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ORIGINAL ARTICLE

Diaphyseal Humeral Fractures Treated by Bracing versus Dynamic Compression Plate

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ABSTRACT

Objective: To compare the results of humerus shaft fractures treated by functional bracing and dynamic compression plate.

Study Design: Cross sectional comparative study.

Place and Duration of Study: Department of Orthopaedic Surgery & Traumatology, Liaquat University Hospital Hyderabad/Jamshoro from 1st June 2015 to 31st May 2016.

Methodology: Eighty cases selected from accident emergency department and outpatient departments. Cases were divided in two groups; group A (dynamic compression plate) and group B (functional bracing). Patients of either gender with age range 18-50 years with an isolated closed fracture of the humeral shaft, of duration within 2 weeks and who were willing to participate in the study were included in the study while open fractures, bilateral injuries, poly-trauma, pathological fracture, smoker, alcoholic, immune compromised, and history of poor compliance, psychiatric disease were excluded.

Results: In conservative group, 32 (80%) were males and 8 (20%) females while in dynamic compression plate group, 30 (75 %) were males and 10 (25%) females with mean age was 35.75±9.083 year. There were 46 (57.5%) patients who sustained fractures following road traffic accidents 16 (20%) cases had fall from height and 18 (22.5 %) cases had after assault. Fracture location was middle third in most of cases in both groups. Mean time for union was 15.45±2.864 and 14.325±3.033 weeks and mean time of follow-up was 48.35±6.436 & 42.52±9.33 weeks in dynamic compression plate and functional bracing groups respectively

Conclusion: Plating of humeral shaft fracture was found to be satisfactory method of treatment with high fracture union rates, better functional outcome [DASH Score] and low complication rate as compared to functional bracing group.

Keywords: Humeus shaft, Fracture, Dynamic compression plate, DASH score, Conservative, Functional bracing

INTRODUCTION

Roughly 1-3% of every human fracture and 5-10% of all long bone fractures happen in the humeral shaft.[1,2] Both surgical as well nonsurgical methods are used to treat these fractures.[3] Sarmiento casting is documented with better outcome as gold standard option, while the surgical options are nailing, plating and external fixation. Both strategies have their own pros and cons.[4,5] There is never ending debate and consensus in literature to choose the best method for management.[6]

There are certain absolute and relative surgical indications; poly trauma, bilateral, open and with neurovascular compromise as radial nerve entrapment.[7] Not long ago newer technique introduced by MIPO method, with two small anterior incisions and application of bridge plate to achieve relative stability and reported good outcomes in cohorts.[8-11]

The rationale of the study was to add to literature the loco-regional data related to the management of humerus shaft fracture [HSF] with dynamic compression plate (DCP) and conservative methods and compare the results reported from different countries.

MATERIALS AND METHODS

This cross sectional comparative study was conducted at Department of Orthopaedic Surgery & Traumatology, Liaquat University Hospital Hyderabad/Jamshoro from 1st June 2015 to 31st May 2016 and 80 cases were selected from accident & emergency and outpatient departments. The cases were divided in two groups; group A (dynamic compression plate) and group B (functional bracing). Patients of either gender with age range 18-50 years with an isolated closed fracture of the humeral shaft [HSF], of duration within 2 weeks and who were willing to participate in the study were included in the study while patients older than 55 year and younger than 18 year, open fracture, bilateral injuries, poly-trauma, pathological fracture, smoker, alcoholic, immune compromised, diabetic, on steroids, drug addicted, and history of poor compliance, psychiatric disease were excluded. Patients meeting the selection criteria were explained the purpose of study, procedure to be performed, with merits and demerits and informed consent was obtained.

Group A patients were initially treated with closed reduction and immobilization by application with U-slab, after 2 weeks, the U slab was replaced by hanging cast for 2 weeks followed by a functional brace till fracture union. Group B patients were treated by open reduction internal fixation by Henry anterolateral approach with broad 4.5 mm dynamic compression plate by engaging at least 6 cortices proximal as well distal to fracture. All patients encouraged for movements around shoulder and elbow joint as soon as

possible except rotation around shoulder joint that was allowed after 6 weeks of fixation. The functional outcome of both groups evaluated by DASH score[10] [disabilities of the arm, shoulder, and head] by 4th 8th, 12th, 24th week, & one year and scores were compared. In OPD cases assessed thoroughly on clinical and radiological backgrounds every time. Each variable noted on predesigned pro-forma and analyzed by SPSS version 18.

RESULTS

In conservative group 32(80%) were males and 8 (20%) females. In dynamic compression plates (DCP) group 30 (75 %) were males and 10 (25%) females with mean age was 35.75±9.083 year. There were 46 (57.5%) patients who sustained fractures following road traffic accidents 16 (20%) cases had fall from height and 18 (22.5%) cases had after assault. Fracture location as middle third in most of cases in both groups. Three (7.5%) cases have radial nerve injury in bracing group before injury that neuropraxia recovered with time while none of the case reported radial nerve injury in other group before and after procedure. Regarding AO classification about half of patients in both groups were classified as simple 12A1, 12A2 and 12A3. In DCP group, 7.5% cases united within 12 weeks, 67.5% in 13-16 weeks, 12.5% in 17-20 weeks and 10% in 21-23 weeks. In bracing group 27.5% fracture healed within 12 weeks, 57.5% in 13-16 weeks, 10% in 17-20 weeks and 5% in 21-23 weeks. Complications were reported in 10 (25%) in the functional brace group and 5 (12.5%) in the plating group. Of the 10 failures in bracing group, 2 (5%) were due to nonunion, 3 developed malunion, 1 delayed union and 4 (10%) have stiffness of shoulder following casting. Both nonunion cases facilitated with plating with bone graft from iliac crest. While stiff shoulder joint rehabilitated with regular physiotherapy, steroid injection, topical & oral analgesic as well muscle relaxants. In DCP group superficial surgical site infection was noticed in 2 (5%) and dealt with sterilized dressings and culture specific antimicrobials while 1 (2.5% case developed delayed union that healed without additional surgery, furthermore 2 (5%) presented with stiff shoulder joint that dealt with regular physiotherapy. Average time from injury to hospital arrival was 28.52±11.43 hours. The mean time from the injury to functional brace application was 24.25±6.06 days. The mean time from the injury to the surgical procedure was 6.45±3.66 days. Average hospital stay was 2.4±1.05 & 9.33±3.74 days in bracing group & DCP group respectively (Table 1)

The mean DASH scores were 52.65±13.53, 45.77±26.66, 27.28±29.98, 18.63±15.87, and 8.35±4.67 points at 4th, 6th, 12th, 24thweeks, and 1 year following functional bracing and 55.68±10.26, 40.46±12.23, 24.82±77.46, 9.69±9.85, and 4.25±6.78 points at the respective follow-up periods after treatment with the DCP. Mean time for union was 15.45±2.864 & 14.325±3.033 weeks in DCP and casting group respectively. The average time of follow-up was 48.35±6.436 and 42.52±9.33 weeks in DCP and casting group respectively (Table 2).

DISCUSSION

Though the trend towards surgical management of HSF is escalating day by day because of various factors by high demand of patients for rapid recovery by stable fixation. Huttunen et al[12] have observed increasing trend from conservative to surgical methods in HSF even double ratio for men and triple for females.

Shaikh[13] at Jinnah Postgraduate Medical Centre Karachi evaluated the outcome of DCP in HSF in 65 cases, among them 55.4% were males& 44.6% were females with average age of 36.29±11.17 years. RTA most common mode of injury 72.3% and they observed satisfactory outcome in 86.2% patients. While in our study conservative group 32 (80%) were males and 8 (20 %) females. In dynamic compression plate (DCP) group 30 (75%) were males and 10 (25%) females with males with mean age was 35.75±9.083 year.

Table 1: Comparison between DCP and functional bracing group (n=80)

Variable	DCP		Functional Bracing	
	No.	%	No.	%
Gender				
Male	30	75.0	32	80.0
Female	10	25.0	8	20.0
Age (years)				
18 – 35	28	70.0	22	55.0
36 – 50	12	30.0	18	45.0
Mode of injury				
Fall	6	15.0	10	25.0
R.T.A	24	60.0	22	55.0
Assault	10	25.0	8	20.0
AO Classification				
12A1	8	20.0	9	22.5
12A2	7	17.5	7	17.5
12A3	5	12.5	6	15.0
12B1	7	17.5	6	15.0
12B2	5	12.5	4	10.0
12B3	2	5.0	3	7.5
12C1	3	7.5	2	5.0
12C2	1	2.5	2	5.0
12C3	2	5.0	1	2.5
Location of fracture				
Junction of proximal & middle one third	9	22.5	8	20.0
Middle one third	26	65.0	23	57.5
Junction of middle & distal third	5	12.5	9	22.5
Time to union (weeks)				
12	3	7.5	11	27.5
13 – 16	27	67.5	23	57.5
17 – 20	5	12.5	4	10.0
21 – 23	4	10.0	2	5.0
Complication				
Infection	2	5.0	-	-
Non Union	-	-	2	5.0
Delayed union	1	2.5	1	2.5
Mal-union	-	-	3	7.5
Stiffness of shoulder	2	5.0	4	10.0

Table 2: Mean DASH score

Duration	DCP	Functional Bracing
4 Weeks	55.68±0.26	52.65±13.53
8 Weeks	40.46±2.23	45.77±26.66
12 Weeks	24.82±77.46	27.28±29.98
24 Weeks	9.69±9.85	18.63±15.87
1 Year	4.25±6.78	8.35±4.67

Matsunaga et al[14] in bridge plate and bracing for HSF in 110 patients evaluated the functional outcome by DASH score and compared it by 2nd, 4th, 8th, 24th weeks and by end of year. This trial favored the bridge plate to functional bracing in terms of DASH score nonunion rate 0% versus 15%. We also observed comparable results that DCP

group had better DASH score. While in our study the mean DASH scores were 52.65±13.53, 45.77±26.66, 27.28±29.98, 18.63±15.87, and 8.35±4.67 points at 4th, 6th, 12th, 24th weeks and 1 year following functional bracing and 55.68±10.26, 40.46±12.23, 24.82±77.46, 9.69±9.85 and 4.25±6.78 points at the respective follow-up periods after treatment with the DCP. We observed better score with DCP group.

Harkin and Large[15] reported that 76.2% cases were managed conservatively, out of that 13% went in delayed union, 33% in nonunion while in operated cases 33% went in delayed union and 4% in nonunion. In the meta-analysis and systematic review of two randomized clinical trials 150 and ten observational studies 1262 by van de Wall et al[16] for the conservative versus operative to manage HSF reported nonunion rate was more with non-operative (15.3%) compared to surgical methods (6.4%). Need have re intervention was more with casting (14.3%) compared to surgical methods (8.9%). Although average union time & DASH score were comparable in both strategies.

Serrano et al[17] from nine level 1 trauma centers across the United States initially managed non-operatively with a functional brace were reviewed for need of surgery and contributing factors. 29% cases needed surgical intervention even after getting functional brace management, contributing factors were nonunion (60%), mal alignment beyond acceptable parameters (24%), inability to tolerate functional bracing (12%), and persistent signs of radial nerve palsy requiring exploration (3.7%), females as being 1.7 times more likely and alcoholics to be 1.4 times more likely to be converted to surgery. In the present study complications related to union in bracing group, 2 (5%) were due to nonunion, 3 developed malunion, 1 delayed union and in DCP group, 1 (2.5%) case developed delayed union and no case witnessed for nonunion.

Lode et al[18] reported that 59.38%were treated surgically and 40.62% conservatively; reported risk ratio of 2.76 deep infections in the operative group while there was no difference in other aspects.

In a study done by Ali et al[19] regarding nonsurgical treatment, reported that comminuted HSF had 89% union rate regardless of position of fractured fragments. Papasoulis et al[20] has reviewed the sixteen case series and two comparative series showed the average union time of HSF of 10.7 weeks and conservative method has main drawbacks of residual deformity and joint stiffness. We also observed comparable results in casting group 4 (10%) have stiffness of shoulder following casting and 2 (5%) presented with stiff shoulder joint in DCP group. None of the case reported limited range of motion in elbow joint. In another study done by Vander Griend et al[21] for open reduction internal fixation of HSF by AO plating technique observed two cases of superficial surgical site infections in 32 operated cases. We also observed comparable results in DCP group.

Mahabier et al[22] has reported that 48.92% were managed by non-operative while 51.08% by operative methods. He reported fall from height as most common mode of injury while we observed rod traffic accidents on top.

CONCLUSION

Plating of humeral shaft fracture was found to be satisfactory method of treatment with high fracture union rates, better functional outcome [DASH Score] and low complication rate as compared to functional bracing group.

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