



Intramedullary Interlocking Nail Fixation for Fracture Shaft Humerus - A Prospective Study

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ABSTRACT

Humerus is the longest and strongest bone of upper extremity and serves as the pivot for functional activities of the upper limb. It is prone for frequent fractures with overall incidence of 3% in all fractures. Most of the fractures of shaft humerus can be managed conservatively but remains controversial particularly when associated with polytrauma. To minimise the risk of complications of conservative treatment the surgical management by open or close reduction and internal fixation by intramedullary nailing or plate osteosynthesis are preferred. The aim of the present study was to evaluate the functional outcome of the fracture shaft humerus treated with closed or open reduction and internal fixation by antegrade intramedullary interlocking nail as this is a better implant biomechanically and provides a good degree of axial, angulatory and rotational stability. 25 Patients with fracture shaft of humerus, admitted in the Orthopaedics department of S.V.R.R.G.G.Hospital and Sri Venkateswara Medical College, Tirupathi were included in the study. Neer's criteria was used to evaluate the results, which was, excellent in 18(72%), good in 5(20%) and poor in 2(8%) patients. Average time for fracture union was around 14 weeks. Only 2(8%) patients had complications, one with non-union and the other with restricted shoulder movement. Hence intramedullary interlocking nailing for fracture shaft of humerus appears to be a safe and reliable method. It allows micro movement at the fracture site, enhancing early fracture consolidation and early mobilization thereby improving functional outcome.

Keywords- fracture shaft of humerus, internal fixation, interlocking, intramedullary nailing.

Introduction

Fracture shaft of humerus accounts for about 3–5% of total fractures encountered by orthopaedic surgeons¹⁻⁴. Fracture shaft humerus is perhaps the earliest of major long bone fractures to be treated by

conservative methods^{3,5}. The treatment of these fractures remain controversial more so when it is associated with multiple fractures. Although non-surgical management has been the long standing treatment for closed humeral shaft fractures,

surgical management significantly reduces the incidence of both non-union and malunion^{6,7}. Surgical options include external fixation, open reduction & internal fixation¹. Two modalities of internal fixation are plate osteosynthesis and intramedullary nailing⁴. Open reduction and internal fixation with plates and screws checks the rational stress at the fracture site and also has effect on the vascularity of the cortex beneath it. Plating provides less secure fixation in osteoporotic bones and chances of re-fracture after removal are also high due to multiple drill holes. Intramedullary nailing being load sharing device offers a better solution to these fractures, but unstable fractures and fractures of proximal and distal third where medullary cavity is wide, unlocked intramedullary nailing often fails to prevent rotational movements and deformity⁸. Intramedullary nailing with interlocking device solves these problems as it is closer to the normal mechanical axis. The nails are subjected to lower bending forces and are less likely to fail due to fatigue^{2,9}. The cortical osteopenia that occur right adjacent to the ends of plates is rarely seen with intramedullary nailing^{2,4,10}. The present study was carried out to evaluate the functional outcome after interlocking intramedullary nail fixation in diaphysial fractures of humerus.

Materials & Methods

The Study was conducted at department of Orthopaedics, SVRRGG Hospital and S.V.Medical College, Tirupathi, after obtaining informed, written consent from all the 25 patients with fracture shaft of humerus .

Inclusion criteria: Fracture with 2cm distal to surgical neck and 3cm proximal to olecranon fossa, closed/open fractures (type I and II) and polytrauma patients.

Exclusion Criteria: Age less than 18 years, type III open fractures and fractures of lower and upper end of humerus.

After complete preoperative assessment and anaesthetic clearance all the fractures were treated by intramedullary interlocking nailing in antegrade technique^{5,8,11} with reaming under general/regional anaesthesia. Postoperatively the limb was placed in the shoulder arm pouch, shoulder and elbow movements were started from second Post operative day, Radiographs were checked to know the adequacy of reduction and any iatrogenic complications. Sutures were removed on 10th post operative day. Regularly followed up for 24 weeks at 6 weeks intervals with radiographs. The functional results were evaluated based on shoulder and elbow range motion, radiological appearance of fracture healing and complications if any. The different categories of patients were classified according to Neer's criteria¹² and Constant's functional assessment 100 point score¹³ as

Excellent: No pain, normal range of motion and strength in motion compared with contra lateral shoulder (Score 80-100)

Good: Occasional minor discomfort, strength and endurance are normal, shoulders movements are restricted less than 20° (Score 60-80)

Poor: Pain at night or weakness of the anterior aspect of deltoid with gross restriction of the movement (Score < 60).

Results

The observations of the 25 patients with fracture shaft of humerus are as shown in table -1.

Table-1 Clinical details of patients with fracture shaft humerus

S.no	Clinical details	patients (n=25)	Percentage %
1.	Sex <ul style="list-style-type: none"> • Males • Females 	20 5	80 20
2.	Age in years <ul style="list-style-type: none"> • Mean • Range 	45 18-80	
3.	Mode of injury <ul style="list-style-type: none"> • Road traffic accident • Domestic accident • Fall from height • Assault 	20 2 2 1	80 8 8 4
4.	Site of fracture <ul style="list-style-type: none"> • Upper third • Middle third • Lower third 	4 16 5	16 64 20
5.	Type of fracture <ul style="list-style-type: none"> • Transverse • Oblique • Spiral • Comminuted • Segmental 	7 4 3 10 1	28 16 12 40 4

Most of the patients were operated within a week. Delay was due to late presentation and management of associated injuries. 16 fractures were fixed using closed technique and 9 by open reduction and internal fixation. 16 cases (64%) were discharged between 6-10days after surgery; delay in other cases was due to associated injuries. The period of healing of fracture and the functional assessment at the end of follow up are shown in table 2.

Table-2 Time of union and functional assessment

S.no	Criteria	patients (n=25)	Percentage %
1.	Time of union in weeks <ul style="list-style-type: none"> • within 12 • 12 – 16 • 16 – 20 • > 20 	5 15 4 1	20 60 16 4
2.	Functional assessment at end of follow up		
	Pain at shoulder	Nil	Nil
	Daily activities <ul style="list-style-type: none"> • Full • Restricted 	23 2	92 8
	Range of shoulder motion <ul style="list-style-type: none"> • Full • Restricted(>20⁰) 	24 1	96 4
	Shoulder power <ul style="list-style-type: none"> • Full • Decreased 	25 -	100 -
	Elbow movement <ul style="list-style-type: none"> • Full • Restricted 	25 -	100 -

Union of fracture was considered when rotatory/angulatory strain was painless and bridging callus was present in all planes on radiogram and failure of fracture union by 6 months as non union. Most of the patients regained full range of shoulder and elbow functions. Post operatively one patient developed radial nerve palsy which recovered completely within 4-6 weeks. One patient developed superficial infection which was managed by regular dressing and intravenous antibiotics. Infection did not have any untoward effect on fracture healing. 2(8%) cases sustained iatrogenic fracture during surgery and both eventually united. Only one patient (4%) had restricted shoulder movement due to proximal impingement of nail and one patient (4%) had non-union. The overall functional results was excellent in 18 (72%), good in 5 (20%) and poor in 2 (8%) patients.

Discussion

Concepts in the management of trauma in Orthopaedics are rapidly changing to keep pace with the increasing severity and complexities of fractures. The goals of humeral shaft fracture management are to establish union and restore the patients to their prior level of function as early as possible with least functional disability. The treatment of humeral shaft fracture is always a challenging problem as they are associated with multiple injuries and fracture complications like shortening, malunion, delayed union, non union, stiffness of adjacent joints and infection etc². Most of these fractures can be treated successfully by conservative methods, but it requires a long period of immobilization which carries a risk of prolonged shoulder joint stiffness, deformity, neurovascular impairment etc¹. To minimise these complications surgical management is preferred. The advantages of intramedullary interlocking nailing are minimal surgical exposure, better biomechanical fixation, and minimal disturbance of soft tissues and early mobilization of neighbouring joints. It also avoids complications like rotation of fracture fragments, migration of nail and requirement of supplementary bracing^{4,9}

In our study there was male predominance (80%) and fracture occurred in active age group (Mean age 45 years)^{2,4,5}. 80% of the fractures were due to traffic accidents^{2,4,5}. Majority of the fractures 60% occurred in middle third^{4,14} with different patterns of which 40% were comminuted, 28% transverse, 16% Oblique, 12% spiral & 1% Segmental. After achieving satisfactory reduction either by closed or open method all fractures was fixed with

intramedullary interlocking nail using antegrade approach. Out of 25 cases 24(96%) fractures united within 12-20 weeks³ & 1 (4%) non union after 6 months¹¹. Majority of patients regained full range of shoulder and elbow functions^{15,16}. Only one patient (4%) had restriction of shoulders movements which was due to proximal impingement of nail. Complications like angulations, malrotation and implant failure were not found in any case. Final outcome was excellent in 18 (72%), good in 5(20%) and poor in 2(8%) patients^{2,4,15,16}. So our study concludes that early fixation of fracture by closed or open reduction and internal fixation with antegrade intramedullary interlocking nail is the method of choice as it provides early fracture union and early return to functional activities.

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