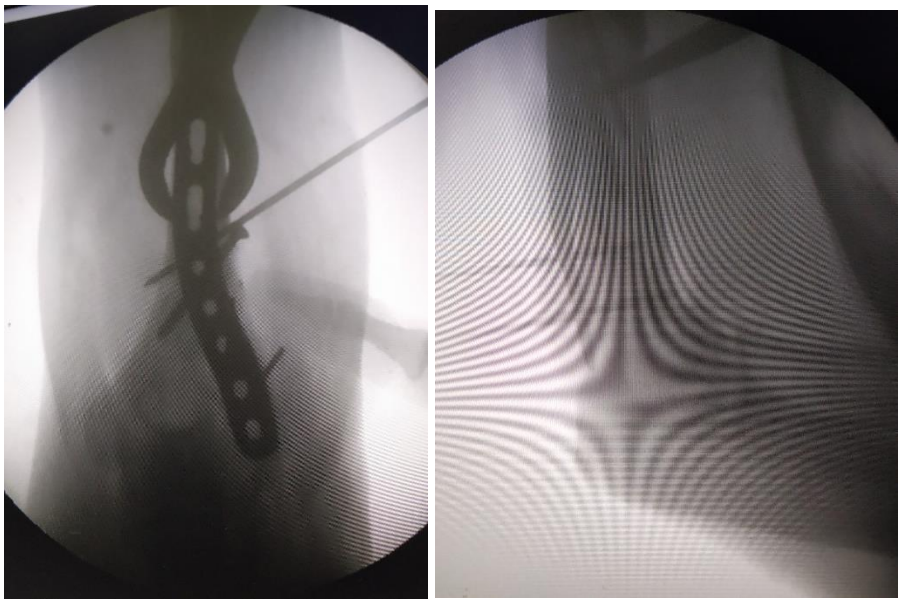


Fig. 2: Intra-operative IITV shoot

Observations and Results

1. 40 patients having distal humerus fracture managed with single extra articular plating and bipillar were selected.
2. The age of patients varied between 18-60 mean being 48.
3. 25 of them were male while 15 were female.
4. In all of them, mode of injury was fall down from height and RTA that are high velocity injury.
5. Mean time of operation was 10 days from admission.
6. Average operating time was 90 ± 10.5 min (70–120 min) for extra articular single plating while 115 ± 15 in (60-230 min) for bipillar plating.
7. Hospital stay varied from 6 days to 20 days, mean being 12 days.
8. Average time of callus formation was found to be 22.4 weeks. Concomitant injuries didn't hamper the bone healing but soft tissue recovery occurred in an uneventful manner.

The mean surgical time was approximately 90 ± 10.5 min (70–120 min) for extra articular single plating while 115 ± 15 in (60-230 min) for bipillar plating. All the patients were regularly followed up and mean followed up time was 13 months (range from 06 to 20 months). Out of 40 patients having extra articular distal humerus fracture, 38 fractures were united with mean time around 22.4 weeks (range 16-29 weeks). Bone Union was defined asclinically absence of pain at fracture site and radiologically bridging callus formation on both antero-posterior and lateral radiographic view. One patient (2%) have non-union at fracture site which require revision surgery with bone grafting. One patient (2%) having post-operative infection which is covered with higher antibiotics and later on patient got recover. One patient operated with bipillar plating developed plate impigment but needed

nofurther management. In our study no patient have any complain of implant impingement or no need of any type of implant removal needed. At the end in our study in final follow up, the Mayo Elbow Performance Score (MEPS) range 95–100 with 90% cases (*n* = 36) patient operated with extra-articular single plating (n=19) and patient operate dwith bipillar plating (n=17) showing excellent scores and 10% cases (*n* = 4) patient operated with extra-articular single plating (n=2) and patient operate dwith bipillar plating (n=2) showing a good score. All the patients can mobilise their elbow fully and the mean flexion at elbow joint is 143.5 degree and can do routine daily activity without any problems. In our study no radial nerve injury, limb shortening was observed.

Table 1: Mayo elbow performance score

Mayo elbow performance score (N = 100 points)	
PAIN (maximum 45 points)	
None	45
Mild	30
Moderate	15
Severe	0
Range of Motion (maximum 20 points)	
Arc >100*	20
Arc 50-100*	15
Arc<50*	5
STABILITY (maximum 10 points)	
Stable	10
Moderately unstable	5
Grossly unstable	0
FUNCTION (maximum 25 points)	
Able to comb hair	5
Able to feed oneself	5
Able to perform personal hygiene tasks	5
Able to put on shirts	5
Able to put on shoes	5

Table 2: Interpretation mayo elbow performance score

Interpreting the mayo elbow performance score	
Score greater than 90	Excellent
Score 75-89	Good
Score 60-74	Fair
Score below 60	Poor

Table 3: Interpretation mayo elbow performance score in our study

Mayo Elbow Performance Score (MEPS)	**Interpretation**	**Patients operated with Extra-articular single humerus plating**	**Patients operated with bipillar plating**
Score greater than 90	Excellent	19	17
Score 75-89	Good	2	2
Score 60-74	Fair	0	0
Score below 60	Poor	0	0

Table 4: Post operative complication in our study

Post operative complication	**No of patients**
Radial nerve palsy	0
Post operative infection	1
Myositis ossification	0
Implant failure	0
Compartment syndrome	0
Non union	1
Plate impigment	1

Table 5: Comparison in between single vs bipillar plating

Parameters	**Single extra articular palting**	**Bipillar plating**
Surgical mean time	90 ± 10.5 min (70–120 min)	180 ± 40ml
Average blood loss	180 ± 40ml	210 ± 40ml
Plate impigment	O patient	1 patient

Case 1: 51 year male closed fracture humerus left side due to road traffic accident

Fig. 3: X-ray showing distal humerus fracture

Follow up x-ray after 1 month of follow up

Fig. 4

Fig. 5: Clinical outcome of patient and range of movements

Case 2: 38 year female closed fracture distal shaft humerus left side due to fall from height

Fig. 6: X-ray showing disatl humerus fracture left side

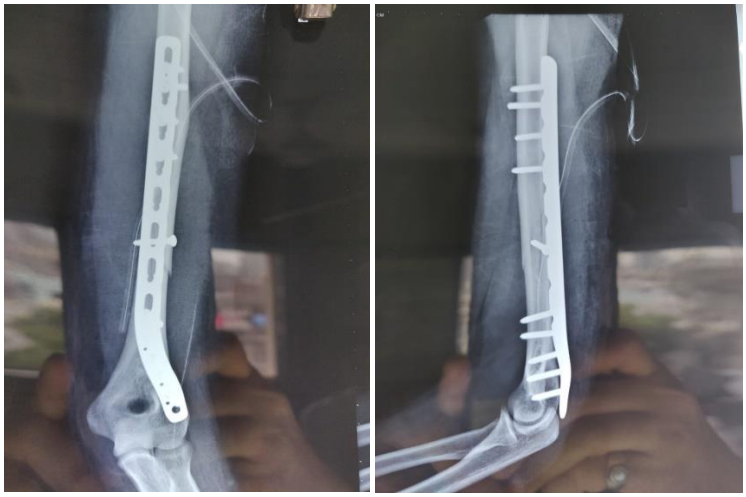


Fig. 7: Immediate post-operative x-ray of same patient

Fig. 8: Clinical outcome of patient and range of movements

Discussion

The needs for definitive management of distal humerus extra articular fracture are demanding and complex.[9] Disadvantages like malunion, skin problems, malunion, functional bracing is outdated in this type of fracture.[4,10] Extraarticular distal humerus fractures have a special problem. Fractures near elbow joint required stable fixation allowing early post-operative rehabilitation and physiotherapy and movements at elbow joint. Earlier literature suggested the use of conventional plating at 5 degree to 8 degree off centre from long axis of humerus shaft to stabilize distal fracture pieces but due to obliquity of plate limited the proximal fixation. Dual plating is also one of the conventional methods to reduce this type of fracture pattern but have some disadvantages like extensive soft tissue damage, chances of non-union, longer mean surgical timing, increased risk of infection.[6,7] Recently studies on extra articular distal humerus fracture managed with the use of single extra articular distal humerus plating shows excellent results like less surgical mean timing, less soft tissue damage, less chances of infection, which all promotes faster facture healing.[11,13] Extra articular distal humerus fracture managed with single plating have average mean time for fracture union around 22.4 weeks (range 15-29 weeks). Union defined as bridging callus formation on two radiographic AP and LATERAL views and clinically absence of pain at fracture site. all the patients have a satisfactory elbow function both flexion, extension and supination and pronation with excellent (90%) and good (10%) MEPS score. Early physiotherapy was stared in all patients. iatrogenic radial nerve palsy is uncommon in the operative treatment of extra articular humerus humeral fractures,[11,13] In our study, there were no post-operative radial nerve palsies noted.

In our post-operative management patients were given humerus slab for immobilization promoting bone healing but every week patient was advised to remove slab and allowed mobilization and active and assisted physiotherapy was given. This improved early recovery of movements at elbow joint allowing daily activities. Excellent results were achieved and observed with use of single extra-articular distal humerus plating.

Conclusion

Our study supportes and proves the use of single extra-articular humerus plating as a cost effective and patient friendly modality in management of extraarticular distal humeral fractures. both single extra articular plating and bipillar plating are good for this type of fracture, however single extra articular plating is more advantageous having benefits like less soft tissue damage, low cost, less mean surgical timing and less chances of infection. This type of single plating is our treatment of choice now a days for this typeof extra articular distal humerus fractures and is also recommended.

References

1. Aitken GK and Rorabeck CH.Distal humeral fractures in the adult. *Clin Orthop Relat Res*. 1986;207:191–7.
2. Levy JC, Kalandiak SP, Hutson JJ, Zych G. An alternative method of osteosynthesis for distal humeral shaft fractures. *J Orthop Trauma*. 2005;19:43-7.
3. Ali E, Griffiths D, Obi N, Tytherleigh-Strong G, Van Rensburg L. Nonoperative treatment of humeral shaft fractures revisited. *J Shoulder Elbow Surg.* 2015;24:210-4.
4. Fjalestad T, Strømsøe K, Salvesen P, Rostad B. Functional results of braced humeral diaphyseal fractures: Why do 38% lose external rotation of the shoulder? *Arch Orthop Trauma Surg*. 2000;120:281-5.
5. Sarmiento A, Horowitch A, Aboulafia Aand Vangsness CT. Functional bracing for comminuted extra-articular fractures of the distal third of the humerus. *J Bone Joint Surg Br*. 1990;72:283–7.
6. Prasarn ML, Ahn J, Paul O, Morris EM, Kalandiak SP, Helfet DL, et al. Dual plating for fractures of the distal third of the humeral shaft. *J Orthop Trauma*. 2011;25:57-63.
7. Sharaby M, Elhawary A. A simple technique for double plating of extraarticular distal humeral shaft fractures. *Acta Orthop Belg.* 2012;78:708-13.
8. Scolaro JA, Matzon JL, Mehta S. Tips and techniques-surgical fixation of extra-articular distal humerus fractures with a posterolateral locking compression plate. *Univ PA Orthop J*. 2009;19:103-8.
9. Pehlivan O.Functional treatment of the distal third humeral shaft fractures. *Arch Orthop Trauma Surg*. 2002;122:390-5.
10. Papasoulis E, Drosos GI, Ververidis AN, Verettas DA. Functional bracing of humeral shaft fractures. A review of clinical studies. Injury. 2010;41:e21-7.
11. Fawi H, Lewis J, Rao P, Parfitt D, Mohanty K, Ghandour A. Distal third humeri fractures treated using the Synthes™ 3.5-mm extra-articular distal humeral locking compression plate: Clinical, radiographic and patient outcome scores. *Shoulder Elbow*. 2015;7:104-9.
12. Scolaro JA, Voleti P, Makani A, Namdari S, Mirza A, Mehta S. Surgical fixation of extra-articular distal humerus fractures with a posterolateral plate through a triceps-reflecting technique. *J Shoulder Elbow Surg*. 2014;23:251-7
13. Capo JT, Debkowska MP, Liporace F, Beutel BG, Melamed E. Outcomes of distal humerus diaphyseal injuries fixed with a single-column anatomic plate. *Int Orthop.* 2014;38:1037-43.

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