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Original Research Paper

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A COMPARATIVE STUDY ON FUNCTIONAL OUTCOMES OF NAILING VS. PLATING IN PATIENTS HAVING FRACTURE SHAFT HUMERUS

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ABSTRACT

Introduction: Fractures of shaft humerus are those fractures which lie distal to the surgical neck of the humerus and proximal to the supra-condylar ridge distally. Conservative management of fracture shaft humerus yield in satisfactory results in most of the cases. Dilemma between dynamic compression plating and ante grade intra-medullary nailing occurs when a surgery is indicated. **Objectives:** In this study, we aim to present a comparative analysis of two series of patients operated with dynamic compression plating and ante-grade intra-medullary interlock nailing respectively with focus over their functional outcomes, complications and other important parameters. **Methods:** A total of 32 patients with fracture shaft humerus were treated surgically. 17 were subjected to plating and 15 were subjected to intra-medullary nailing. Functional outcome of patients was recorded using Constant and Murley score along with other parameters such as duration of surgery, intra-operative blood loss, complications, and union time. **Results:** Treatment with plates in this comparative study led to a better ROM in the shoulder and fewer complications. Loss of shoulder motion may be expected after humeral shaft osteosynthesis. However, the functional scores and the healing index can be good and excellent with both techniques.**Conclusion:** In this comparative study, treatment with plates led to a better ROM in the shoulder and fewer complications. However, functional scores and healing rates can be good and excellent with both techniques. A loss of shoulder motion may be expected after humeral shaft osteosynthesis. Prospective studies are necessary with a long-term follow-up to strengthen these findings.

KEYWORDS :

INTRODUCTION:

The treatment of humeral shaft fractures is still controversial. In many cases, treatment is nonsurgical. But in those cases where surgery is indicated, the selection between rigid nails and plates with screws is difficult. Multiple studies on this topic have been published, but they usually conclude that there are no differences in outcomes by comparison.

Fractures of the humeral 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. [1]

However, loss of reduction in the plaster cast invariably leads to malunion. 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, 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.

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. [2] The plate may fail in osteoporotic bone. 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. The theoretical advantage of intramedullary nailing included less invasive surgery, an undisturbed fracture hematoma and use of a load sharing device support. [3]

However, the phenomenal success of interlocking nailing in long bones like femur and tibia is not seen in humerus. 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 functional outcomes of each method of fixation (dynamic compression plating and interlocking nailing) for the fracture shaft of humerus and to analyze statistically significant difference in the results of these two methods.

OBJECTIVES:

- To present a comparative analysis of two series of patients operated with dynamic compression plating and ante-grade intra-medullary interlock nailing respectively
- To focus over their functional outcomes, complications, and other important parameters during these procedures.

Methodology:

A Cross sectional study was conducted among patients who had fracture of shaft humerus and having surgical indication, at one of the tertiary care hospitals of Lucknow. Study duration was 9 months.

After getting permission of Institutional Ethical Committee, patients who had fracture of shaft humerus and willing to participate in the study were included. Prior consent from individual participants were taken.

Exclusion Criteria:

Patients with complications and heavy bleeding and who had undergone a previous surgery in the same shoulder, arm, or elbow were excluded.

Participants were selected by purposive sampling method. A total of 32 patients with fracture shaft humerus were treated

surgically. Seventeen were subjected to plating and fifteen were subjected to intra-medullary nailing with a minimum follow-up of 6 months. Functional outcomes of patients were recorded using Constant and Murley score along with other parameters such as duration of surgery, intra-operative blood loss, complications and union time. Pre-operative and final follow-up X-rays were evaluated.

Fracture healing status and final shoulder ROM, including forward elevation, external rotation, and internal rotation, were evaluated. The patients were also assessed by the Rodríguez-Merchán criteria, which simultaneously evaluates shoulder and elbow ROM. Subjective data, such as pain, were also considered on a graded scale: none, occasional, pain with activity, and variable pain. General subjective disability was rated as none, minimal, moderate, and severe. The final scores were qualified as excellent, good, fair, and poor, using the lowest score of each item for the final result.

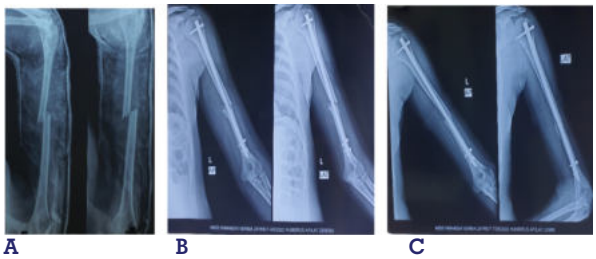
Shoulder forward elevation and external rotation were measured with a manual goniometer. Internal rotation was determined by the highest spinal level reached by the thumb, graded as follows: T7, excellent; T12, good; L5, fair; and <L5, poor. In the plate (P) group, the Constant score was used as well.
The following variables were compared: gender, age, fracture type as per the AO classification, full shoulder ROM, Rodríguez-Merchán score, complications, and associated injuries. A full ROM was considered with shoulder flexion of 180°, external rotation of 90°, and internal rotation with the thumb reaching T7 or higher. The anterolateral or posterior approach was used for all cases in the P group. The surgical approach was determined as per the location of the fracture. The anterolateral approach was used for midshaft and proximal shaft fractures, whereas the posterior approach was used for more distal diaphyseal fractures.

All nail surgeries were performed with the patient in a beach-chair position by an anterolateral acromial approach, dissection between the anterior and middle deltoid, and a longitudinal incision through the supraspinatus tendon.

RESULTS:

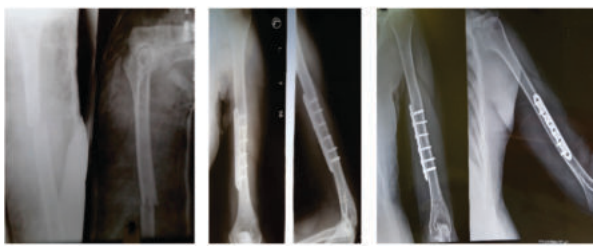
Attributes		Plating Group	Nailing Group	P value
Number of Patients (total=32)		17	15	
Age	Range (Years)	22-69	20-62	0.63
	Mean (years)	39.65	41.09	
Gender	Male	13	9	0.78
	Female	4	6	
Mode of Injury	Traffic Accidents	11	10	0.15
	Other	6	5	
Mean Duration of Surgery (minutes)		125.13	51.95	0.006
Mean Amount of Blood Loss (ml)		209.09	60.5	<0.001
Mean Duration of Hospital (days)		9.68	4.65	<0.001
Complications	Number of Cases	3	3	0.23
	Superficial Infection	2	0	
	Radial Nerve Palsy	1	0	
	Shoulder Pain	0	2	
	Decreased Shoulder	0	1	
Constant and Murley Score	Excellent	13	11	0.43
	Good	2	2	
	Fair	1	1	
	Poor	1	1	
	Mean Grading	13.64	11.95	
Mean Radiological Union Time		15.63	14	0.06

Mean duration of surgery in plating group was 125.13 minutes and in the nailing group was 51.95 minutes. Average amount of blood loss in plating group was 209.09 ml and in nailing group was 60.5 ml. In the plating group 14 (82.35%) patients had complication free recovery period. 1 (5.88%) patient was found to have post-operative radial nerve palsy. 2 (11.76%) patients reported with superficial surgical site infection with wound dehiscence. In the nailing group 12(80%) patients had uneventful recovery. 2 (13.33%) reported pain at shoulder and 1 (6.66%) patient complained of decreased abduction of shoulder at 6 month follow up. As per the Constant and Murley score, in the plating group 13 (76.47%) patients yielded excellent, 2 (11.76%) good, 1 (5.88%) fair and 1 (5.88%) poor result. Whereas, in the nailing group11 (73.33%) patients yielded excellent, 2 (13.33%) good, 1 (6.66%) fair and 1 (6.66%) poor results. Mean radiological union time in plating group was 15.63 weeks and in the nailing group was 14 weeks.



A B C

Figure 1: 24 year old female with fracture shaft humerus treated with intra-medullary nailing.
A: Pre-operative radiograph;
B: Immediate post-operative radiograph;
C: Radiograph on 6 months follow-up



A B C

Figure 2: A 57 year old male with fracture shaft humerus treated with plating.
A: Pre-operative radiograph;
B: Immediate post-operative radiograph;
C: Radiograph on 6 months.

DISCUSSION:

Most surgeons agree that intra-medullary 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. [4]

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. [5]

In several reported series, the presence of associated multiple injuries was the most frequent indication for internal fixation of the humeral shaft. In our study failed closed reduction and associated injuries were the most common indications. In a study carried out by Amit Putti et al [6], he reported a mean time of healing of 16 weeks in patients with DCP plating and 18 weeks in patients treated with nailing. In our study we achieved a mean healing time of 14 in patients treated with

humerus nailing and 15.6weeks in patients treated with DCP plating.

In previous reports the incidence of non-union after plating has ranged from 2% to 4%. [7] In our study there is no incidence of non-union. Retrospective studies of locked intramedullary nail fixation quote incidences of non-union ranging from 0% to 8%. [8] We had a single case of delayed union in the Intra-medullary nailing group but it progressed to union by 22 weeks without intervention.

The incidence of post op radial nerve palsy with fracture shaft humerus varies from 6% to 15%. [9] In our series the incidence was 3.15 % and recovered completely. Dabezies EJ et al in his study found that in the DCP group the incidence of post-operative radial nerve palsy is 2% to5% [10], and there was 1 case 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. [11] In our study there are no such case of the radial nerve palsy in interlocking group. There was no problem with infection in our patients with only 2 patients having superficial infection among 32 patients, which responded well to debridement and intravenous antibiotics for 3 weeks. There were no cases of failure of fixation in our study.

The rate of intra operative comminution during interlocking nail insertion with various studies varied from 7.7% to 10%. [4] In our series there was 1 intra operative comminution out of 15 patients treated with interlocking nailing. In cases of humerus fractures treated operatively by IM nailing, the most common problem in post-operative period is restricted abduction movement at shoulder. In our study we found that following the rehabilitation/mobilization plan our patients were able to achieve a good functional range of motion at elbow in 2-4 weeks where as we had 70° abduction at shoulder by 4-5 weeks and 90° abduction by 5-6 weeks. In cases of patients treated with DCP we achieved a good functional range of motion at elbow in 2-4 weeks and shoulder in 4-5 weeks except in 2 cases where we started guarded mobilization considering the fixation and quality of bone.

Habernek and Orthnerin[12] 1991 reported good results with interlocking nail but Persistent pain after antegrade nailing was common and so later they withdrew their support in 1998, as they had not assessed the shoulder functions of their patients properly. 4 Patients had developed shoulder pain/stiffness in the interlocking nailing group in our study. 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. [13]

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 union rates are comparable in both the groups with DCP group having more results in excellent while in good category results are similar (p value insignificant). There were more fair and poor results in the interlocking nailing group compared to DCP group.

The complications were more in the interlocking nailing group with most of them pertaining to poor shoulder function or pain. The overall functional outcome in our study is better for the DCP group (24.95) as compared to Interlocking Nailing group (44.4) and this difference when compared is statistically significant (p value – 0.0062). 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 DCP fixation is better than interlocking nailing in treating fractures of the diaphysis of the humerus.

CONCLUSION:

Both intra-medullary nailing and dynamic compression plating are excellent methods for surgical fixation of shaft humerus fractures. Both methods yield in comparable results in terms of functional outcomes and union rates. Intra-medullary nailing holds edge over plating in terms of lesser blood loss, lesser operative time, shorter stay in hospital and less incidence of complications such as radial nerve palsy.

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