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Comparative study of results of ORIF with plating vs. CRIF with nailing in fracture midshaft humerus

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Abstract

Background: Fractures of the humeral mid shaft are common. The advantages of operative management are early mobilization and patient comfort but, operative management carries the risk of technical errors and post-operative complications like infections and nerve injuries.

Aims and Objectives: To study the fracture pattern and surgical management of fracture midshaft humerus by intramedullary nailing and plating.

Materials and Methods: Forty eight patients were studied in the Department of Orthopaedic, MLB Medical College Jhansi from August 2018 to August 2019, after randomizing them into plating or interlocking nailing. A thorough history and clinical examination was done. Once the patients were randomized, pre-operative planning and investigations were done and the patients were posted for open reduction and internal fixation with plating or interlocking nailing. The patients were followed up every second week till radiological union was seen. The functional outcome was measured by the "Disabilities of Arm, Shoulder and Hand" (DASH) Questionnaire at nine months or at full recovery which ever was earlier.

Result: Out of 60 fractures shaft of humerus, 48 were operated and the rest 12 treated conservatively. Mean time taken for radiological healing in the interlocking group was 14.05 and in plating was 16.06. The mean DASH score in the plating group was 24.1 and in the interlocking group it was 43.1 (0.024). Postoperatively in the plating group there were 13 complications and in the interlocking group there were 6 cases with complications (p=0.009).

Conclusion: Cases where both plating and interlocking nailing can be done, plating should be preferred as plating offers better result with respect to pain and function of the shoulder joint.

Keywords: Humerus fractures, healing, DASH score, interlocking nailing, Plating

Introduction

Fractures of the humeral mid shaft are common and accounts for 1% of all fractures. Fractures of humeral shaft have traditionally been regarded benign, with high percentage of primary healing with conservative methods, using either a hanging arm cast or a functional brace. However loss of reduction in the plaster cast invariably leads to malunion^[1].

Operative treatment for humerus fractures has usually been reserved for the treatment of nonunion, associated with fractures of forearm, for polytrauma patients, and for those with neuro-vascular complications^[2]. The advantages of operative management are early mobilization and patient comfort but, operative management carries the risk of technical errors and postoperative complications like infections, nerve injuries etc. Most of the studies have used fracture union as the major determinant of the outcome and very few studies have examined the functions at the shoulder and elbow^[3].

The optimal method of humeral shaft fracture fixation remains in debate. Two techniques under study include intramedullary nailing and dynamic compression plate fixation. Plating provides satisfactory results but requires extensive dissection, and meticulous radial nerve protection. The plate may fail in osteoporotic bone^[4].

With the dynamic success of intramedullary fixation of fractures of the femur and tibia, there was speculation that intramedullary nailing might be more appropriate for humeral shaft fractures than dynamic compression plating.

According to recent studies the preferred method of fixation of humeral fractures is by

dynamic compression plate. The purpose of this study is to compare the outcomes of each method of fixation (dynamic compression plating and interlocking nailing) for the fracture mid shaft of humerus and to analyse statistically significant difference in the results of these two methods.

Material and Methods

This study was conducted in the Department of Orthopaedic, MLB Medical College Jhansi from August 2018 to August 2019. Patients with diaphyseal fractures of the humerus with indications for surgical management were included having age 18 years or more.

Patient with pre-existing shoulder or elbow pathology, pathological fractures, segmental fractures, fractures within 4cm of proximal and distal end of humerus, and patients who were lost to follow-up or at early stages of follow-up at the time of completion of the study (minimum follow up of six months required), polytrauma patient and compound grade II & III fracture were excluded.

A thorough history and clinical examination was done. The status of radial nerve injury was recorded. Roentgenogram of the arm with shoulder and elbow was taken in both antero-posterior and lateral views. Additional roentgenograms were taken if any other injury was suspected. The humeral shaft fracture was temporarily immobilized with a U-slab and arm pouch.

The 48 patients were prospectively randomised into two categories of plating or interlocking nailing by a computer generated list. Once the patients were randomized, pre-operative planning and investigations were done and the patients were posted for open reduction and internal fixation with plating or interlocking nailing.

Anterolateral approach was used in patients with fractures of the upper and middle thirds of the shaft of the humerus. Posterior approach was used in patients with fractures of the lower thirds of the shaft. Only antegrade nailing was done in case of interlocking nailing group, none of the cases were treated by retrograde nailing.

In the first group, 4.5 mm narrow plating was used, and in second group standard intramedullary interlocking nail was used. All the surgeries were conducted in the same centre by 4 orthopaedic surgeons who were all trained in both the procedures.

8 patients was lost to follow up and 2 patients were excluded from the study as they expired leaving us with 38 patients of the 38 fractures, 18 were fixed with plating and 20 were fixed by interlocking nail.

The patients were followed up every second week till radiological union was seen. At every follow up clinical examination was done to assess status of the surgical wound, pain, tenderness, range of motion of shoulder and elbow, stability of the fracture and clinical union. Roentgenograms were taken in AP and Lateral views to look for signs of radiological union. The union is confirmed radiologically when plain X-ray showed bone trabeculae or cortical bone crossing fracture site on at least three surfaces on orthogonal radiograms. The time taken for clinical and radiological union was noted. If there are no clinical and radiological signs of union by 16 weeks, the fracture was categorised as delayed union and if absence of fracture union after 32 weeks after injury was categorized as non-union.

The functional outcome was measured by the "Disabilities of Arm, Shoulder and Hand" (DASH) Questionnaire at nine months or at full recovery which ever was earlier.

All the data analysis was performed using IBM SPSS ver. 20

software. Frequency distribution was performed to prepare the tables. Quantitative data was expressed as mean and standard deviation whereas categorical data was expressed as percentage. Chi Square test was used to compare the percentage and number. P value of <0.05 is considered as significant.

Result

There were 60 fractures shaft of humerus in adults, presented to our hospital during the course of the study of the 60 fractures, 48 were operated and the rest 12 treated conservatively, of the 48 patients, 8 were lost to follow up and 2 patients expired leaving us with 38 patients with the distribution being 18 in plating and 20 in interlocking group.

In the plating group there were 13 males and 5 females. In the interlocking group, there were 14 males and 6 females. ($p < 0.05$) The age of the patients in the plating group ranged from 22 to 60 years with a mean of 37.28 years. The age in the interlocking group ranged from 23 to 70 years with a mean age of 35.05 years. ($p > 0.05$).

The most common mode of injury in both groups is RTA, with fall being the second most common cause. Right side was the most commonly involved side in both the plating and interlocking group with no statistically significant difference.

21 fractures occurred in the middle third of the diaphysis, 11 in the interlocking group and 10 in the plating group. 9 fractures were there in lower third 3 fracture in the middle third and lower third junction. 3 fractures in the upper third. 1 fracture between upper third and middle third junction. 1 segmental fracture extending between upper third and lower third.

There were 9 AO type A fractures in plating group and 11 in interlocking group. 6 type B fractures in the plating group and 6 in interlocking group. There were 3 type C fracture in the interlocking group and 3 in the plating group.

Pre-operative radial nerve palsy was present in 3 patients. All the 3 of them in the plating group of which 2 recovered completely. The mean duration between trauma and surgery in plating group was 4.15 days and in ILN group was 2.95 days.

In plating anterolateral approach was used in 14 patients and posterior approach was used in 4 patients. Among the interlocking group only antegrade nailing was done. Average time taken for surgery was 82 minutes for plating and 70 minutes interlocking nailing group. The average duration of follow up in our study was 11.4 months. Range (6 to 17 months).

Average time taken for radiological healing was 15.05 weeks (14.05 in interlocking group and 16.06 in plating group). So the healing rate was relatively faster in the interlocking group as compared to the plating group. There was no statistically significant difference in the time taken for radiological union. ($P = 0.065$). Two fractures treated with plating remained ununited.

Table 1: Comparison of DASH scores

Results	Group		Total	P value
	ILN (n=20)	Plating (n=18)		
Excellent	2	8	10	0.024
Good	6	6	12	
Fair	8	2	10	
Poor	4	2	6	

Intraoperatively the interlocking group had 4 complications and the plating group had only 2 complications.

Postoperatively in the plating group there were 13 complications and in the interlocking group there were 6 cases with complications. Complications were more in the interlocking group, which was statistically significant ($p=0.009$).

Discussion

Most surgeons agree that intramedullary nailing is the best internal fixation for femoral and tibial shaft fractures, but there is no agreement about the ideal procedure for fractures of the humeral shaft. Plate osteosynthesis requires extensive soft tissue dissection with the risk of radial nerve damage [5].

The indications for open reduction and internal fixation of acute fractures of the humeral shaft have been described as: fractures in patients with multiple injuries, open fractures, fractures associated with vascular or neural injuries or with lesions of the shoulder, elbow or forearm in the same limb; bilateral upper extremity injuries, fractures for which closed methods of treatment have failed and pathological fractures [6, 7].

In several reported series, the presence of associated multiple injuries was the most frequent indication for internal fixation of the humeral shaft [8, 9]. In our study failed closed reduction and associated injuries were the most common indications.

This study is having a short term follow up of minimum of 6 months and maximum of 17 months (mean 11.44 months) and therefore discussion is essentially a preliminary assessment.

In previous reports the incidence of non-union after plating has ranged from 2% to 4% [10, 11]. In our plating group the incidence of non-union was 11.11%. Retrospective studies of locked intramedullary nail fixation quote incidences of non-union ranging from 0% to 8% [12-13]. In our series the incidence of non-union in the interlocking nail group is 0%.

The incidence of radial nerve palsy with fracture shaft humerus varies from 6% to 15% [15, 16]. In our series the incidence was 7.9%. Out of the 3 cases, 2 cases recovered (66.6%), which tallied with Seddon's and Pollock's series of 70% and 68% respectively.

In the plating group the incidence of post-operative radial nerve palsy is 2% to 5% [10, 11], but there were no such cases in our study. The incidence of post-operative radial nerve palsy in various studies varies from 2.6% to 14.3% in the interlocking group [16, 17].

There was no problem with infection in our patients with only 1 patient having superficial infection (2.63%) among 38 patients, which responded well to debridement and intravenous antibiotics for 3 weeks.

The failure of fixation in a case of plating was due to poor technique due to inadequate hold. When this fracture was replated with the addition of 2 extra holes and bone graft, the fracture united at 6 months without complications. The patient with implant failure in interlocking group went on to unite uneventfully despite the screw breakage at one of the two distal interlocking sites.

The rate of intra operative communitation during interlocking nail insertion with various studies varied from 7.7% to 10%. [17, 18] In our series there were 2 (10%) intra operative communitations out of 20 patients treated with interlocking nailing. One occurred at fracture site due to hoop stress and the other at the greater tuberosity during nail insertion.

Persistent pain after antegrade nailing is common [29-21] Habernek and Orthner [22] reported good results with Seidel's interlocking nail but later withdrew their support in 1998, as they had not assessed the shoulder functions of their patients properly. The cause of pain could be disruption of the rotator

cuff in its avascular zone within 1 cm of its insertion to the greater tuberosity that may lead to poor healing [21]

Three patients had developed shoulder pain/stiffness and 11 of our 20 patients in the interlocking nailing group reported some or the other shoulder pain. Our study confirms that antegrade insertion of nail can lead to problems with shoulder function and range of movement probably because of damage to the rotator cuff.

The sample size of our study is small with only 38 patients included in the final study. The union rates are comparable in both the groups with the results in excellent and good category are similar (p value insignificant). There were more fair and poor results in the interlocking nailing group compared to plating group. The complications were more in the interlocking nailing group with most of them pertaining to poor shoulder function or pain and this difference in the complications was statistically significant.

Though interlocking intramedullary nailing is good for specific conditions like pathological fractures, segmental fractures or with associated lower limb fractures which require early weight bearing with crutch walking, we still consider plate fixation is better than interlocking nailing in treating fractures of the diaphysis of the humerus.

Conclusion

Fractures of the shaft humerus are one of the common fractures affecting present generation and treatment modality has to be decided carefully. We are of the opinion that the operative treatment of the humerus fractures should be done in patients with polytrauma and in patients with failed conservative treatment. Both the modalities of treatment i.e. dynamic compression plating and interlocking nailing are good as far as union of the fracture is concerned, but considering the functional outcome and rate of complications, we are of the opinion that plating offers better result than interlocking nailing with respect to pain and function of the shoulder joint. We therefore conclude that in cases where both plating and interlocking nailing can be done, we would prefer to use plating, as the results are better than interlocking nailing. The fallacies in our study are, the sample size is small and we have not taken retrograde interlocking nailing in to consideration.

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