Anterior Bridge Plating of Mid Shaft and Lower Mid Shaft Humerus Fractures - A Novel & High Result Yielding Technique

Amber Varyani¹

¹Department of Orthopaedics, Government Medical College, Tirwa, Kannauj, Uttar Pradesh, India.

ABSTRACT

BACKGROUND

Humerus fractures, mainly midshaft are one of the most common fractures treated by orthopaedicians around the globe, either conservatively or by internal fixation by plate and screw or by intramedullary humerus nail. Each has its own merits and demerits. The objective of our study was to assess functional and radiological results of minimally invasive anterior bridge plating of humerus shaft as well as lower third shaft fractures and prove its efficacy, in fact, supremacy over other used techniques till day.

METHODS

38 patients, fulfilling inclusion criteria were operated by minimally invasive anterior bridge plating using dynamic compression /locking compression plates. UCLA shoulder & MAYO elbow scores were used for assessing shoulder and elbow function and radiographical assessment was done to confirm healing and union.

RESULTS

Out of 38 patients in the study, 26 were males and 12 were females, the mean age was 40.184 years (range 25 to 56 years). 29 patients had mid-shaft fractures and 9 patients had lower mid-shaft humerus fractures. Mean surgical time was 77.868 (range 60 min to 100 min), mean union time (radiological) was 13.78 weeks (range 10 to 19 weeks), shoulder function was good to excellent in 36 cases (94.7 %) and moderate in 2 cases (5.26 %) on UCLA score.

CONCLUSIONS

Our study proved to be a huge success, with excellent rates of union and very good functional results. Minimally invasive anterior bridge plating is a biological fixation and proves itself a very efficacious surgical treatment option for mid-shaft and lower mid-shaft humerus fractures. This method is very safe, with the best outcomes, and can be considered as the best technique for such fractures of the humerus to date.

KEY WORDS

Anterior Bridge Plating, Mid Shaft, Lower Mid Shaft Humerus Fractures, UCLA Score

Corresponding Author:

*Dr. Amber Varyani,
Model Town, Pandav Nagar,
Uttar Pradesh, India.
E-mail: amber_varyani2000@yahoo.com*

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BACKGROUND

In today's surgical scenario, anterior bridge plating (ABP) of long bone shaft fractures esp., midshaft fractures of the femur, mid and lower midshaft fractures of humerus^{1,2} is becoming popular among the orthopaedic surgeons, as it facilitates good alignment of fragments as well as preserves the soft tissue attachment and vascularity which in turn gives excellent results. Unlike the previous applied approaches of proper anatomical reduction which induces the disturbance of soft tissues and vascularity, and also the risk of direct handling and chances of damaging of radial nerve, resulting from the relatively high cases of non-union of a failure of plate fixation. In the case of intramedullary nailing of humerus,³ despite being minimally invasive, it is the main culprit in many cases of the damaged rotator cuff and impingement^{3,4} and so it has now become an unattractive option to treat such fractures. On the other hand, the conservative treatment of such fractures yield poor results and is becoming nearly obsolete. With rapid advances in surgical techniques, anterior bridge plating (ABP) is gaining popularity among orthopaedic surgeons, as it is minimally invasive (only 2 small incisions), so it protects the soft tissues and thus maintains vascularity,^{5,6} the mechanical stability provided by bridge plating is adequate for callus formation (indirect healing).⁷

In this study, we tried to assess radiological and functional results of minimally invasive anterior bridge plating (ABP)^{8,9} and evaluate its efficacy, superiority or equality over other previous surgical techniques as well as conservative treatment.

Before the surgical procedure was in practice, these fractures were treated conservatively yielding poor results but with the advancement of technologies, I/M nailing, plates and screws were used to treat such fractures, with good results but also with some demerits, like non-union, malunion etc. but with the advent of ABP extremely good result was being obtained with extremely low rates of failure.

METHODS

This prospective study was carried out from August 2019 to November 2020 in our institution, Government Medical College Tirwa, Kannauj for 16 months. There were a total of 50 patients, of which 38 fulfilled the inclusion criteria and were selected for the study; the remaining 12 patients were excluded from the study.

Inclusion Criteria

1. Patients with midshaft / lower mid-shaft humerus fractures.
2. Patients with ages ranging from 25 years to 56 years irrespective of sex.
3. Patients with fractures not older than 4 days.

Exclusion Criteria

1. Patients with compound fractures

2. Patients with other injuries, which could affect postoperative recovery
3. Patients with both limb fractures
4. Patients with poly-trauma
5. Patients with a history of chronic illness.

Operative Technique

Thorough clinical preoperative examination was done such as checking swelling, blisters, radial nerve status etc.

Radiographs (AP) anteroposterior and (Lat) lateral of humerus, were taken and examined and cases and implant selection was done accordingly.

The patients were placed supine, all patients were given local brachial block, two small incision's of 2-3 cm were made anteriorly on the proximal part as well as distally.

The 4.5 DCP plates were inserted through the extraperiosteal tunnel (made by using soft tissue retractor and periosteal elevator), (not disturbing the soft tissue on the fracture site), from distally to proximal humerus.

Mostly 10 to 14 hole dynamic compression plates and 12 to 14 hole locking plates were used in the cases of mid distal third shaft fracture of humerus, same technique was used⁸ to achieve alignment & reduction. Traction from distal humerus with manipulation was used, in two cases, distractor was used to achieve reduction and realignment of the axis & rotation the plates were inserted & slide on, and the plate position was confirmed by image intensifier single bicortical screw-on third hole of the proximal segment was inserted once the plate position and reduction got confirmed with image intensifier the remaining distal & proximal screws were inserted screw length was again checked under image intensifier.

In 3 cases of locking compression, plates were used in the same manner with 2 locking head screws inserted on both sides; in these three cases the bone was osteoporotic.

Statistical Analysis

There were 6 patients of age between 25 and 30 years, 5 patients of age between 31 and 35 years, 10 patients of age between 36 and 40 years, 3 patients of age between 41 and 45 years, 9 patients of age between 46 and 50 years, 4 patients of age between 51 and 55 years and 1 patient in the age group of 56-60 years. 29 patients were of midshaft fractures & 9 patients were of lower third humerus fractures. Out of these 38 cases, 14 were comminuted, 4 were oblique fractures & 20 were transverse fractures.

RESULTS

All 38 patients (26 males, 12 females) were assessed for functional and radiological results for $1\frac{1}{2}$ years, radiographs were taken immediate postoperatively, at 8 weeks, 4 months, 8 months & 16 months after surgery.

29 patients had midshaft fractures and 9 patients had lower $1\frac{1}{3}$ shaft fractures. 26 patients were cases of roadside accidents & 12 patients were cases of fall. Mean surgical time was 77.868 range (60 min-100 min), mean fracture union

time (radiologically) was 13.78 weeks range (10-19 weeks), UCLA based shoulder function was good to excellent in 36 cases, and fair in 2 cases.

In three cases, callus formation was not very evident radiologically after 8 weeks, but, at four months radiograph, it became very evident in all three cases.

Mayo elbow score was good to excellent in 32 cases & fair in 6 cases. Intraoperatively < 5 % varus /valgus angulation was accepted, out of 3 cases, angulation had reached to acceptable alignment with fair to good functional score and in 1 case, 5 % of varus angulation had a fair functional outcome. All radiographs at 16 months postoperatively revealed union and functional score's of all 38 patients were encouraging.

Sex	Cause of Injury	Level of Fracture	Type of Fracture
26 male	RTA 22	Proximal humerus -0	Comminuted -14
12 female	Fall 16	Middle shaft-29	Oblique -04
		Lower middle shaft -09	Transverse -20

Table 1.-Causes and Types of Fractures

Age Groups (Years)	Frequency(N)	Percentage (%)
16-30	100	50
31-65	100	50
Total	200	100

Table 2. Age Distribution of Patients

Gender	Frequency(N)	Percentage (%)
Male	100	50
Female	100	50
Total	200	100

Table 3. Sex Wise Distribution of Patients

Sl. No.	Surgery Time Minutes	Union Time Weeks	Shoulder ROM Abduction/ Flexion	Elbow ROM Flexion/ Extension	UCLA	MEPS	Complication
1	66 Min	11	100/145	140/0	34	95	5°varus angulation
2	63 Min	12	110/165	135/0	35	100	
3	70 Min	10	130/120	130/0	32	95	
4	83 Min	10	90/100	130/5	26	89	
5	86 Min	11	120/145	120/0	33	95	
6	90 Min	16	90/145	130/0	32	95	
7	80 Min	18	110/160	110/0	30	85	
8	93 Min	19	100/140	135/0	34	95	
9	80 Min	16	100/160	140/0	33	100	
10	76 Min	16	120/145	130/0	32	90	
11	60 Min	14	110/165	140/0	31	85	
12	65 Min	12	110/160	130/0	32	95	
13	70 Min	12	120/150	130/0	32	90	
14	73 Min	10	100/140	125/0	34	90	
15	61 Min	11	100/160	130/0	35	95	
16	68 Min	12	100/145	120/0	32	100	
17	73 Min	14	110/165	130/0	33	95	
18	80 Min	16	120/145	110/0	33	70	
19	86 Min	14	130/120	135/0	32	72	
20	90 Min	16	100/145	140/0	27	95	
21	95 Min	18	110/165	130/0	34	85	
22	88 Min	16	120/160	140/0	33	90	
23	61 Min	16	130/145	140/0	32	74	
24	90 Min	12	110/160	135/0	31	95	
25	100 Min	10	100/140	130/0	32	90	
26	70 Min	12	100/160	110/0	32	100	
27	89 Min	10	120/145	135/0	34	71	
28	95 Min	15	110/165	140/0	31	95	
29	90 Min	17	110/160	130/0	32	90	
30	60 Min	11	100/145	130/0	34	85	
31	75 Min	14	110/165	125/0	32	100	
32	83 Min	16	130/120	130/0	31	73	
33	73 Min	19	90/100	120/0	33	95	
34	74 Min	10	120/145	130/0	34	100	
35	64 Min	12	100/145	110/0	32	85	
36	68 Min	15	110/160	120/0	32	90	
37	76 Min	18	120/145	130/0	29	72	
38	95 Min	13	130/165	140/0	35	95	

Table 4. Clinical Data of All Patients

U CLA >27 (Good/Excellent), <27 (FAIR/POOR), MEPS > 90 Excellent, 75 – 89 Good, 60 – 74 FAIR < 60 – POOR

DISCUSSION

With such an excellent radiological union and the good functional score's in UCLA & MEPS, one thing was sure from our study that anterior bridge plating of mid-shaft & lower 1/3rd humerus fractures^{8,9} with minimal invasion, is a very effective technique to treat such fractures till date, the main advantage of ABP, is that it doesn't disrupt the soft tissue and periosteal supplies (vascularity) and gives stable fixation, which makes the healing and union much more predictable. This technique also passes the chances of non-union¹⁰ (as in cases of rigid posterior plating as well as damaging rotator

cuff and impingement¹¹ (as in case of intramedullary humerus nailing) and provides excellent radiological as well as functional results, a previous option of posterior plating for humerus shaft fracture disturbs soft tissue and there are chances of direct encounter to the radial nerve and also disrupts the vascularity which in turn results in high chances of non-union,¹⁰ mal union as well as implant removal, which causes great problems to the patient as well as becomes costlier, whereas the second option of intramedullary nailing of the humerus is though minimally invasive, it poses a major danger in damaging rotator cuff and impingement, which causes further more complications and revision surgery. So, (ABP) anterior bridge plating can be considered as the standard technique for mid-shaft and lower midshaft

humerus fractures⁸ in today's scenario. Since it is more tissue friendly as well as with minimal body invasion results in excellent outcomes.

CONCLUSIONS

Our study gives a clear cut conclusion, that the anterior bridge plating technique for mid-shaft and lower mid-shaft humerus fractures offers novel, efficacious, acceptable modality of treatment with small skin scar, and gives high union rates & marvellous functional recovery. However, a large study with a higher number of patients and control group, as well as a comparative study including ABP and other techniques used for such fractures can be done to establish clear cut supremacy, the efficacy of ABP, (minimally invasive) on midshaft and lower mid-shaft humerus fractures over other surgical techniques and conventional methods.¹² But we can conclude our study saying that "Minimally invasive ABP (Anterior Bridge Plating) is a highly novel, effective and excellent result-oriented technique for mid-shaft and lower mid-shaft humerus fractures and should become more and more popular among the orthopaedic surgeons as it is beneficial to the patients, cost-effective, and reliable and excellent result giving technique to the orthopaedic surgeons. We finally conclude that our study was a success and conspicuously gave supremacy, efficacy and acceptability of (ABP) anterior bridge plating overall in present-day surgical techniques for handling mid-shaft and lower one-third mid-shaft humerus fractures.

Data sharing statement provided by the authors is available with the full text of this article at jemds.com.

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