

## ANTEGRADE INTRAMEDULLARY FIXATION OF HUMERAL SHAFT FRACTURES WITH INTERLOCKING NAIL - AN ANALYSIS OF COMPLICATIONS

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**ABSTRACT :** Fractures of the humeral shaft account for 3% of all the fractures. Primary cause of these fractures is high energy traumas. Goals in managing these fractures are osseous union, minimal deformity and return of maximal extremity function. The union rate of simple fractures of humerus treated conservatively is over 90%. Surgical management of these fractures is preferred in Segmental fractures, Polytrauma patients, Pathological fractures, Open fractures, Failed conservative treatment, Associated progressive neurological deficit, Vascular injury, Morbid obesity.

We analysed intraoperative and postoperative complications in twelve patients with humeral shaft fractures managed with antegrade interlocking nails. There were seven males and five females. Their ages ranged between 20 – 60 years with an average of 32.6 years. There were 11 close and one Gustilo grade I open fractures. There were six comminuted, four transverse, and two oblique fractures. Nine fractures were in middle third one in proximal third and two in distal third. Five patients had associated injuries.

We faced difficulty in localizing entry portal in 2 patients. There was difficulty in reduction in 2 patients We had one patient with iatrogenic comminution. Three patients had improper locking screw size. One had nail protrusion proximally, one patient had distraction at the fracture site. There were two superficial entry portal skin infections and one deep proximal cross screw infection. We had two patients with shoulder and one patient with elbow stiffness. Chronic rotator cuff irritation was present in three patients. We recorded three delayed unions, one nonunion and one rotatory malunion

The results of the present study indicate that antegrade intramedullary interlocked nailing is one of the best method of treatment among the currently available methods.

**INTRODUCTION:** Fractures of the humeral shaft account for 3%<sup>5</sup> of all the fractures. Primary causes of these fractures are RTA, falls from height or other high energy traumas. The primary goals in managing these fractures are osseous union, minimal deformity and return of maximal extremity function. The union rate of simple fractures of humerus treated conservatively is over 90%<sup>27</sup>. Open reduction and internal fixation of these fractures is preferred in segmental fractures, polytrauma patients, pathological fractures, open fractures, failed conservative treatment, associated progressive neurological deficit, vascular injury, morbid obesity<sup>6</sup>. Among the various surgical methods for management of humeral shaft fractures is the intramedullary fixation with interlocking nail.

**MATERIAL AND METHODS:** Twelve patients with humeral shaft fractures underwent intramedullary fixation with antegrade interlocking nails. There were seven males and five females.

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Their ages ranged between 20 – 60 years with an average of 32.6 years. Road traffic accidents and falls were the chief causes of injury. There were 11 close and one Gustilo grade I open fractures. There were six comminuted, four transverse, and two oblique fractures. Nine fractures were in middle third one in proximal third and two in distal third. Five patients had associated injuries. Seven patients were operated within five days of injury, remaining five were operated within 5 to 15 days depending upon the associated co-morbidities or injuries.

Fractures were initially temporarily stabilized in emergency with a U shaped adequately padded cramer wire splint after recording the neurovascular status. I/V antibiotics were started according to the requirements of the case. Radiographs of the humerus were obtained in anteroposterior and lateral profiles including both the shoulder and elbow joints. Patients were taken up for surgery when fit. In case of compound fracture, emergency debridement and lavage followed by definitive internal fixation was done within 8 hrs of injury.

Patients were positioned supine with a foam wedge under the shoulder. Nailing was done by a standard technique under C-arm control on a radiolucent table. Proximal lockings were done through the jig and distal lockings were done by free hand technique. Post operatively an arm sling was routinely used. In patients with associated ipsilateral injuries of forearm, a pop splint was given. Analgesics were administered as and when required. Antibiotics were given according to the individual requirements of the case. Post operative neurovascular status was checked and recorded. Shoulder and elbow movements were initiated as tolerated by the patients. Patients were discharged after removal of suture and followed up in the outpatient department and assessed clinically and radiologically at monthly intervals till the fractures united.

**RESULTS:** All the events intra operatively and post operatively were systematically noted and categorized into intraoperative and postoperative complications. American shoulder and Elbow Surgeons (ABES) assessment score was used with 13 daily activities requiring full shoulder and elbow movements.

1. Use back pocket	2. Perineal care
3. Wash opposite axilla	4. Eat with utensil
5. Comb hair	6. Use arm at shoulder level
7. Carry 10 lb on same side	8. Dress
9. Sleep on affected side	10. Pull
11. Use hand overhead	12. Throw
13. Lift	

4=Normal, 3= Mild compromise, 2= Difficulty, 1= Great difficulty.

Maximum score =52; Minimum score= 13

A.S.E.S. score of upper limb function

52 – 47 in 5 patients

46 – 42 in 3 patients

41 – 36 in 2 patients

34 – 31 in 1 patients

< 30 in 1 patient

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We had a union rate of 91.6% and the mean duration for primary union was 21 weeks.

## **Intraoperative complications**

We faced difficulty in localizing entry portal in 2 patients. There was difficulty in reduction in 2 patients We had one patient with iatrogenic comminution. Three patients had improper locking screw size. One had nail protrusion proximally, one patient had distraction at the fracture site. There were no cases of primary or iatrogenic neurodeficit, failed locking or violation of the adjacent joint.

## **Postoperative complications**

There were two superficial entry portal skin infections and one deep proximal cross screw infection. These resolved with antibiotics and local debridement.

We had two patients with shoulder and one patient with elbow stiffness. There were initiated on monitored physiotherapy and they recovered. Chronic rotator cuff irritation was present in three patients, out of these one patient had protruded nail which was removed at 14 weeks once the fracture consolidated, remaining two had persistent symptoms with episodic flare-ups.

We recorded three delayed unions, one nonunion and one rotatory malunion. Nonunion was managed with removal of metal work revision internal fixation with a plate and bone grafting.

Table showing intraoperative and postoperative complications.

Difficulty in localization of entry portal	2
Difficulty in reduction	2
Iatrogenic comminution	1
Improper locking screw size	3
Nail protrusion(proximal)	1
Distraction at fracture site	1
Infection	
Superficial	2
Deep(proximal locking screw)	1
Joint Stiffness	
Shoulder	2
Elbow	1
Chronic rotator cuff irritation	3
Delayed Union	3
Nonunion	1
Malunion	1



Fig 1: Radiograph showing distraction at fracture site.

**DISCUSSION:** Fric et al, 2001<sup>7</sup> reported an average age of 55 years with male to female ratio of 1:2.08. Rommen PM et al, 2008<sup>1</sup> reported a mean age of 63 years. 75% of the fractures were in mid 3<sup>rd</sup> with one open fracture. Rommen et al, 1995<sup>17</sup>, Ipkeme, 1984<sup>18</sup> recorded maximum number of fractures in middle third. Intraoperative difficulty is encountered in reducing the fractures, especially in closed nailings. There is difficulty encountered in passing the nail in cases where the marrow is narrow and it calls for additional hand reaming. In humerus with narrow medullary canal, distraction at the fracture site can take place (Tapio et al 1999<sup>10</sup>). If narrow medullary canal is not anticipated preoperatively another problem of jammed nail is faced. Robinson and court et al, 1992<sup>22</sup> reported a series of 30 humerus nailings and had problems in passing the guide wire for reduction in three transverse fractures. They reported 10% minimally displaced iatrogenic fractures. Tapio et al in 1999<sup>10</sup> reported their results and problems in 126 humeral fractures, they had distraction at fracture site in 18 cases. According to Rupp et al, 1996 distraction at the fracture site is the major cause of nonunion. Ingram et al<sup>23</sup> they had 16.6% cases with distraction at fracture site. Osteoporotic bone offers little resistance to drilling and it is difficult to be certain that the screws had passed through the target holes, difficult in proximal locking was seen in 27% of patients and failed distal locking in 30%. (Robinson et al, 1992<sup>22</sup>). Moran et al 14 reported missed target in distal locking. Veisei N et al, 2001<sup>8</sup> had proximal target failure in 5.6%, iatrogenic comminution in 4.2% and protrusion in 6.4%. Fric V et al, 2001<sup>7</sup> reported 42 per operative complications in 23 patients. There were six nail protrusions, fifteen patients had problems with lockings, three patients had iatrogenic comminution. Rommens PM et al, 2008<sup>1</sup> reported iatrogenic comminution in 2%, false placement of lockings in 1%. Proximal locking is associated with increased risk to axillary nerve. Tapio et al, 1999<sup>10</sup> reported in one patient, injury to the posterior antebrachial nerve during distal locking. Mc Kee et al, 1996<sup>13</sup> reported three cases of fractures through distal locking screws after the patients sustained a rotational force to arm. Rommens et al, 1998<sup>1</sup>, reported radial nerve palsies in 4.2%. John crates, 1998, reported 2.7% of his patients having radial nerve palsy. Tapio et al, 1999<sup>10</sup> reported 3 intraoperative nerve complications. Proximal migration of intramedullary

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nails caused subacromial bursitis in 66% of patients( Robinson et al, 1992<sup>22</sup>). According to Ikpeme, 1994<sup>18</sup> locking screws protruding into deltoid are major cause of pain.

Robinson et al, 1992<sup>22</sup> had two patients with deep infection out of 30 cases. Tapio et al, 1999<sup>10</sup> had 2 cases of infection in a study of 126 nailings. Rommens PM et al, 2008<sup>1</sup> reported infection in 15, nonunion in 3%.

Flinkkila T et al, 1999<sup>10</sup> stated distraction at the fracture site as the main cause of nonunion. Literature shows an incidence of 0 to 12% of nonunion with interlocking nail. Bhuller et al<sup>15</sup> 1996<sup>14</sup> had 5 nonunions of 17 fractures nailed soon after injury. Robinson et al, 1992<sup>22</sup> reported 7 delayed unions out of 30 fractures. Ingram et al<sup>23</sup> reported a union rate of 95% with 90% uniting within 12 weeks. Robinson et al<sup>22</sup> observed a mean duration of 18 weeks for union. Hems and Bhullar<sup>15</sup> reported nonunion in 30% of their cases. Frick V et al, 2001<sup>7</sup> observed a nonunion rate of 15.4% and no infection. Maurch J et al, 2000<sup>2</sup> reported a nonunion in 20% and shoulder stiffness in 20%.

**CONCLUSION:** Internal fixation in the patient's with multiple associated injuries hastens recovery, prevents further injury to adjacent soft tissues, prevents and facilitates nursing care and rehabilitation. In the presence of ipsilateral injuries in the same extremity, stabilization of the humeral fracture makes the management easier. The results of the present study indicates that antegrade intramedullary interlocked nailing is one of the best method of treatment among the currently available methods, provided the surgery is meticulously done so that the intra operative complications, particularly tendency for distraction at the fracture site and damage to the rotator cuff are kept to the minimum.

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