

Original Research Article

Intramedullary nailing versus plating in shaft humerus fractures: a prospective randomized study

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ABSTRACT

Background: The two most commonly used modalities of internal fixation in fracture shaft of humerus are plate osteosynthesis and intramedullary nailing. The present study aims to analyze and compare both the techniques in terms of functional and radiological outcome.

Methods: 43 patients with diaphyseal fracture humerus were treated with Intramedullary nailing and plating between March 2015 and March 2016. The inclusion criteria were patients with closed diaphyseal fracture humerus. Compound fractures, pathological fractures, non-union, mal-union fractures were excluded from the study.

Results: 22 (51.2%) cases were operated using the antegrade nailing technique whereas dynamic compression plating was done in 21 (48.8%) cases. The mean age was 42±4.2 years. Road traffic accident was the most common mechanism of injury with 29 (67.5%) cases. 12 A2 type of fracture pattern were most common involving 23 (53.5%) cases. The mean surgical time was 68 minutes in cases where nailing was done and 115 minutes in cases with plating (P <0.001). Radiological union was seen at 13±4.8 weeks and 15±3.9 weeks in the nailing and plating group respectively. There were 2 (9.09%) cases in the nailing group and 1 (4.7%) case in the plating group which had delayed union. 3 (13.6%) cases in the nailing group had post-operative shoulder stiffness. The mean ASES score at the end of one year was 31.3 in nailing and 29.6 in plating group (P =0.327). There were 37 (86.5%) cases with excellent to good results.

Conclusions: Nailing and plating have equal functional outcomes in cases with shaft humerus fracture.

Keywords: Humerus fractures, Bone plates, Intramedullary nail

INTRODUCTION

A fracture of the humerus shaft is commonly encountered by orthopaedic surgeons and representing between 3% and 5% of all fractures.^{1,2} Many will heal with appropriate conservative care, although a consistent number will require surgery for optimal outcome. The emphasis has changed from splinting and prolonged immobilization, to internal fixation and early

mobilization, with return to normal function as early as possible. The successful treatment of a humeral shaft fracture demands a holistic approach involves knowledge of anatomy, surgical indications, techniques and implants, patient functions and expectations. The two most commonly used modalities of internal fixation in fracture shaft of humerus are plate osteosynthesis and intramedullary nailing. The aim of the present study was to analyze and compare both the techniques in terms of

functional and radiological outcome in patients with shaft humerus fractures.

METHODS

A prospective randomized trial was conducted at a tertiary care hospital between March 2015 and March 2016. 43 consecutive patients with diaphyseal fracture humerus were treated with Intramedullary nailing and plating. The randomization process used was closed envelope technique. All the patients were asked to open the envelope just prior to the surgery. The inclusion criteria were skeletally matured patients with closed diaphyseal fracture humerus. Compound fractures, pathological fractures, Non-union, mal-union fractures and patients unfit for surgery were excluded from the study. All the patients were classified as per the AO classification system. A through clinical and radiographic examination (Figure 1 and Figure 4) was in all the patients pre-operatively. Final results were calculated using the ASES scoring system. Prior well written consent was taken from all the patients. Ethical committee was obtained before commencing the surgery.



Figure 1: Preoperative X-ray.

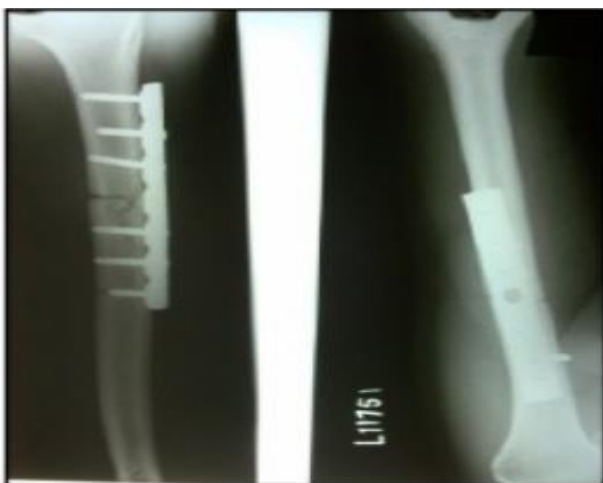


Figure 2: Immediate postoperative X-ray.



Figure 3: 12 months followup X-ray.



Figure 4: Preoperative X-ray.



Figure 5: Immediate postoperative X-ray.



Figure 6: 12 months followup X-ray.

Surgical technique

Intramedullary nailing

General anaesthesia combined with interscalene block was used in majority of the patients. In supine position, a bolster was kept in between the scapula. Affected limb was scrubbed, draped and prepared. 3 cm incision was taken from the anterolateral edge of acromion extending distally. Once the deltoid fibers were split and retracted, the supraspinatus tendon was incised along the length of its tendon. Entry was made with the help of awl just lateral to the articular cartilage in the line of the medullary canal. Guide wire was passed and reduction of the fracture was achieved. After initial reaming of the canal, the expert humerus nail (Depuy Synthes®, Switzerland) was mounted on the zig and inserted over the guide wire. Proximal locking was done with the help of zig while the distal locking was executed by free hand technique. The position of the nail was checked in C arm in both the orthogonal views at all the major steps. Meticulous closure of the rotator cuff and distal part of humerus was done.

Plating

General anaesthesia combined with interscalene block was used in majority of the cases. All the patients were operated in lateral position. Affected limb was scrubbed, draped and prepared. 8-10 cm incision, centered at the fracture site was taken. Interval between long and lateral head of triceps followed by isolation of radial nerve and subperiosteal elevation of the medial head of triceps was performed with utmost care. A 3.5 mm dynamic compression plate (Depuy Synthes®, Switzerland) was applied in compression mode after the preliminary reduction of fracture was achieved. Position of the plate was assessed in both the orthogonal planes. The wound was closed over layers. Immediate post-operative x rays

were taken to confirm the position of the implant (Figure 2 and 5).

Patients were asked to use arm pouch initially for a period of 2 weeks. Similar post-operative protocols were followed for both the groups. Gradual mobilization was started in both the groups. Regular follow-ups were done at 1, 3, 6 and 12 months (Figure 3 and 6) respectively.

Statistics

Independent sample student's t test was done to assess the parameters like duration of surgery, intra-operative blood loss and radiological union. The results were expressed as mean with standard deviation and $p < 0.05$ was considered to be statistically significant. Analysis was done using the Epi-info software (Version 3.5.4) and Microsoft Excel 2013 (Microsoft Office v15.0).

RESULTS

Out of 43 patients enrolled in the study, 22 (51.2%) cases were operated using the antegrade nailing technique whereas dynamic compression plating was done in 21 (48.8%) cases. The mean age of the patient was 42 ± 4.2 years. There were 27 (62.7%) males and 16 (37.3%) females in the present study. 19 (44.2%) cases had right sided involvement whereas 24 (55.8%) cases had fracture on left side of the limb. Road traffic accident was the most common mechanism of injury comprising of 29 (67.5%) cases which was followed by history of fall in 11 (25.6%) cases. 3 (6.9%) cases had domestic trauma resulting in shaft humerus fracture. As per the A.O. classification system, 23 (53.5%) cases had an oblique (12-A2) fracture pattern while 17 (39.6%) cases had transverse (12-A3) and 3 (6.9%) cases had segmental (12-C2) fracture pattern respectively. The mean surgical time was 68 minutes in cases where nailing was done and 115 minutes in cases with dynamic compression plating which was statistically significant ($P < 0.001$). The mean intra-operative blood loss was 24ml in the nailing group and 209 ml in patients with plating which was statistically significant ($P < 0.001$). Radiological union was seen at 13 ± 4.8 weeks and 15 ± 3.9 weeks in the nailing and plating group respectively ($P = 0.14$). There were 2 (9.09%) cases in the nailing group and 1 (4.7%) case in the plating group which had delayed union. There were 2 (9.5%) cases in plating group which had superficial infection and responded well to oral antibiotics. Delayed-union was seen in 1 (4.5%) case among the nailing group which was later opened and plating was executed along with bone grafting. Radiological union was seen after 7 weeks of the second surgery. Post-operative radial nerve palsy was seen in 2 (9.5%) cases in the plating group both of which resolved completely within 3 months of the index surgery. There were 3 (13.6%) cases in the nailing group who had post-operative shoulder stiffness. Out of these, 2 (9.09%) cases recovered completely at one year follow-up. 1

(4.54%) case however had persisted pain and decreased range of movements till the last follow-up. Adhesive capsulitis can be attributed as a cause for the same. The mean ASES score at the end of one year was 31.3 in

nailing and 29.6 in plating group (P=0.327). There were 11 (25.6%) cases with excellent, 26 (60.5%) cases with good, 4 (9.3%) cases with fair and 2 (4.6%) cases with poor results respectively in both the groups.

Table 1: Demographics and results.

Parameter	Intramedullary Nailing n=22 (%)	Dynamic Compression Plating n=21 (%)	P value
Sex			
Male	13 (48.1%)	14 (51.8%)	
Female	09 (56.3%)	07 (43.7%)	
Side			
Left	13 (54.1%)	11 (45.9%)	
Right	09 (47.3%)	10 (52.6%)	
Mechanism of Injury			
Road Traffic Accident	13 (44.8%)	16 (55.2%)	
Fall from height	07 (63.6%)	04 (36.4%)	
Domestic trauma	02 (66.7%)	01 (33.3%)	
Type			
12-A2	11 (47.8%)	12 (52.2%)	
12-A3	09 (52.9%)	08 (47.1%)	
12-C2	02 (66.7%)	01 (33.3%)	
Duration of Surgery	68±5.4	115±7.8	<0.0001*
Intra-operative Blood loss	24±8.2	209±5.7	<0.0001*
Radiological Union	13±4.8	15±3.9	0.14

Statistically Significant*

DISCUSSION

Although humeral shaft fractures can be managed well with conservative line of management, operative intervention has an advantage of anatomical reduction and early mobilization. Dynamic compression plating has proved to be gold standard for fracture shaft humerus achieving higher union rates.^{3,4} Patients with radial nerve palsy requires exploration where plating holds to be a good option.^{5,6}

Albeit, many of the studies have shown concern regarding the rates of infection, non-union and radial nerve palsy along with extensive surgical exposure in patients where plating is contemplated, recent meta-analysis discontents the same.⁷⁻⁹ In the present study, there were 2 (9.5%) cases in plating group with superficial infection and radial nerve neuropraxia. While the infection responded well to oral antibiotics, there was complete recovery of the radial nerve within 3 months post-operatively. The cause for the neuropraxia can be attributed to the intra-operative retraction and extensive exposure which was required due to complex fracture geometry. None of the patients in the present study had non-union or post-operative radial nerve palsy. There was no case of elbow stiffness encountered in the present study.

Many of the opponents of intramedullary nailing state that antegrade technique has an increased incidence of delayed union and shoulder problems.⁷⁻⁹ Violation of the rotator cuff, adhesive capsulitis and proximal migration of the nail tip can lead to above issues. In our experience, proper exposure of the rotator cuff and its adequate repair at the end of the procedure can prevent few complications. Also, the tip of the nail should be buried subchondrally to avoid the proximal migration which is the most important cause for impingement.

In the present study, range of movements of shoulder and elbow were not statistically significant. Our findings were similar to the studies by McCormack et al, Gongol et al and Heim et al.^{5,10,11}

The mean ASES score at the end of one year was 31.3 in nailing and 29.6 in plating group respectively which was not statistically significant (P =0.327). There were 37 (86.5%) cases with excellent to good results in the present study which were similar to studies by McCormack et al, Gongol et al and Tingstad et al.^{5,10,12} In a recent meta-analysis by Ouyang et al, plate fixation might be a better option in terms of post-operative shoulder impingement.¹³ However, there was no clinically significant difference in terms of fracture union.

Me et al in their meta-analysis found that although similar rate of fracture union was found in both the groups, intramedullary nail is associated with increased risk of intra-operative fracture comminution and post-operative decreased range of movements.¹⁴ There was only one patient in the present study as mentioned earlier with persisted decreased shoulder movements. The final results in both the groups were similar.

Limitations

Smaller number of sample size and less duration of follow-up were the limitations of the present study.

CONCLUSION

Intramedullary nailing has few advantages like simpler exposure, short learning curve, decreased operative time and blood loss. This procedure also preserves the fracture hematoma and requires less surgical dissection. Plating on the other hand holds to be a gold standard procedure, which helps in rigid internal fixation. In our experience, both the techniques give equally good functional outcome. Nailing though can be a good option in patients with osteoporosis and polytrauma patients whereas plating can be executed in those with smaller medullary canal, transverse fractures requiring stable fixation and where radial nerve exploration is contemplated.

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Ethical approval: The study was approved by the institutional ethics committee

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