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Comparison of outcome of shaft humerus fracture: Anterior bridge plating versus posterior plating vs humerus intramedullary nailing

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Abstract

Introduction: Shaft humerus fractures are complex injuries as their management requires stable fixation and adequate reduction. Management includes conservative cast application, intramedullary nailing, open reduction and internal fixation or MIPPO plating in the form of Anterior Bridge plating.

Aims and Objectives: Comparison of outcome of shaft humerus fracture treated by: Anterior bridge plating versus posterior plating versus intramedullary humerus nailing.

Materials and Methods: A retrospective clinical study was done on 40 patients with shaft humerus fractures treated with Anterior bridge plating and posterior plating and intramedullary nailing by trained surgeons at a tertiary trauma care centre in the Department of Orthopaedics, BJ medical college, Civil hospital Ahmedabad between Nov 2019 to Nov 2020. The mean follow-up study time was approximately 6 months. (1-12 months).

Observation and Results: All the operated patients were followed up for a mean period of 6 months (range from 01 to 12 months). The clinical, physiological and ortho-radiological assessment was performed to observe and evaluate fracture stabilization and reduction and fracture healing and callus formation and range of movements.

Conclusion: Adequate reduction with less operative time and less soft tissue damage and preservation of neurovascular with an increased rate of union and early mobilization was seen with ABP plating. Nailing had the same benefits except for the decreased range of movement at the shoulder.

Keywords: Shaft humerus fractures, intramedullary nailing, plating of humerus, anterior bridge plating

Introduction

The humerus can be considered the most versatile bone in the human body as it can be successfully approached by a variety of methods for fracture fixation, including functional bracing, plating (posterior, lateral, and anterior), and intramedullary nailing (ante-grade and retrograde). Plating can be performed using a classic open approach or minimally invasive methods. In the presence of a myriad of treatment options, it is necessary to individualize these options depending on the patient profile. The main target was to achieve an early mobilization and regain the strength of the humerus without infection or neurovascular damage. Anterior bridge plating (ABP), which utilizes the minimally invasive approach popularly known as the minimally invasive percutaneous plate osteosynthesis (MIPPO) technique, can be said to be the latest entrant in this list.

In the posterior approach, biological disruption of fracture & soft tissue, poor cosmetic scarring, and direct handling of the radial nerve has been of concern. On the other hand, the classical intramedullary nailing is minimally invasive, but it has the main drawback of potentially damaging the rotator cuff & compromised shoulder motion. The ABP is designed to combine the best features of these two techniques: therefore, it is minimally invasive, biological and cosmetic friendly and causes minimal manipulation of vital structures.

From the period of November 2019 to November 2020, 40 patients who met the inclusion criteria and having shaft humerus fractures had included in the study.

Aims and Objectives

1. Evaluation of Clinico-Radiological & functional outcome of shaft humerus fractures managed by different modalities.

Materials and Methods

This randomized retrospective clinical study was conducted on 40 patients with shaft humerus fracture. Shaft humerus fracture was treated with intramedullary nailing, posterior plating and ABP plating by trained surgeons at a tertiary trauma care centre in the Department of Orthopaedics, B.J. medical college, Civil hospital Ahmedabad between Nov 2019 and Nov 2020. These cases were selected for study randomly. Fracture patterns were classified on the basis of AO/OTA classification of shaft humerus fractures.

Inclusion criteria

1. Patients with shaft humerus fractures (AO 12-A)
2. Only closed fracture patients were included
3. Fresh trauma up to 2 weeks

Exclusion criteria

1. Age less than 18 years and greater than 60 years excluded
2. Open fracture
3. Osteoporotic patients
4. Pathological fractures

40 consecutive patients with shaft humerus fractures presenting within 2 weeks of clinical injury who were operated on between November 2019 and November 2020 were included in this retrospective study. The mean age of patients was 48 years (range 18–60 years). The mechanisms of injury included Road traffic accident in 18(45%), fall when walking and from height in 13(32.5%) assault in 9(22.5%).

The standard AO classification was used. The surgery was done in the supine position in case of nailing and ABP plating and lateral position in posterior plating. All the operations were done by operating surgeons of our department in B.J. Medical College. The post-operative day one passive mobilization and physiotherapy of the elbow and shoulder were given once the pain was decreased. Active physiotherapy and assisted exercises were allowed after the radiologically bone union was seen on the x-ray and clinically absence of pain over the fractured site. All the patients were followed after 15 days for suture removal and later on every month for ortho-clinico-radiological correlation till the fracture got united. Union of fracture was defined as the formation of bridging callus on two radiographic antero-posterior and lateral views and clinically defined as no pain at the fracture site. Clinical examination and follow-up included patient satisfaction, visual analogue scale, range of motion over the elbow joint and shoulder joint. Daily activities were allowed after one-month post-operation, but lifting of light weight was allowed once after radiological bone union seen at the fracture site.

1. 40 patients having shaft humerus fracture were included, out of which 15 were treated with posterior plating, 15

- with intramedullary nailing and 10 with ABP plating.
2. The age of patients varied between 18-60 mean being 48.
3. 25 of them were male, while 15 were female.
4. In all of them, mode of injury was fall down from height and RTA or assault that are high-velocity injury.
5. Total of 7 patient have pre-op radial nerve palsy of which 2 treated with IM nail, 2 with ABP & 3 with Posterior plating, all 7 recovered from palsy over 6-10 months with steroid, cock-up splint & physiotherapy.
6. Out of the other 33 pt. 1 pt. Treated with IM nail & 1 treated with Posterior plating Had post-op radial nerve palsy, neuropraxia in nature recovered fully over 6-8 month with steroid cock-up splint & physiotherapy but required proper pt. Counselling & follow-up.
7. The mean time of operation was 10 days from admission.
8. The average operating time was 75 ± 15 min (60–90 min) for intramedullary nailing and ABP plating while 130 ± 30 min (120-180 min) for posterior plating.
9. Hospital stays varied from 5 days to 8 days, mean being 7 days longer for Posterior approach.
10. The average time of callus formation was found to be 20 weeks. Concomitant injuries didn't hamper the bone healing, but soft tissue recovery occurred in an uneventful manner.

All the patients were regularly followed up and the mean followed up time was 13 months (range from 06 to 20 months). Out of 40 patients having shaft humerus fracture, 37 fractures were united with meantime around 20 weeks (range 16-24weeks). Bone Union was defined as the clinically absence of pain at the fracture site and radiologically bridging callus formation on both antero-posterior and lateral radiographic view. Three patients (7.5%) have non-union at the fracture site (1:IM nail & 2: posterior plate), which require revision surgery with bone grafting. One patient (2.5%) having posterior plating implant failure and 2 having SSI, treated with Posterior plating, which is covered with higher antibiotics regular dressing and later on 1 patient got recovered 1 required removal of the posterior plate & external fixator.

Discussion

Plating has early mobilization and adequate reduction on the other hand anterior bridging plating has minimal invasive so less wound complications & early post-op rehab. Anterior bridging plate done only for closed reduction and cause good union and having less chance of radial nerve injury intraop. Nailing has less wound complication but not having an absolute reduction, Compromised shoulder functional ROM in nailing and needs aggressive physiotherapy. In our post-operative management, patients were given U- slab or sarmentio brace for 2-3 week, promoting bone healing but after 2-week patient was advised to remove the slab and allowed mobilization with active and assisted physiotherapy was given. This improved the early recovery of movements at the elbow joint and allowing daily activities.

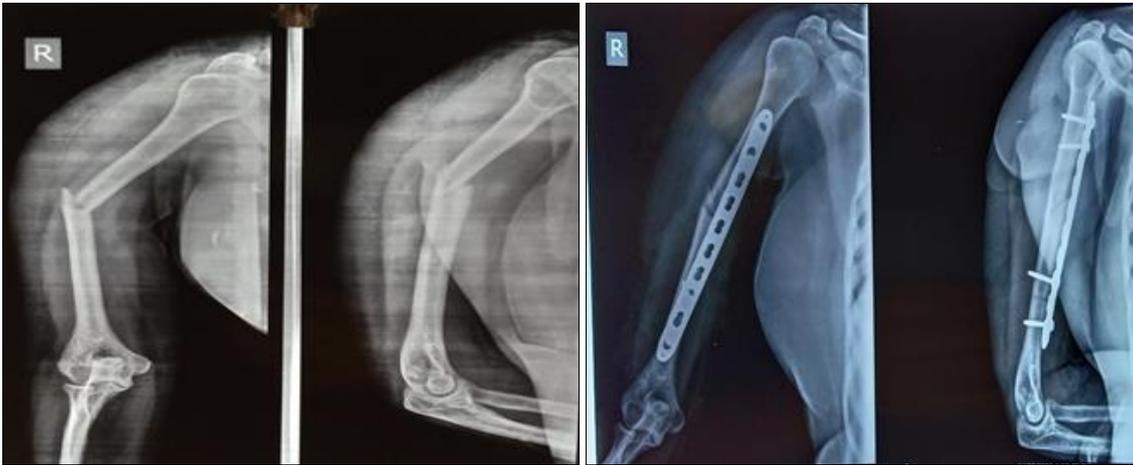


Fig 1: Pre-OP x-ray, Post-op x-ray of ABP plating



Fig 2: ABP plating in shaft humerus fracture with callus formation (5 month)



Fig 3: Pre-op humerus fracture.

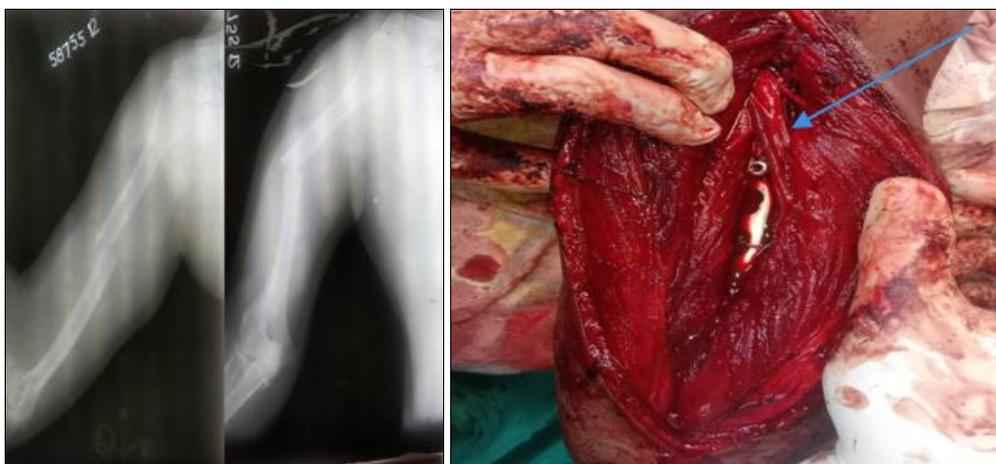


Fig 4: Pre-op posterior plating Radial Nerve

Conclusion

Plating has the advantage of early mobilization and adequate reduction over nailing. Early physiotherapy and early use of the elbow and shoulder joint could improve the functional success outcome of this type of surgery as well as concomitant assessment and management of radial nerve if injured but has more chances of infection owing to increased duration of surgery, soft tissue damage, radial nerve damage. Nailing has the advantage of minimal soft tissue damage, lesser operative period and increased rate of the union but more chances of rotator cuff damage and decreased ROM of the shoulder. ABP is fundamentally different from traditional open posterior plating or conventional intramedullary nailing. It gives relative stability and secondary union by callus formation, and a longer plate on the tensile surface ensures that the humerus can withstand a greater amount of rotational and bending stresses. The minimally invasive nature causes minimal soft tissue damage and, if done correctly, causes no damage to the vital structures in proximity.

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