

Evaluation of Functional Results of Type C Distal Humeral Fractures by Fixation with Precontoured Locking Parallel Plates

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ABSTRACT

Objective: To determine the functional results of type C fractures (AO Classification) of the distal humerus in adults by the parallel plating system

Methods: This Prospective Study was conducted from Sep 2012 to April 2015. A total of thirty two patients were included in the study who presented in Accident and Emergency department after trauma around elbow joint with type C distal humerus fractures. They were treated by parallel plates along both sides of distal humerus at 180°. Patients were followed for 2 weeks, 1 month, 2 months, 3 months, 6 months and 1 year. They were evaluated for union, movements and functional outcome at elbow joint according to the Mayo Scoring system and also for any complication and disability by Disability of Arm, Shoulder and Hand (DASH) score.

Results: The functional results were evaluated in terms of Mayo Elbow Performance score (MEPS) and Disability of Arm, Shoulder and Hand (DASH) score., the mean MEPS after one year was 89±3.5 and DASH score was 25±3.7. The range of movements improved within first 3 months. Mean elbow flexion was 115±10° and extension was 10±5.

Conclusion: Parallel plating system provide better stability in all the distal humeral intraarticular fractures especially in the old age patients when used with locking screws. Early range of movements are started leading to better results.

Key Words : Parallel Plating, Humeral Fractures

INTRODUCTION

Intraarticular fractures of distal humerus provide a challenging situation to the Orthopaedic surgeons. Among all the elbow injuries the fractures of distal humerus are 30% and about 2-6% of overall fractures. Mostly the fractures in the young age is due to a severe trauma particularly after road traffic accident while by only a trivial trauma in elderly. This is essential to achieve the anatomical reduction of the fracture so that the congruity of the articular surface is restored. This would directly affect the functional outcome as far as the range of movements of elbow are concerned¹. Success in treating such fractures depend upon the understanding the geometry of fractures and stable fixation².

There is continuous process of evolution and improvements in the reconstructive techniques and implants used for fixation of these fractures. The stability of fixation in the parallel plating system can be enhanced by putting screws through all the

holes particularly in the distal segment , engaging as many fragments as possible , long screws and interdigitation with the opposite screws creating a fixed single unit ³. Parallel plates give more stability against the axial and torsional forces during the movements of elbow joint ^{4,5,6}. Moreover parallel plate system offer better stability in the osteoporotic bones when the bone mineral density is less than 420 mg/cm³ as compared to the other method of fixation ⁷.

METHODS

The prospective study included thirty two patients who presented in the accident and emergency department of Jinnah Hospital Lahore between Sep 2012 and Apr 2015

Inclusion Criteria

All the patients between 20-60 years of age with closed intraarticular type 3 fractures according to AO Classification.

Exclusion Criteria

Open Fractures
 Previous Deformity
 Associated injuries around elbow including fracture of radial head.

All the patients were investigated, especially two orthognal radiographs and 3-D reconstruction CT Scan of elbow joint were obtained. Consent for surgical intervention under general anaesthesia was taken. Patient and his attendants were informed about the surgical procedure.

Patients were positioned in lateral decubitus position with the arm rested on a support. Tourniquet was inflated. A midline posterior incision with a curve around the olecraon was made. A Chevron (V – shaped) osteotomy was made with tip of V 2 cm distal to the tip of olecranon. Ulnar nerve located and protected by a sling. Fracture pieces were aligned and fixed with the help of K wires and partially threaded 3.5mm cancellous screws. Two precontoured locking plates applied along both columns (lateral and medial) of the distal humerus with interdigitation of the screws from opposite sides to increase the stability.

Olecranon osteotomy was fixed with the help of Tension Band Wirring (TBW). Movements of elbow were checked . Ulnar nerve was transposed anteriorly. Wound closed in two layers with suction drain inside. Plaster of Parris back slab applied and the tourniquet was released. Drain was removed after 24 hours.

The movements were started just after the removal of stitches after 2 weeks. Strong analgesia was given. Active movements around the elbow joint encouraged.

Follow up was performed regularly after monthly interval for 3 months, than at 6 months and than at 12 months for range of movements , any limitation of movements , sign of infection and any disability.

RESULTS

Thirty two patients were included in this study. Among 32 patients, 23 patients (72%) were male and 9 patients (28%) were females (M:F 3:1).The age of the patients ranged between 20 – 55 years (mean 40 years). Twenty Six patients (81%) presented after Road traffic Injury and Six patients (18%) presented after fall. Twenty two patients (68%) suffered injury to right elbow and ten patients (31%) got injury to left elbow. All the patients presented in the Accident and Emergency Department of Jinnah Hospital on the same day of injury. There were four patients (12.5%) suffering from additional injuries like femur and tibia fractures. All the patients were suffering from type C fracture with supracondylar and intra condylar extension according to AO classification.

The duration of surgery was 120-160 minutes (average 140 min). Three patients (9%) developed superficial infection at the operated site that was settled with antibiotics. Two patients (6%) developed radiating pain on the ulnar aspect of forearm and hand due to ulnar nerve irritation that responded well to analgesics. No complications associated with the olecranon osteotomies were encountered .The range of movements increased gradually from 2 weeks postoperatively till 3 months.

Mean elbow flexion was 115±10° and extension was 10±5°. There was a lag of 10-15° of extension at the final follow up after one year. The Mayo Elbow Performance Score (Table 1) gradually improved 2 weeks postoperatively (6±1.5) to 12 months later (89±3.5). The Mayo score was excellent in 19 patients and good in 13 patients.

The disability gradually improved and the DASH index (Disability of Arm, Shoulder and Hand) decreased gradually within one year of follow up to 35±3.7

Table 1: Mayo Elbow Performance Score

Pain Intensity		Motion		Stability		Function	
	points		points		points		points
Mild	30	Range of movements more than 100°	20	Stable	10	Can comb hair	5 points for each function
Moderate	15	Range of movements between 50° to 100°	15	Moderate instability	05	Can eat	
Severe	0	Range of movements below 50° degrees	05	Grossly Unstable	0	Manage hygiene	
						Can wear shirt	
						Can put on shoes	

ORIGINAL ARTICLE

Table 2: Interpretation of MEPS

Total Points	Grading
> 90	Excellent
75-89	Good
60-74	Fair
< 60	Poor

DISCUSSION

According to the two column theory, the distal humerus is divided into a lateral and a medial column⁸. This is essential to restore the integrity of two columns by putting two plates on both sides⁹. This will restore the congruity of the joint and articular surface and give a stable fixation that will lead to the good functional results¹⁰. All these objectives can be achieved by criteria of O’Driscoll that were laid down in 2005¹⁵.

1. Put screws through all the holes of the plate
2. All the screws have a purchase in the distal fragments in the far cortex.
3. As many screws as possible should be placed in the distal fragments.
4. All the screws must have maximum length possible.
5. As many fragments as possible must be engaged by each screw.
6. The screws from one side should interdigitate and lock with the screws from the opposite side so that a fixed angled structure is developed to provide better stability.
7. Application of plates must achieve compression at the supracondylar level.

8. The plates are strong enough to withstand the forces that lead to implant failure and to prevent the chances of non union at the supracondylar level.

There are studies in which other plating systems like Y plates, perpendicular plates and different modes of treatments were adopted but that did not give excellent stability. The success depends upon early range of movements^{12,13,14}. The patients are forced to do early movements even under strong analgesia. Non steroidal anti inflammatory drugs are given for at least 4 weeks. This will not only decrease the pain to enhance early movements but also decrease the rate of heterotopic ossification that range from 4-49%. Heterotopic ossification is more common in highly comminuted fractures. However different comparative studies between parallel plating and the orthogonal plating around the distal humerus confirm the superiority of parallel plating system as far as stability is concerned¹⁵.

Table 3: Functional Improvement

Time	Average Mayo Performance Score	Average Dash Score
2 Weeks	6	150
1month	30	100
2 months	60	70
3 months	75	32
6 months	85	27
1 year	90	25

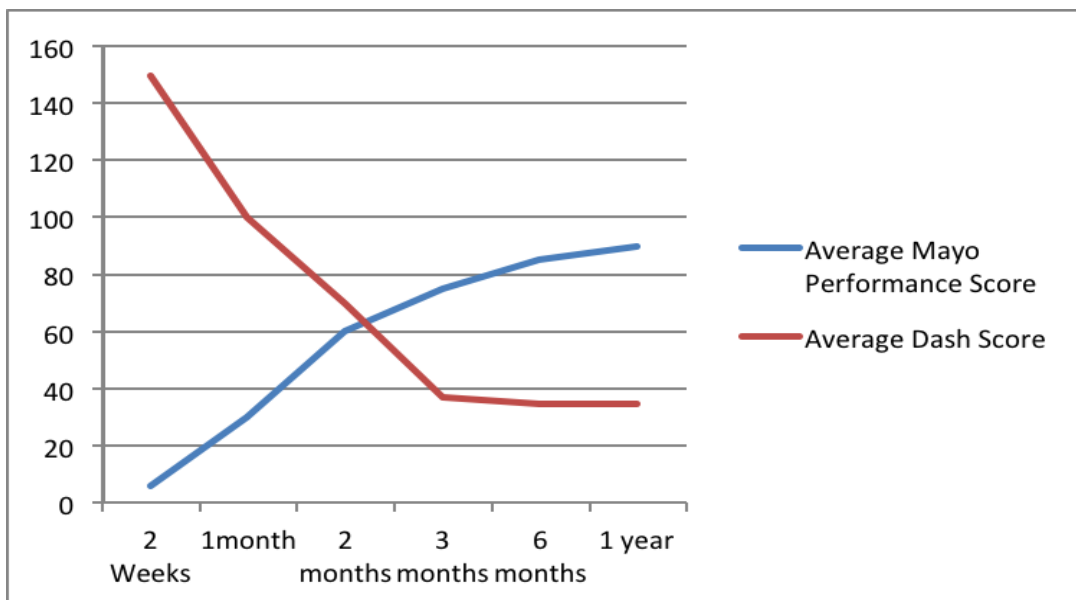




Table 1.2: Comparison of various studies for parallel plate system

Author	Sample size	Follow up months	Union	ROM	MEPS	DASH	Complication
Athwal et al ¹⁶	32	27	100%	97 ⁰	82	24	53%
Theivendran et al ¹⁷	16	35	100%	103 ⁰	72.3	46.1	12.5%
Sanjev et al ¹⁸	32	12	100%	116 ⁰	96.32	31.42	19.0%
Atalar et al ¹⁹	31	28	100%	90.2 ⁰	86.1	7.6	29.0%
Present Study	32	12	100%	115 ⁰	89	25	10%

Postoperative 3 months are very important as far as functional results are concerned and aggressive physiotherapy is the solution for good range of movements.

Postoperatively the first 3 months are very important. Maximum gain in the good functional outcome is achieved by an aggressive physiotherapy protocol. In all the studies, the range of movements improved marvelously when early postoperative movements were started. Patients were made realized by counselling the importance of early range of movements and its impact upon the functional status of the limb in the future. Although there was improvement clinically after 3 months but at very slow pace and it did not matter statistically (p value more than 0.001).

In parallel plating system, the interdigitation of the screws from opposite side give a more strong stability than any other method of fixation so that there are less chances of implant failure and this allow early range of motion.

A comparison between our study and the other studies is mentioned in the table1.2. All the studies showed 100% union rate.

CONCLUSION

Parallel plating system in the distal humeral intra articular fractures is an excellent method of fixation that gives an advantage of more stable fixation over other techniques. Although there is no difference between union rate but functional outcomes are better because of early movements.

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