



CLINICAL OUTCOME ANALYSIS OF PARALLEL PLATE TECHNIQUE IN DISTAL HUMERUS FRACTURES

Orthopedics

Dr S Senthil Sailesh

MS Ortho, Sr Asst Prof, Institute of Orthopaedics and traumatology, Madras medical College, Chennai- 600003.

Dr P Kannan*

MS Ortho, Sr Asst Prof, Institute of Orthopaedics and traumatology, Madras medical College, Chennai- 600003. *Corresponding Author

Dr Vignesh P S

MS Ortho, Junior Resident, Institute of Orthopaedics and traumatology, Madras medical College, Chennai- 600003.

ABSTRACT

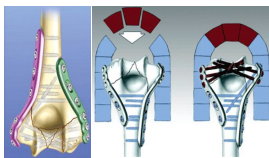
The quality of fixation of distal humerus fractures depends on stability. The solution to achieve maximum stability is by maximizing fixation in distal fragments and achieving compression at supracondylar level. This is achieved by parallel plating. 10 patients were treated by parallel plating and the results were analysed using MEPS and Jupiter elbow score. The mean duration for union was 10 months with 100% (n=10) union. Mean range of movement was 0- 94 deg. The mean MEPS score was 83 and by Jupiter elbow score, 40% (n=4) had excellent outcome and 10% (n=1) had poor outcome. The absence of implant failure and nonunion of fracture is attributed to the intrinsic stability achieved by parallel plating. This method is not one another variant of plate placement, it is a completely different method with good outcome results.

KEYWORDS

distal humerus, parallel plating, bicolunar, intrinsic stability

Introduction:

Distal humerus fracture is a relatively uncommon fracture: 2- 6% of all fractures. It has a bimodal distribution affecting young males and old females. Most fractures are bicolunar and intra-articular. The quality of fixation depends on stability. Limiting factor is purchase/anchorage in distal fragment especially in the lateral column. Communion and osteopenia needs to be taken into account. The solution to achieve maximum stability is by maximizing fixation in distal fragments and achieving compression at supracondylar level. This is achieved by parallel plating.

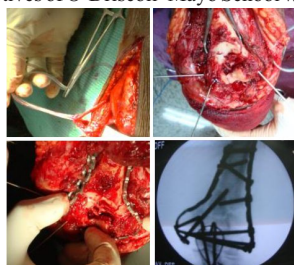


The parallel plating is based on the concept of an imaginary arch, with inter-digitation through strong plates that act as the keystone of the arch. This construct acts like a rebar type with rigid linkage around which the fragments can be assembled.

Materials and methods:

The aim of the study is to analyse the functional outcome of open reduction and internal fixation of the distal humeral fractures using parallel plate technique. 10 patients were taken for the study out of which 7 were males and 3 females. The mean age of the study group was 34 years. The average duration for surgery from trauma was 7 days with a range of 1 day to 22 days. Out of the 10 patients, 2 sustained AO type A3.3, 5 sustained AO type C2 and 3 sustained AO type C3.

The patient is put on lateral decubitus position with arm in an arm board and elbow hanging down freely. Tourniquet was not used. Through standard posterior midline approach, surgery proceeded. Chevron Olecranon osteotomy was done for AO type C3 fracture and for other types triceps splitting approach was done. 3.5 mm stainless steel recon plate was implanted for both columns in all patients. The eight technical objectives of O' Driscoll- Mayo School was followed.



Post- operatively, the limb was placed in a splint in extension. The passive elbow movements are started between 3- 7 days. Later active-assisted and active range of movements encouraged. All patients received heterotopic ossification prophylaxis for 1 month. The patients are followed up at 4th, 6th and 8th week to identify radiological union. The outcome was analysed using MEPS score and Jupiter Elbow Score.



Results:

The Fracture union was seen in all 10 patients and the mean duration of union was 10 months with range of 6 months to 12 months. Mean range of movement was 94°. Mean MEPS score which includes pain, Range of movements, Stability and function was 83. The Jupiter elbow score includes Range of movements, Pain and Disability. Based on this criteria 4 patients had excellent score, 4 patients had good score, 1 patient had fair score and 1 patient had poor score. The poor Range of movements in the patient may be due to delayed fixation as the patient was initially treated for head injury.

None of the patients had implant failure. 1 patient had to undergo revision of olecranon osteotomy due to nonunion. 1 patient had heterotopic ossification. Superficial infection was reported in one patient and none of the patient had deep infection.

This study is a prospective short term study hence further follow up and a large study population is required.

Discussion:

Distal humerus fractures need to be fixed to achieve anatomical alignment to restore its complexity as well as the fixation must be stable to mobilise the elbow joint as early as possible. Parallel plating is a method of achieving both anatomical reduction and stability. Orthogonal plating/ 90-90 plating/ perpendicular plating, involves placing plates, one on the medial column and the other on the posterolateral column. In the concept of parallel plating one plate is placed along the medial column and the other along the lateral column.

The medial column diverges at 45 degrees from the humeral shaft and the lateral column at 20 degrees to humeral shaft. The medial column is made up of cortical bone in its proximal two third and cancellous bone including the medial epicondyle in its distal third. The proximal half of the lateral column is composed of cortical bone, while the distal half is composed of cancellous bone which includes the lateral epicondyle. (5)

Bicolumnar fractures are the most common type of distal humerus fracture representing 5-62% of distal humerus fractures. (6) These fractures involve each limb of the "triangle", thus making them extremely difficult to treat.

The concept of parallel plating emerged because it was conceived that orthogonal plate fixation method does not give adequate stability and that when fixation does fail, it occurs at the supracondylar level. (7) This is due to suboptimal anchorage of the articular fragments to the shaft due to the limited number and length of screws that can be placed in the distal fragments (7) and when mobilization is started without adequate stability, the fracture goes into nonunion (8). And if the elbow is immobilized to compensate for inadequacy, the elbow becomes stiff and nonfunctional (9). Also in parallel plating, longer screws can be placed from a medial to lateral direction. (10)

The Mayo clinic group proposed the idea of parallel plating utilizing the principles of enhancing fixation of the distal fragments and achieving stability at the supracondylar level. (7) There are eight technical objectives of O' Driscoll, that have been described concerning parallel plating. Six of these objectives are related to distal screw insertion and two are related to plate fixation (11). With regard to distal screw insertion (11),

1. Each screw should pass through a plate.
2. Each screw should engage a fragment on the opposite side that is also fixed to a plate.
3. There should be an adequate number of screws placed in the distal fragments
4. Each screw should be as long as possible engaging as many articular fragments as possible.
5. The screws should lock together by inter-digitation,
6. The inter-digitation creates a "fixed-angle" structure linking the columns together.

With regard to fixation of the plates (11),

1. The plates should be applied allowing for compression of both columns at the supracondylar level.
2. The plates chosen must have enough strength and stiffness to resist breaking or bending before union occurs at the supracondylar level.

The inter-digitation of the distal screws is the structural link necessary for adequate fixation. (11) During reduction if a fragment is missing, the anterior aspect of the distal part of the humerus and medial half of trochlea is the critical area and must be restored to allow for a functional joint. (11)

Conclusion:

The absence of implant failure and Nonunion of fracture is attributed to the intrinsic stability achieved by parallel plating. This method is not one another variant of plate placement, it is a completely different method – especially in transcondylar fractures, osteoporosis and comminution. Not only long term evaluation but also adapting similar technique in other complex fractures is highly recommended.

Bibliography:

1. Nicholson JT. Compound comminuted fractures involving the elbow joint. Treatment by resection of the fragments. *J Bone Joint Surg Am* 1946;28:565–575.
2. Jupiter JB, Morrey BF. Fractures of the distal humerus in the adult. In: Morrey BF, ed. *The elbow and its disorders*, 2nd ed. Philadelphia: WB Saunders, 1993:328–366.
3. Rose SH, Melton LJ III, Morrey BF, et al. Epidemiologic features of humeral fractures. *Clin Orthop* 1982;24:30.
4. Robinson CM, Hill RM, Jacobs N, et al. Adult distal humeral metaphyseal fractures: epidemiology and results of treatment. *J Orthop Trauma* 2003;17:38–47
5. Milch H. Fractures and fracture-dislocations of the humeral condyles. *J Trauma*. 1964;4:592-607.
6. McKee MD, Jupiter JB. Fractures of the distal humerus. *Skeletal Trauma Basic Science, Management, and Reconstruction*, third edition. Saunders. Philadelphia. 2003:1436-80.
7. Sanchez-Sotelo J, Torchia ME, O'Driscoll SW. Complex distal humeral fractures: Internal fixation with a principle-based parallel-plate technique. *J Bone Joint Surg Am*. 2007;89:961-9
8. Ackerman G, Jupiter JB. Non-union of fractures of the distal end of the humerus. *J Bone Joint Surg Am*. 1988;70:75-83.

9. Ring D, Jupiter JB. Fractures of the distal humerus. *Orthop Clin North Am*. 2000; 31:103-13.
10. Leugmair M, Timofiev E, Chirpaz-Cerbat JM. Surgical treatment of AO type C distal humerus fractures: internal fixation with a Y-shaped reconstruction (Lambda) plate. *J Shoulder Elbow Surg*. 2008;17:113-20
11. Sanchez-Sotelo J, Torchia ME, O'Driscoll SW. Complex distal humeral fractures: Internal fixation with a principle-based parallel-plate technique. *Surgical Technique. J Bone Joint Surg Am*. 2008;90S2:31-46.