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A STUDY OF FUNCTIONAL OUTCOME OF ANTERIOR BRIDGE PLATE IN SHAFT HUMERUS FRACTURES

Orthopaedics

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ABSTRACT

Introduction: *Anterior bridge plating with minimally invasive technique for type A shaft humeral fractures is reported as an acceptable less traumatic and reproducible procedure by several authors. We have evaluated the clinical, radiological, and functional outcome of such fractures in thirty patients, all of which were managed with dynamic compression plate over an average follow- up period of 32 months. Though open reduction and plating technique of humerus shaft fracture is prevailing, this technique also gives favorable outcome.* **Materials And Methods:** *Thirty patients with type A humerus shaft fractures were managed by anterior bridge plating using MIPO technique between March 2023 to January 2025 were included in this series. All cases were treated with closed reduction and 10-12 hole 4.5mm dynamic compression plate fixation over anterior aspect in bridging mode using the MIPO technique. The dominant side, gender ratio, surgery time, and fracture union time, and complications were noted. The UCLA shoulder and Mayo elbow performance scores were used for assessing the shoulder and elbow function.* **Results:** *Of the Thirty patients in the study,fifteen were males and fifteen were females. The mean age was 44.73 years (range 20 to 63 years). twenty out of ihirty patients (66%) had the dominant side fractured. Mean surgical time in minutes was 84.03 (range: 50 to 155 minutes) .The mean fracture union (radiological) time was 13.7 weeks (range: 10–16 weeks)and clinical union time was 10.4 week . . However Shoulder function was excellent in 23 cases (76.66%) on the UCLA score.* **Conclusion:** *This study confirmed a high overall rate of union and excellent functional outcomes. Mini incision anterior bridge technique for type A fracture shaft humerus gives good functional results and should be considered as an effective, cosmetically advanced surgical option in the treatment of type A humeral shaft fractures. It is a safe and less time consuming method for type A humeral shaft fractures when the surgeon is experienced in the technique.*

KEYWORDS

Anterior Bridge plate, Minimally invasive plate osteosynthesis (MIPO), Diaphyseal humerus fracture

INTRODUCTION

Absolute anatomical reduction by compromising soft tissue and hence the vascularity, is becoming older trend now. Precise reduction and absolute stable fixation has its biological price.[1] Biological fixation of fractures with soft tissue preservation and near acceptable reduction is becoming a more acceptable entity. However it is still a matter of debate. For a satisfactorily outcome Healing in the desired time is not the only requirement but early and acceptable functional result of the limb is the goal.

Evidence shows, that a biological fixation is far more superior over a stable mechanical fixation.[2] This sensitizes the development and improvement in the techniques of biological fracture fixation and stabilization systems.[3,4]

From conservative cast and braces[5,6] to internal fixation with nailing[7], plating and screw, Treatment of humeral fracture has evolved a lot with their complications.[7-10] Studies are still going on to prove superiority of one over another. Minimally invasive technique for humerus shaft fracture has shown promising results recently.[11-14] we have evaluated the clinical, radiological, and functional outcomes of this mini invasive technique for humerus fracture over a minimum follow-up of 2 year and 8 months.

MATERIALS AND METHODS

Thirty patients with fractures of humerus shaft were treated with Anterior bridge plating using minimal invasive technique in a case series of study between march 2023 to November 2025 at our centre. The cases were followed for a minimum period of 2 year and 8 months. All patients who had fracture at midshaft level were selected. These fractures were reduced and fixed with 4.5mm narrow Dynamic compression plate (DCP)& locking compression plate(LCP). All surgeries were done by the same surgeon. Institutional Ethical Committee approved the study.

S.NO.	Age(Year)	Sex	Surgery Time(Minutes)	Blood loss (cc)	Dominant side Fracture	Union (Weeks)	ULCA radiological	MEPS Score
1	20	F	93	150	No	16	24	85
2	25	M	75	100	Yes	16	28	100
3	28	M	62	80	Yes	15	26	90
4	28	M	43	100	Yes	12	28	100
5	35	F	120	120	Yes	10	28	100
6	35	M	155	70	Yes	15	28	95
7	40	F	48	80	Yes	14	24	90
8	40	M	60	80	Yes	12	28	100
9	40	F	125	110	No	15	28	95
10	45	M	110	80	No	16	28	100
11	48	F	78	50	No	11	30	100
12	50	M	86	50	No	12	30	100
13	50	F	122	70	Yes	14	28	100
14	51	M	110	60	No	15	24	85
15	52	F	95	110	Yes	15	28	95
16	52	F	122	65	No	16	28	95
17	55	F	100	100	Yes	12	30	100
18	60	M	85	120	Yes	12	30	100
19	62	M	82	70	Yes	14	21	90

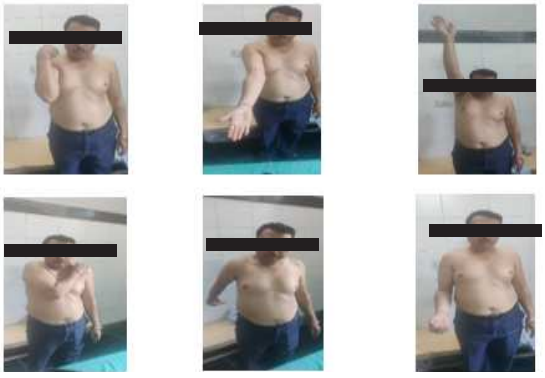
20	63	F	50	80	YES	14	28	1OO
21	52	M	65	100	YES	12	27	90
22	57	F	80	100	YES	16	28	95
23	58	F	60	130	NO	12	30	85
24	62	F	70	100	YES	14	28	90
25	58	F	60	130	YES	10	24	95
26	24	M	90	80	NO	14	28	85
27	26	M	70	120	YES	12	30	90
28	30	M	70	100	YES	16	24	95
29	57	F	65	100	NO	15	30	90
30	39	M	70	100	YES	14	28	95
UCLA	>27 (Good / Excellent) , < 27 (Fair /Poor)							
MEPS	> 90-Excellent , 75- 89- Good , 60-74 -fair , < 60- poor							

The inclusion criterion included all those mid shaft fracture of humerus between 18 and 88 years and who consented to participate. The operative procedure was performed within 4 to 5 days of the injury.

A preoperative clinical examination of the affected arm was carried in all aspects like- abrasions, swelling, contusion, puckering and neurovascular deficit (chiefly Radial nerve status). Antero posterior (AP) and lateral (Lat) radiographs of the humerus, of the patient were evaluated. These radiographs were also used to decide the appropriate length of implant and planning the surgery.

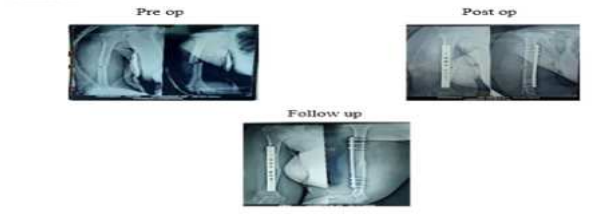
CASE 1

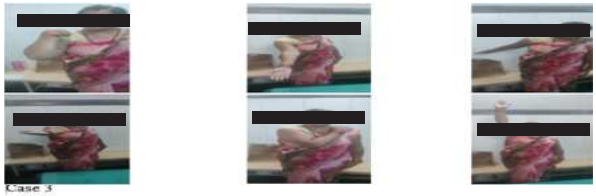
ASHOK BHAI



Case 2

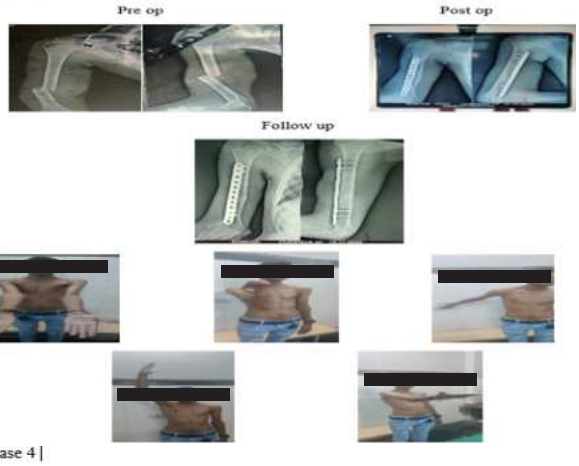
Veenaben





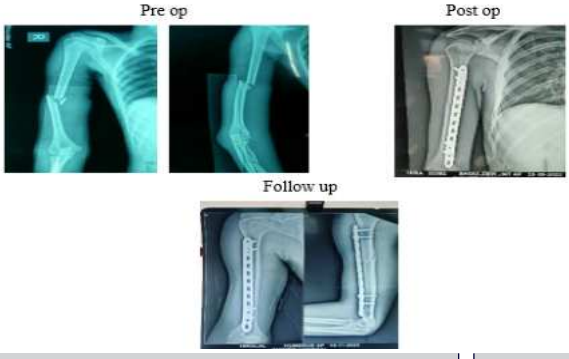
Case 3

Roshan



Case 4 |

Hiralal



SURGICAL TECHNIQUE

The patients were positioned supine with affected armon side board with 90 abduction. twelve patients were given local brachial block, Eight under general anesthesia. A 2-3 cm incision between the medial border of deltoid and proximal biceps, 5 cm caudal to the acromion process was made. Distally, a 2-3 cm incision at the lateral border of the biceps, nearly 5 cm proximal to the flexion crease. Retraction of biceps was done to expose the musculocutaneous nerve, overlying the brachialis muscle. The nerve is then retracted and brachialis muscle was split till bone. The lateral half of brachialis muscle then protects radial nerve. A sub-brachialis, extra-periosteal tunnel was created and a 4.5-mm narrow dynamic compression plate,lcdcp or lcp(usally 12 or more) is passed through the incision on the anterior surface of the humerus. Varus/ valgus angulation, length and rotation are restored by traction. Confirmation of the reduction done. Each side of the plate is fixed withtwo screws in anterior to posterior direction. Tunneling was done carefully in anterior fashion to prevent iatrogenic radial nerve injury. The amount of force required to be used for manual traction for achieving proper reduction was not easy at first, but becomes easy as technique is practiced. The 'cortical step sign' as described by Krettek[15] is used to look for any rotational malalignment. The operative time (skin incision to closure) and duration of radiation exposure (in seconds) was recorded. Postoperatively, shoulder immobilizer was applied.

RESULTS

Of the thirty patients followed up to a minimum of 32 months in the study, fifteen were males and fifteen were females. The mean age was 44.7 years (range 20 to 63 years). twenty out of thirty patients (66%) had the dominant side fractured. The mean surgical time was 84.03 minutes (range: 50–155 minutes) . The mean radiological fracture union time was 13.7 weeks (range: 10–16 weeks). Shoulder function based on the UCLA score was excellent to good in 23 cases (76.6%). Road traffic accident (RTA) was the most common mode of injury, found in 30 cases, The mean follow-up of our cases were 22 months (range: 18– 38 months). Fracture union was observed at a mean period of 13.7 weeks (range: 10–16 weeks).

FOLLOW UP

The operative limb was kept in shoulder immoblizer till stitches were removed (15th day), there after the patients were advised to perform active gentle limb range of motion exercises as their pain control permits. The immoblizer wascontinued for another two weeks. However they were informed to take out the limb and perform informed exercise for five minutes after every hour. To avoid stiffness, after four weeks they were trained by a dedicated physiotherapist to perform active range of motion exercises and were allowed to perform usual gentle activities. After radiological signs of healing, a rehabilitation program was started. The aim was to gain full mobility, muscular strengthening and proprioception as soon as possible. The total rehabilitation period depends on the individual patient's progression. The final goal is to restore ache free functional to full range of motion and strength. The union time and complications were noted. The patients were followed up by same surgeon, first after 2 weeks then monthly for the next 6 months, then once every 3 months till 1 year. The patients shoulder and elbow function were analyzed using the UCLA shoulder score[16] and the Mayo elbow performance score (MEPS)[17] The UCLA shoulder score was graded into excellent to good (>27 points), fair to poor (<27 points). Elbow function was graded on the MEPS basis into excellent (≥90 points), good (75–89 points), fair (60–74 points), or poor (<60 points). Based on the anteroposterior and lateral radiographic view Union was accepted as the presence of bridging callus in three of the four cortices and absence of pain. Also any loss of fracture reduction was analyzed in similar radiograps-

DISCUSSION

Tscherne and Krettek first reported minimal invasive osteosynthesis for supracondylar femoral fractures in 1996.[18] Since then this technique is used in managing various other fractures. Despite the requirement of high surgical expertise and time taken for adaptation of the procedure, the MIPO technique seems to be reproducible and applicable in almost all types of shaft humeral fractures. Lower rates of iatrogenic nerve injury with minimal bone vascularity disruption, and soft tissue dissection are all the advantages over conventional plate technique. Though indirect reduction and plate placement is technically difficult and requires experience, Plates can be safely used anteriorly or anteromedially over the humeral shaft. Bridging the fracture fragment, with fixation only at either ends of the plate and bone.

Excellent to good results have been achieved with sub brachialis plating with no major soft tissue problems and with functional results as per other methods.[19] Open technique of plating interferes with the local vascularity, leading to osteonecrosis underneath the plate, which may cause delayed healing to non healing (published rate of nonunion being 5.8%).[20]

Union of the humeral shaft fractures in this series presents good results with fixation through indirect reduction aims at maintaining bone alignment through mini incision and replacing absolute stability by relative stability. This anterior bridge- plate technique can be used even for the treatment of humeral shaft nonunion (both atrophic and hypertrophic nonunion).[21] The present technique through its less tissue dissection and periosteal stripping makes a promising modality of treatment.

In conclusion, this series demonstrates that the anterior minimally invasive bridge-plate newer, effective, cosmetically advanced (minimal operative site scar) and acceptable modality of treatment for such fractures. Though the technique is complex, requiring a relatively long learning time the results are good and reproducible. However a larger multi centric metanalytical study with control groups will help us to arrive at a standardize protocol. To conclude, MIPO is definitely a newer and acceptable modality of treatment.

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