

STUDY OF FUNCTIONAL AND RADIOLOGICAL OUTCOMES OF SHAFT HUMERUS FRACTURE TREATED WITH ANTERIOR BRIDGE PLATE AT TERTIARY CARE HOSPITAL-AN OBSERVATIONAL STUDY

Orthopaedics

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ABSTRACT

Background: Literature is limited in this new method, Traditionally posterior plate (ORIF) used for shaft humerus fracture but recently minimally invasive plate osteosynthesis(MIPO)in form of anterior bridge plate(ABP) gain popularity, due to its minimal invasiveness, not opening fracture site and not disturbing hematoma, This study will give us some idea as to selecting better approach for shaft humerus fracture. **Methods:** It is prospective observational study, 13 patients with shaft humerus fracture treated by anterior bridge plate at department of orthopaedics new civil hospital surat, india between JANUARY - 2023 TO JULY – 2024 were enrolled. **Results:** RTA is most common mode of injury, nearly 65% fracture is TYPE-A, In functional outcome out of 12 patient 67% had excellent, 33% had good UCLA and MEPS score. Average union time is 14.5 weeks with 2 patients with delayed union. Clinical union precedes radiological union. **Conclusions:** ABP offers excellent functional outcome, near normal biological reduction for shaft of humerus with better union rate and decreased risk of non union, better surgical scar cosmetically, decreased postoperative morbidity and early return to function.

KEYWORDS

Humerus, Anterior bridge plate, minimally invasive plate osteosynthesis, open reduction internal fixation (ORIF).

INTRODUCTION

The rapid growing population with increasing vehicles has lead to increase in road traffic accidents. Humeral shaft fractures are commonly encountered in accounting for 1 to 2 % of all fractures¹. The conservative treatment of these fractures results in satisfactory results due to wide range of motion in shoulder joint supplemented by elbow joint. Hence the treatment of these fractures are a much debated topic.² But in some cases conservative treatment results in varus deformity and limitation of shoulder and elbow motion which leads to reduced function. There are several techniques available to operatively fix humeral shaft fractures such as tens nail, intramedullary nail, external fixation and plate fixation². Non-operative treatment has the advantages of no surgical risk, low treatment cost and no wound infection but it also has disadvantages, such as nonunion and dysfunction. Traditional ORIF can perform the anatomical reduction of fractures under direct vision, but it also has disadvantages, such as large surgical trauma, wound infection, and nonunion due to excessive periosteal stripping. Intramedullary nail can protect the integrity of the periosteum and the blood supply of fracture ends, and promote fracture healing, but it also has disadvantages, such as Rotator cuff impingement. Minimally invasive plate osteosynthesis can better protect the blood supply of the broken end, minimize the peeling of the periosteum, and reduce surgical trauma.³ It augments the natural healing of fracture site on concept based on the relative stability of the fracture. One of the positive aspects of this technique was that all of the patients benefited not only from early limb mobility but also from the resulting stability that was adequate to support the stress and eliminate the pain that resulted in a rapid recovery with limb movement.^{4,5}

METHODS

In this prospective observational study, total of 13 patients who treated by anterior bridge plate for shaft humerus fracture in Department of Orthopaedics, New Civil Hospital, Surat, India between JANUARY - 2023 TO JULY - 2024 were enrolled and Ethical approval Taken from human research ethics committee ,government medical college surat.

Inclusion Criteria

- A. Adult patient from age ≥ 18 year
- B. Intact vascularity
- C. Closed fractures
- D. Patients giving consent for operative management and are medically fit for surgery.

Exclusion Criteria

- A. Patient with proximal humerus fracture & very distal lower humerus fracture
- B. Patients of age < 18 year
- C. Patient having fracture with radial nerve palsy or Vascular deficit in affected limb

- D. Patients having previous humerus surgery
- E. Patient having unfavorable local skin or Fracture > 3 week old
- F. Pathological fracture
- G. Ipsilateral upper limb other fracture.

Radiological investigation by Antero-posterior and Lateral Views X-ray of the affected arm including the ipsilateral Shoulder and elbow: then the fracture pattern was classified according to AO classification.

OPERATIVE TECHNIQUE

After the anesthesia patient is positioned supine in operating table with forearm post support and forearm in supination and arm in 90 degree abduction. The proximal incision is 3 to 5 cm in length, 5 cm below the acromion and made between the medial border of deltoid and the lateral border of biceps. The distal incision is also 3 to 5 cm in length was made between the biceps and brachioradialis muscle, 5 cm proximal to the elbow crease. The interval between biceps and brachialis is identified and care is taken to avoid injury to the musculocutaneous nerve.⁶ A submuscular extraperiosteal tunnel was prepared between brachial muscle and underlying periosteum then the straight, non contoured, long (8-14 hole), narrow, 4.5-mm, dynamic compression plate or locking compression plate inserted in direction of proximal incision to distal incision.⁷ The radial nerve is not exposed during the whole procedure. (Figure 1)



Figure 1 - Intra operative image of incision mark for anterior bridge plate and insertion technique.

Centre of plate at fracture site. LCP is good option in osteoporotic bone⁸. It is fixed with one screw distally. (second last hole of distal end of plate) Reduction of the fracture is usually achieved by traction with

elbow flexed to 90 degrees and forearm in supination to restore length and correct varus as well as angulation. Then one screw is inserted proximally. (second last hole of proximal end of plate) and both screws not fully tightened. Reduction checked with C-ARM then both screw tightened⁹ and if acceptable reduction achieved then one more screws are inserted into each fragment (through last hole in each end). If these did not achieve good enough stability, a third screw can be inserted.^{4,10}

Post operatively patients followed up at 1 month,³ and 6 month and functional assessment done by UNIVERSITY OF CALIFORNIA AT LOS ANGELES (UCLA) AND MAYO ELBOW PERFORMANCE SCORE (MEPS) and Radiological Assessment by Degree of angulation at the fracture site & evidence of union at the Fracture site.

RESULTS

Out of total operated 13 patients 1 patient followed up with implant failure (and not willing for revision surgery), so 12 patients taken for functional analysis and radiological assessment in result. 13 patient having age range 24-65 years, majority patient from 18-30 year group and mean age is 38 years with 54 % male patient and 46% female and among all 61% with left side and 39% with right side of humerus fracture. RTA is most common mode of injury followed by fall down. Nearly 65% fracture is TYPE-A, 30% TYPE-B and remaining 5% TYPE-C according to AO classification. Most of patient operated within 7 days of trauma, average time interval from trauma to surgery is 5 day. In functional outcome out of 12 patients 67% had excellent, 33% had good UCLA and MEPS score (Table 1).

Table 1- Functional Evaluation By UCLA and MEPS SCORE

	UCLA SCORE	MEPS SCORE
EXCELLENT	8	8

Table 2- Master Chart

ID NO.	NAME INITIAL	AGE (YR)	SEX (M/F)	MODE OF INJURY	SIDE	AO TYPE	TIME SINCE INJURY (DAY)	UCLA	MEPS	UNION (WEEK)	ANGULAT ION	COMPLICATI ON
158723	SS	24	M	RTA	RIGHT	12-A3	1	33	85	13	NIL	-
217987	DK	20	M	RTA	LEFT	12-A3	9	32	85	24	NIL	DELAYED UNION
00080	RP	48	F	FALL	LEFT	12-B2	7	33	85	12	NIL	-
235026	HC	49	F	RTA	RIGHT	12-A2	4	35	100	11	NIL	POST OP RADIAL NEUROPREXIA
71366	MP	40	F	RTA	LEFT	12-C2	6	34	100	10	5° VALGUS	-
911151	MS	30	F	FALL	LEFT	12-B2	7	IMPLANT FAILURE				
52909	DP	48	M	FALL	LEFT	12-A3	3	35	100	12	NIL	-
54032	MS	30	M	FALL	LEFT	12-A3	2	35	100	13	NIL	-
87143	SM	65	F	RTA	RIGHT	12-A3	6	35	100	12	5° VARUS	-
148691	RL	38	M	RTA	RIGHT	12-A2	14	30	75	32	NIL	-IMPLANT FAILURE -REVISION -INFECTION -DELAYED UNION
5528	HB	25	M	ASSULT	LEFT	12-B1	2	35	100	11	15° VARUS	-
194446	AV	35	M	RTA	RIGHT	12-B2	1	35	100	12	NIL	-
123818	AM	37	F	FALL	LEFT	12-A3	19	35	100	11	5° VALGUS	-

DISCUSSION

Minimally invasive surgical technique does not only imply that the length of the incision is small, but rather the soft tissue dissection and the fracture reduction are from a distance, remote to the fracture site. This way, the soft tissue and bone biology is preserved and indirect reduction with relative stability principle preserves fracture hematoma leads to essential callus formation by secondary bone healing which is far more superior to the healing that occurs in primary healing in ORIF. The problem was that, all too often, precise reduction and absolute stable fixation were achieved at the expense of extensive soft-tissue trauma caused by the surgery. Also, the plate in open reduction and internal fixation causes osteonecrosis beneath the plate causing refracture after the removal of plate. The union rate of fracture under our study was one hundred percent with 2 cases of delayed union with a mean time to union of 14.5 weeks, which is comparable with meta analysis done by beer⁵ which having average union time 15.2 weeks. ABP is devoid of the entry-point problems of intramedullary nailing such as rotator cuff impingement, there was no case of postoperative shoulder impingement as that occurs with nailing. It

GOOD	4	4
FAIR	0	0
POOR	0	0

Average union time is 14.5 weeks with 2 patients with delayed union (Figure 2)

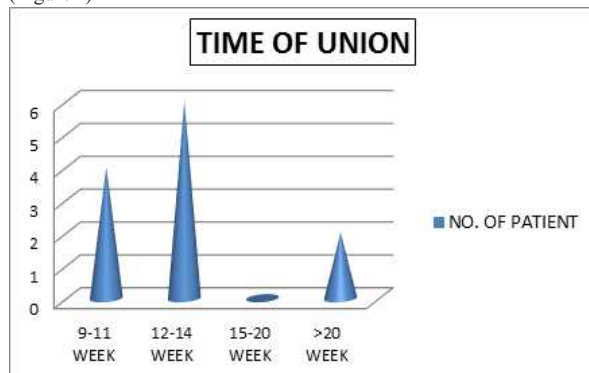


Figure 2- Time of union in weeks

One patient had radial nerve palsy post operatively. Immediate postoperatively exploration done and nerve was found intact and no entrapment was there and in post operatively dynamic cock-up splint given & full recovered by 5 weeks. One case showed delayed union by 24 weeks. One patient presented with implant failure at 9th week post operatively and revision surgery was done at that time and satisfactory reduction and stability achieved, in post operative period stitch line got infected and regular dressing done and delayed union seen. (TABLE 2)

carries a lower risk for non union and secondary radial nerve palsy and Radial nerve palsy secondary to operation is a temporary issue⁵. The scar was cosmetic and minimal and the average blood loss was also less when compared with traditional open technique. Here clinical union precedes radiological union as on xray fracture looks uniting but on examination patient will be painless and with good function.

CONCLUSION

Minimal invasive plate osteosynthesis in form of ABP offers excellent functional outcome, near normal biological reduction for shaft of humerus with better union rate and decreased risk of non union compared to ORIF. There is better surgical scar cosmetically, decreased postoperative morbidity with early return to function. The operating time and blood loss are less compared to ORIF. The chance of infection is negligible due to decreased surgical exposure.

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