

Original Research Article

A Hospital Based Prospective Study to Evaluate the Comparison of Radiological and Functional Outcome in Patients with Fracture Shaft of Humerus Treated with Interlocking Nailing and with Plate Osteosynthesis at Newly Established Tertiary Care Centre

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Abstract

Background: Intramedullary nailing is considered as gold standard in treatment in fracture of femoral and tibial shaft fractures. But there is no agreement about the ideal treatment for fractures of humeral shaft. The aim of this study is to compare the Radiological and Functional outcome in patients with fracture shaft of the humerus treated with Dynamic Compression plating and those treated with Intramedullary Interlocking nailing. **Materials & Methods:** This is a prospective comparative study of 20 patients with humeral shaft fractures treated with Intramedullary interlocking nailing and Plate osteosynthesis done in the Department of Orthopaedics, Newly established Government Medical College, Dungarpur, Rajasthan, India during one year period. Wound inspection done on 2nd post op day. Suture removal done on 12th day. Active shoulder and elbow started on 3rd in nailing procedure and 5th to 6th day in compression plate once the pain level decreases under physiotherapist guidance and tolerability of the patient. **Results:** The average age of patients was 46 years in both groups. Mostly patients were males (75%) in both groups. The mode of injury in most of the cases in both the groups are due to Road Traffic Accidents (70% in IL nailing group and 80% in Plating group). The remaining are due to fall and due to assault. 60–80 % of the patients in the study have involvement of the dominant side in both groups. Average time of union in INL group was 22 weeks & 20 weeks in DCP group. The functional Range of Movements in shoulder joint after Nailing is excellent and good in 90% of patients and fair in 1 patient (10%) & elbow function recovered in almost all patients with 90% excellent result and 10 % has good recovery in INL group. All patients treated with Plate Osteosynthesis had excellent to good functional outcome in elbow, 90% of cases have excellent and good results in shoulder function and 1 case had fair result. **Conclusion:** We concluded that patients can be treated with dynamic compression plating and interlocking nailing for fracture of shaft of humerus. Intramedullary interlocking nailing is an effective and safe alternative for treatment of diaphyseal fractures of humerus. It is suitable for patients with osteoporosis, polytrauma and in segmental fractures.

Keywords: Fracture Shaft, Humerus, INL, DCP, Functional Outcome.

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Introduction

Fracture shaft of the humerus accounts for 3 to 5 % of all fractures and it is one of the common fractures. They are caused by high energy trauma and most commonly seen in Middle third of the shaft [1]. Traditionally humeral shaft fractures have been treated non-operatively with hanging cast or brace. Sarmento et al [2] reported use of plastic sleeve with early introduction of functional activity. But the non-operative treatment has disadvantages of prolonged immobilization in cast or brace which sometimes may be required as long as 6 months resulting in huge morbidity. Moreover, not all fractures of humeral shaft can be treated conservatively. Current research in this area focuses on defining the incidence and health care resources needed to treat these fractures, refining the indications for surgical intervention, decreasing the surgical failure rate through new implants and techniques, and minimizing the duration and magnitude of disability post injury.

Plate osteosynthesis is considered as gold standard of fixation of humeral shaft fractures comparing with other methods of fixation. But this requires extensive soft tissue dissection and complicated by the proximity of the radial nerve and the risk of mechanical failure in osteoporotic bones in old age [3].

Intramedullary interlocking nail is a better implant biomechanically. Nails are subjected to smaller bending loads and are less likely to fail due to fatigue. They act as load sharing and stress shielding devices. In cases of intramedullary nails, cortical osteopenia that occurs right adjacent to the ends of plates is rarely seen. Thus, chances of re-fracture after implant removal is less often seen. This does not require extensive soft tissue dissection but has stable fixation and rotational control. It can be done by antegrade or retrograde manner [4].

Traditionally the indication for closed intramedullary nailing of fracture of shaft of humerus are in polytrauma, in fractures with overlying burns, patients with osteoporotic bone, pathological fractures and in segmental fractures. The development of interlocking nail system has dramatically broadened the indication. Now shaft of humerus fracture with severe comminution or bone loss, can now be treated with interlocking nails that control length and rotational alignment. External fixation is used only as a method of treatment in compound injuries and not used as a method of definitive fixation [5]. The goal of operative treatment of humeral shaft fractures is to re-establish length, alignment and rotation with stable fixation that allows early motion and ideally early weight bearing on the fractured

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extremity. The aim of this study is to compare the Radiological and Functional outcome in patients with fracture shaft of the humerus treated with Dynamic Compression plating and those treated with Intramedullary Interlocking nailing.

Materials & methods

This is a prospective comparative study of 20 patients with humeral shaft fractures treated with Intramedullary interlocking nailing and Plate osteosynthesis done in the Department of Orthopaedics, newly established Government Medical College, Dungarpur, Rajasthan, India during one year period.

Inclusion Criteria

- Patients aged above 18 years
- Fractures 2cm below surgical neck and 3 cm above olecranon fossa
- Multiple injuries
- Osteoporotic bone
- Angulation more than 15 degrees
- Noncompliance in conservative treatment

Exclusion Criteria

- Open physis
- Age <18 years
- Fractures involving proximal 2 cms and distal 3 cms of the humeral diaphysis

Methods

Intramedullary nail are available in diameters of 6.0mm which are non-cannulated solid nails and the 7.0mm,8.0mm cannulated nails. They can be inserted over 2.4 mm thick guide wire. The nails are available in various lengths starting from 160mm onwards at increments of 10 mm. The proximal locking is provided from lateral to medial direction. The Proximal locking are 2 in number and both are static for the 6.0mm solid nails and the proximal being dynamic and distal static for the 7.0mm cannulated nails. The Distal locking are in the antero-posterior direction.

The nail size is measured with the full-length x-ray from tip of greater tuberosity to 3cms above the proximal tip of olecranon fossa. Clinically it is measured by subtracting 5 cms from the tip of acromion to the lateral epicondyle of humerus. The best method is by a scanogram. It is a must to have all nail sizes and appropriate instrumentation. It is mandatory to have the C- arm image intensifier and a good technician.

Surgical Approach for Nailing

The patient is positioned supine on a fracture table with a sand bag under the shoulder and the whole upper limb is prepared and draped to keep the limb free. The surgery was done under general anesthesia & regional anesthesia. Fracture site is exposed by anterolateral approach. Skin incision is made in the groove between the prominences of biceps brachii and deltoid. Cephalic vein is identified and ligated. Plane is created between the muscle bulk of biceps and deltoid. Brachialis is split in the middle to expose the fracture site.

Fracture site is exposed and freshened. Bone grafting may be placed to promote fracture union.

Through Lateral Deltoid Splitting approach with the image intensifier the entry point is made just medial to the greater tuberosity and in the area at junction between the articular surface of the head and greater tuberosity with a k-wire and passed into the medullary canal.

After splitting the deltoid, the rotator cuff is exposed and split at the tendon of the supraspinatus. The entry point reamer is used over the k-wire and is enlarged. 45cms guide wire is introduced through the entry point and is passed into the distal fragment after reducing the fracture closed and under the guidance of C-arm image intensifier. Progressive reaming was done over the guide wire upto 1 mm more than the desired nail size. The nail size should be carefully selected because over size nail may end up splintering the distal fragment. The nail is pushed to a level where the nail is not protruding out through the articular surface of the proximal humerus. The distal locking are antero-posterior locking. Under image guidance a stab incision is made at the anterior aspect of forearm, the bicep and brachialis is split to expose the surface of the bone. Under image guidance appropriate drill bit is used and the distal screws are inserted.

Proximal locking was done using the proximal jig that is mounted with the nail. Care must be used to avoid the axillary nerve. The proximal locking are in the mediolateral plane.

Surgical Approach for Plate Osteosynthesis

The patient is positioned lateral with elbow flexed over a pillow and forearm hanging by the side. The surgery was done under general anesthesia & regional anesthesia. Through posterior approach incision was made in midline upto the tip of olecranon in line with the humerus. The dissection is carried down to the triceps fascia and the fascia is incised. The radial nerve is identified and freed proximally and distally to allow for mobilization. The triceps is incised off the periosteum and the fracture site is exposed. After the fracture ends are freshened, the fragments are reduced and held with bone clamps or with a lag screw. Then it is fixed with 4.5mm broad or narrow DCP in neutralization or compression mode.

Post – Operative Protocol:

Wound inspection done on 2nd post op day. Suture removal done on 12th day. Active shoulder and elbow started on 3rd in nailing procedure and 5th to 6th day in compression plate once the pain level decreases under physiotherapist guidance and tolerability of the patient.

Results

Majority of the patients taken for the study both in the Interlocking nailing group and in the Plating group are in the age group of 21 to 40 years (60%). Mostly patients were males (75%) in both groups. The mode of injury in most of the cases in both the groups are due to Road Traffic Accidents (70% in IL nailing group and 80% in Plating group). The remaining are due to fall and due to assault. 60–80 % of the patients in the study have involvement of the dominant side in both groups (table 1).

Table 1: Data variables in between groups

Variables	Interlocking nailing	Plate osteosynthesis	P-value
Age groups (yrs)			
18-40 yrs	6	6	1.00
41-60 yrs	3	1	
>60 yrs	1	3	
Gender			
Male	7	8	1.00
Female	3	2	
Mode of Injury			
Road traffic accident	7	8	1.00
Fall	2	2	
Assault	1	0	

Side involvement		
Right	6	8
Left	4	2

The minimum time taken for union in the group treated with Interlocking nailing is 16.5 weeks and the maximum time is 28 weeks with an average of 22 weeks. One case went in for non-union. The minimum time for union in the group treated with Plate Osteosynthesis is 16 weeks and the maximum time is 24 weeks with an average of 20 weeks. All cases united within this period in this group (table 2).

Table 2: Time taken for Fracture Union

Surgical procedure	Time taken for union		Average
	Minimum	Maximum	
Interlocking nailing	16.5 wks	28 wks	22 wks
Plate osteosynthesis	16 wks	24 wks	20 wks

The functional Range of Movements in shoulder joint after Nailing is excellent and good in 90% of patients and fair in 1 patient (10%). The decrease in movement in 1 patient is due to the impingement of nail. The elbow function recovered in almost all patients with 90% excellent result and 10% has good recovery. All patients treated with Plate Osteosynthesis had excellent to good functional outcome in elbow, 90% of cases have excellent and good results in shoulder function and 1 case had fair result (table 3).

Table 3: Comparison of Functional score according to RODRIGUEZ MERCHAN score

Results	Interlocking nailing	Plate Osteosynthesis	Total
Excellent	3	5	8
Good	5	3	8
Fair	1	1	2
Poor	1	1	2
Total	10	10	20

In the group of patients treated with interlocking nailing 1 case went in for nonunion (10%), for which subsequent exchange nailing was planned. In the group treated with Plate Osteosynthesis all cases united with an average period of 20 weeks (table 4).

Table 4: Complications

Complications	Interlocking nailing	Plate Osteosynthesis
Non-union	1	0
Shoulder impingement	1	0
Infection	1	2

In Interlocking Nailing group, 1 patient had shoulder impingement due to protrusion of nail due to prominence of the nail at the proximal end. In Plate Osteosynthesis group, no cases had shoulder impingement or stiffness or pain (table 4). 1 patient in whom the fracture reduction was done by open reduction had superficial infection which settled with parental antibiotics in Interlocking Nailing group. In patients who were treated by Plate Osteosynthesis, 2 patients developed superficial infection which settled with parental antibiotics and all fractures went in for union (table 4).

Discussion

Intramedullary nailing is considered as gold standard in treatment in fracture of femoral and tibial shaft fractures. But there is no agreement about the ideal treatment for fractures of humeral shaft.

In this study, the age group of the patients in both the groups ranges from 18 to 75 years with a mean age of 46 years. Majority of the patients sustained this fracture are males and the most common mode of injury is due to Road Traffic Accident (around 75%) in both groups.

This study shows no significant difference between the time of union with an average of 22 weeks in the Interlocking Nailing group and an average of 20 weeks in the Plating group. Raghavendra S et al [6] in their study of 31 patients compared the time of union between the patients treated with Plating and with Interlocking Nailing concluded that there is no significant difference between the two groups. In this study one patient in the Interlocking Nailing group went in for non-union (10%) which required secondary procedure. In a study by ABPutti et al [7], showed a nonunion rate of 8% in patients treated with Interlocking Nailing. The anatomical configuration of the shaft of the humerus makes it prone for residual fracture site distraction. In our study the fracture site distraction occurred in 1 patient (10%). In a study by Shyamasunder Bhat et al [8], they showed distraction at the fracture site during nailing in about 8.1% of cases.

In this study shoulder pain occurred in 1 out of 10 patients due to impingement of nail (10%). This is comparable to the study by James P. Stannard et al [9] where they showed an occurrence of mild to moderate shoulder pain in about 20% of the patients and also in a study made by Chapman et al [10] there is significant reduction in shoulder movement in the Nailing group. Impairment of shoulder function could be due to impingement at the acromion and consequent impairment of abduction. Ante grade nailing is found to violate the rotator cuff. A medial starting point is an avascular area of rotator cuff and it gives entry point for access to medullary canal without compromising the healing of rotator cuff.

Conclusion

We concluded that patients can be treated with dynamic compression plating and interlocking nailing for fracture of shaft of humerus. Intramedullary interlocking nailing is an effective and safe alternative for treatment of diaphyseal fractures of humerus. It is suitable for patients with osteoporosis, polytrauma and in segmental fractures.

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