DOI: https://doi.org/10.3329/medtoday.v36i2.74797

ORIGINAL ARTICLE OPEN ACCESS

Comparison the Results of Humerus Shaft Fractures Treated by Functional Bracing versus Dynamic Compression Plate

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Abstract

Introduction with Objective: *To compare the results of humerus shaft fractures treated by functional bracing and dynamic compression plate.* ***Materials and Methods:*** *This experimental study was carried out at the Department of Orthopedic Surgery at Chittagong Medical College Hospital, Chattogram from August 2019 to July 2021. All adult patients of closed diaphyseal fracture of humerus attending the Orthopaedics department, Chittagong Medical college Hospital during study period were the study population. Purposive sampling was done according to availability of the patients. Cases were divided in two groups; group A (dynamic compression plate) and group B (functional bracing). All the data were compiled and sorted properly and the quantitative data was analyzed statistically by using Statistical Package for Social Science. The results were expressed as percentage and mean ± SD and p<0.05 was considered as the level of significant.* ***Result:*** *Average mean ± SD age was 40.22 ± 12.451 (range: 19-65) years. The mean age was 37.24 ± 10.686 in plating group and 43.20 ± 13.559 in bracing group. Out of 50 patients, 30 (60%) were male and 20 (40%) were female. Male was predominant in both groups (P=0.564). Regarding time taken for radiological union, average mean ± SD time was 15.32 ± 2.613 (range: 12-22) weeks. The mean time for radiological union was 14.91 ± 2.712 weeks in plating group and 15.76 ± 2.488 weeks in bracing group. Regarding ROM of shoulder & elbow,there was statistically nonsignificant difference found between the groups except shoulder flexion(P= 0.031s),abduction(P=0.025s) & extension(P=0.041s) more on plating group. QUICK-DASH score at 3 month shows highly significant difference between the study groups (p=0.001). At 6 and 12 month significant difference was found between the groups. Out of 44 patients at 12 months follow-up, 19 (43.2%) patient's functional outcome was excellent and 10 (22.7%) patient's functional outcome was good. Statistically significant difference was found between the groups (p=0.022).* ***Conclusion:*** *This study observed that functional outcome was relatively better in patients treated by dynamic compression plate in adult diaphyseal fracture of humerus.*

Keywords: *Dynamic compression plate, functional bracing.*

Number of Tables; 04; Number of Figures: 02; Number of References: 12; Number of Correspondences:04.

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Introduction:

Humerus shaft fractures account for 1 to 3% of all orthopaedic injuries and 20% of all humeral fractures[1]. There are several treatment methods for management of humeral shaft fractures

Received: 30 April 2024 *Accepted revised version:* 08 June 2024

including non operative management by functional brace, open reduction internal fixation (ORIF), minimally invasive plate osteosynthesis, intramedullary nailing and external fixation. Each of these modalities has its own advantages and disadvantages[2]. Historically, nonoperative treatment with a functional brace has been the most popular choice of orthopaedic surgeons for acute isolated closed humeral shaft fractures[3]. A maximum of 3cm of shortening, 20° angulation and 30° of rotation is acceptable in patients treating with conservative management of humeral shaft fractures[4]. Although functional bracing has been shown to achieve a union rate of nearly 95%, there are some complications of non-operative management like nonunion, malunion, and persistent radial nerve deficit[5]. More recently, however, with the advent of new surgical techniques, implant options and less compliance with conservative management, many orthopaedic surgeons are managing patients operatively[6]. The encouraging results that have been reported with recent advances in internal fixation techniques and the latest instrumentation have led to an expansion of surgical indications for such fractures[7]. The ideal management of closed fractures of the humeral shaft continues to be debatable. Fracture shaft of humerus can be treated by either operative or conservative method. Although most of the fractures of shaft of humerus can be treated conservatively, but with sufficient experienced orthopedic surgeons and well equipped operation theater, we can manage patients operatively also. With this background, the purpose of this study is to determine outcome in patients with diaphyseal fracture of humerus treated with dynamic compression plating and functional bracing.

Materials & Methods:

This experimental study was carried out among 50 patients attending at the Department of Orthopedic Surgery at Chittagong Medical College Hospital, Chattogram from August 2019 to July 2021. All adult patients of closed diaphyseal fracture of humerus attending the Orthopaedics department, Chittagong Medical college Hospital during study period were the study population. Purposive sampling was done according to availability of the patients. In this study, adult patients with diaphyseal fracture of humerus undergoing dynamic compression plating (Group- A) or functional bracing(Group- B) were the study sample. Ethical clearance was obtained from the Institutional Review Board (IRB) of Chittagong Medical College hospital, Chittagong. The collected data were entered into the computer and analyzed by using SPSS (version 20.1) to compare the results of humerus shaft fractures treated by functional bracing and dynamic compression plate.

Results:

In present study, average mean ± SD age was 40.22 ± 12.451 (range: 19-65) years. The mean age was 37.24 ± 10.686 in plating group and 43.20 ± 13.559 in bracing group. P value was 0.091, statistically non-significant **(Table 1)**.

Table I: Age distribution of the patients (n=50)

Age (years)	Plating n	Plating %	Bracing n	Bracing %	Total n	Total %	P value
19-30	7	28	5	20	12	24	
31-40	10	40	6	24	16	32	0.296^{ns}
41-50	5	20	6	24	11	22	
50-65	3	12	8	32	11	22	
Mean ± SD	37.24 ± 10.686		43.20 ± 13.559		40.22 ± 12.451		0.091^{ns}
Range	21-60		19-65		19-65		

- Statistical analysis was done by Chi-square test and unpaired Student's t-test
- P value > 0.05 indicates non-significant.
- ns= non-significant

Out of 50 patients, 30 (60%) were male and 20 (40%) were female. Male was predominant in both groups (P=0.564).

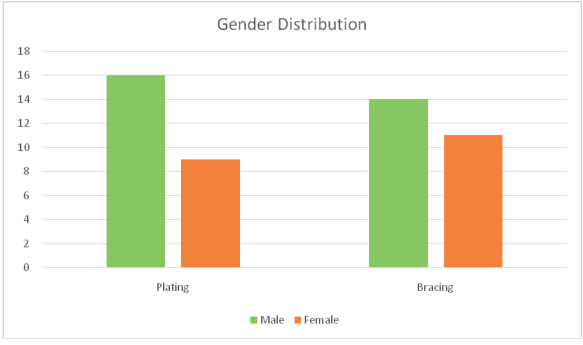

Figure 1: Gender distribution of the study population

Table II shows that regarding time taken for radiological union, average mean ± SD time was 15.32 ± 2.613 (range: 12-22) weeks. The mean time for radiological union was 14.91 ± 2.712 weeks in plating group and 15.76 ± 2.488 weeks in bracing group. P value was 0.287.

Table- II: Time taken for radiological union (n=43)

Time for radiological union (weeks)	Plating n	Plating %	Bracing n	Bracing %	Total n	Total %	P value
12-15	18	78.3	14	66.7	32	72.7	
16-19	2	8.7	4	19.0	6	13.6	0.583^{ns}
20-22	3	13.0	2	10.0	5	11.6	
Mean ± SD	14.91 ± 2.712		15.76 ± 2.488		15.32 ± 2.613		0.287^{ns}
Range	12-22		12-22		12-22		

- Statistical analysis was done by Chi-square test and Student's t-test.
- P value > 0.05 indicates non-significant
- ns= non-significant
- 7 patients dropped out from study

Table- **III** shows average mean ± SD change in shoulder range of motion (flexion, abduction, extension, internal rotation and external rotation) and elbow ROM. According

to P value, result is statistically non-significant between the groups except shoulder flexion, abduction and extension.

Table- III: Shoulder & Elbow Range of Motion at 12th month

Shoulder ROM (degree) Flexion	Plating	Bracing	Total	P value
Mean ± SD	157.18± 8.942	149.91± 12.367	153.55±11.282	0.031[s]
Range	130-165	120-168	120-168	
Abduction				
Mean ± SD	162.55±12.931	151.59± 17.951	157.07±16.424	0.025[s]
Range	120-175	100-175	100-175	
Extension				
Mean ± SD	54.95± 6.701	49.55± 10.003	52.25±8.848	0.041[s]
Range	35-62	30-62	30-62	
Internal rotation				
Mean ± SD	65.86± 6.643	61.14± 9.667	63.50±8.539	0.066[ns]
Range	45-72	40-72	40-72	
External rotation				
Mean ± SD	63.32± 6.992	60.00± 9.861	61.66±8.613	0.21[ns]
Range	45-70	40-70	40-70	
Elbow ROM (degree)				
Mean ± SD	127.136±8.7684	123.091±11.0450	125.114±10.0654	0.186[ns]
Range	105-135	85-135	85-135	

- Statistical analysis was done by student t-test.
- P value > 0.05 indicates non-significant; <0.05 indicates significant.

Table IV reveals that,QUICK-DASH score at 3 month shows highly significant difference between the study groups (p=0.001). At 6 and 12 month significant difference was found between the groups.

Table IV: QUICK-DASH score at 6thweek (n=50), 3 month (n= 50), 6 month (n= 47) and 12 month (n= 44)

QUICK-DASH score	Plating	Bracing	Total	P value
At 6 week				
Mean ± SD	36.63± 3.289	38.64± 6.431	37.635± 5.400	0.987[ns]
Range	30-40	35-43.18	30-43.18	
At 3 month				
Mean ± SD	27.88 ± 4.986	33.99 ± 6.500	30.93 ± 6.513	0.001[hs]
Range	20.45-40.91	22-43.18	20.45-43.18	
At 6 month				
Mean ± SD	23.10 ± 7.313	28.12 ± 8.88	23.22 ± 9.520	0.032[s]
Range	11-44	11-43.18	11-43.18	
At 12 month				
Mean ± SD	9.43 ± 7.689	15.62 ± 9.815	12.53 ± 9.260	0.025[s]
Range	0-34	0-34	0-34	

- Statistical analysis was done by student t-test.
- P value > 0.05 indicates non-significant; <0.05 indicates significant; <0.005 indicates highly significant
- ns= non-significant; hs= highly significant

Figure 2 shows, out of 44 patients at 12 months follow-up, 19 (43.2%) patient's functional outcome was excellent and 10 (22.7%) patient's functional outcome was good. In Bracing group, 5 (22.7%) patient's functional outcome was excellent and 8 (36.4%) patient's functional outcome was fair and in Plating group, 14 (63.6%) patient's functional outcome was excellent and 5 (22.7%) patient's functional outcome was good. Statistically significant difference was found between the groups (p=0.022).

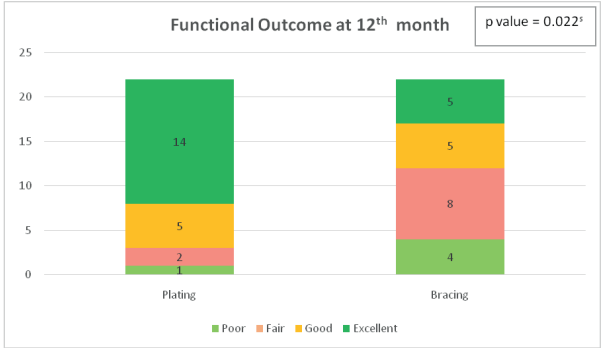

Figure-2: Functional outcome at 12th month (n= 44)

- Statistical analysis was done by Chi-square test.
- P value > 0.05 indicates non-significant and P value < 0.005 indicates significant.
- ns= non-significant and s= significant.

Discussion:

In this study several follow up were done at 6th week, 3rd month, 6th month and 12th month. At 3rd F/U, from Group-A 1 patient & from Group-B 2 patients dropped out from study. At 4th F/U, from Group-A 2 patients & from Group-B 1 patient dropped out from study. The overall functional outcomes were categorized according to Quick DASH Score (Gummesson, Ward and Atroshi, 2006) as excellent, good, fair and poor at 6th week, 3rd month, 6th month & 12th month follow-up[8]. In present study, average mean ± SD age was 40.22 ± 12.451 (range: 19-65) years. The mean age was 37.24 ± 10.686 in plating group and 43.20±13.559 in bracing group. P value was 0.091, statistically non-significant. Ramo et al. (2020) showed, the mean age was 49.6±18.2 in plating group and 48.4 ±16.2 in bracing group[9]. Mahdi et al. (2019) reported, the mean age was 37.7±15.4 in plating group and 48.5±19.4 in bracing group. P value was 0.202 which is statistically non significant[10]. Out of 50 patients, 30 (60%) were male and 20 (40%) were female. Male were also predominant in study showed by Ramo et al.(2020) , there were 44 men (54%) and 38 women (46%)[9].In our study,in plating group 16(64%) patients were male and 9 (36%) patients were

female, in bracing group 14 (56%) patients were male and 11(44%) patients were female(P=0.564). Mahdi et al.(2019) showed, in plating group , 23 (77%) patients were male and 7 (23%) patients were female, in bracing group 26 (87%) patients were male and 4(13%) patients were female, p value was 0.317[10]. Regarding time taken for radiological union, average mean ± SD time was 15.32 ± 2.613 (range: 12-22) weeks. The mean time for radiological union was 14.91 ± 2.712(range: 12-22 weeks) weeks in plating group and 15.76 ± 2.488(range:12-22 weeks) weeks in bracing group. In both groups maximum fractures (72.7%) united between 12 to 15 weeks, p value was 0.287 that is statistically non-significant. Similarly Kumar et al.(2021) showed in both groups maximum fractures(62.5%) united between 13 to 16 weeks and the mean time for radiological unionwas15.45±2.864 weeks in plating group and 14.325±3.033 weeks in bracing group[11]. Sandhu et al (2018) also showed, there was no significant difference in time to union between the two treatment groups, 11.7±2.8 weeks (range, 8-18 weeks) in the plating group and 12±2.6 weeks (range, 8-18 weeks) in the bracing group (P=0.8659)[12]. In this study functional outcome scores (Quick-Dash score) were better for plating group as compared to bracing group with p-value 0.987, 0.001, 0.032 & 0.025 at 6th week, 3rd month, 6th month and 12th month respectively. In plating group, Mean ± SD Quick-Dash score was 36.63±289, 27.88 ± 4.986, 18.10 ± 7.313& 9.43 ± 7.689 at 6th week, 3rd month, 6th month and 12th month respectively. In bracing group, Mean ± SD Quick-Dash score was 38.64±6.431,33.99 ± 6.500, 28.12 ± 8.88&15.62 ± 9.815 at 6th week, 3rd month, 6th month and 12th month respectively. Functional outcome scores (DASH score) were also better in platng group in a study showed by Kumar et al (2017), where Mean±SD 23.40 ±22.87 in plating group and 41.35±16.32 in bracing group (p value 0.007). In a study Kumar et al.(2021) showed better functional outcome scores in plating group. In plating group, Mean±SD DASH score was 40.46±2.23, 24.82±77.46, 9.69±9.85&4.25±6.78 at 8th week, 12 weeks, 24 weeks and 12th month respectively. In bracing group, Mean±SD DASH score was 45.77±26.66,27.28±29.98, 18.63±15.87&8.35±4.67 at 8th week, 12 weeks, 24 weeks and 12th month respectively[11]. In this study, regarding range of motion of shoulder at 12th month there was no statistically significant difference found between the groups except flexion(P=0.031), abduction(P=0.025) &extension((P=0.041) more in plating group. Elbow ROM (degree) was mean± SD,127.136±8.7684 in plating group and mean ± SD, 123.091±11.0450 in bracing group, the difference was statistically non significant (p value was 0.186). Similarly in a study Sandhu et al. (2018) showed, elbow ROM at fracture union was not significantly different between the 2 groups, average 120.3 degrees vs average 132 degrees in the bracing and plating group, respectively (P=.5532)[12]. Ramo et al (2020) showed, average elbow ROM (degree) was 143.5 inplating group and 136.8 in bracing group, the difference was statistically non significant (p value was 0.10)[9].

Conclusion:

This study observed that functional outcome was relatively better in patients treated by DCP in adult diaphyseal fracture of humerus. Regarding other outcome variables, there was no statistically significant difference found between the groups except shoulder flexion(p=0.031), abduction (p=0.025) & extension(p=0.0410) more on plating group.

Acknowledgements:

The authors are grateful to the entire staff of department of Orthopaedic Surgery at Chittagong Medical College Hospital, Chittagong during the study period.

Conflict of Interest: None.

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