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A Study of the Functional Outcome of Retrograde Ender's Nail for Humeral Shaft Fractures in Adults

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Abstract
To study the functional outcomes of retrograde ender's nail for humeral Shaft fractures in adults. 35 consenting adult patients were operated for retrograde enders nailing for shaft humerus fractures and followed up over period of 15 months. ASES Score was used to evaluate functional outcome. 24 patients had sound union in <18 weeks, 4 patients had sound union by up to 22 weeks, 6 patients had union delayed >22 weeks, 1 patient showed non union of the fracture. 32 patients recovered full range of motion of shoulder and elbow joint while 3 patients recovered good range of motion. As per ASES Score, 24 patients had excellent, 6 had good, 4 had fair and 1 had poor functional Outcome. Retrograde ender's nailing yielded excellent results, enhancing patient mobility, reducing pain and improving quality of life. It provides distinct advantage by requiring minimal soft tissue handling, by being a closed procedure, showing low rates of radial nerve palsies and infections, having low cost to patients and requires minimal operative instrumentation and less surgical skill.

INTRODUCTION

Incidence of shaft of humerus fractures commonly seen between 3-5% among all fractures[1,2]. Most fractures of Shaft of humerus unites with appropriate conservative treatment. Some patients will need surgery for relatively good functional outcomes. In conventional management, acceptance criteria include the following points:

- Good motion at the shoulder and elbow joint.
- Some neglected degree of shortening with minimal effect to broad spectrum of radiographical malunion with minor functional deficit[3].

The era of management has changed from splinting and long-term immobilization to internal fixation and early range of motion with the benefits of returning to daily activity as soon as possible. Internal fixation in orthopaedic treatment was suggested as the foremost management strategy after the formation of the AO group in 1958. Internal fixation techniques were tried for various diaphyseal fractures. The two suggested management approaches for internal fixation in humerus Shaft fractures are plate osteosynthesis and intramedullary nailing. Recent research in this area has concentrated on the healthcare resources needed to manage this trauma. The review of the indications for surgical management will minimize surgical failure rates using recent advanced implants and techniques. That decreases the time and severity of post-trauma disability[2,4,5]. Successful management of a fracture of the humerus shaft may not only result in bony radiographic union but also in the recurrent emphasis on a wholesome approach to patient care. The treating orthopaedic surgeon should look to manage and improve a patient's daily life activity beyond what is conventionally recognized. As with most orthopaedic traumas, good management of shaft humerus fracture requires good knowledge of anatomy, appropriate surgical indication, surgical approaches, implant selection and patient functional outcomes and expectations[6]. Intramedullary nailing gives a distinct advantage in this regard as to being a minimally invasive procedure, cost friendly, as well as bypassing the requirement of soft tissue and radial nerve exploration and thus having lower nerve palsy rates as compared to plate osteosynthesis. With this in mind, this study was conducted to study the functional outcome of retrograde intramedullary enders nailing in diaphyseal fracture of the humerus.

Aims and Objectives:

- To study the functional outcomes of retrograde ender's nail for humeral Shaft fractures in adults.
- To evaluate the time period of union in such fractures.
- To evaluate the complications of retrograde ender's nailing for humeral Shaft fractures.

MATERIALS AND METHODS

This was a prospective observational study which was carried out from Aug 2023 to Jan 2025 in our tertiary care hospital of Surat City, Gujarat, India. In this study period 35 cases of fracture of humerus shaft were managed by ender's nailing with closed reduction and internal fixation technique.

Patient Selection:

Inclusion Criteria (All of the Following):

- Consent for the surgery and to participate in the study.
- Both male and female patients above 20 years of age with closed and OG type I and II diaphyseal fractures of Humerus.

Exclusion Criteria (All/Any of the Following):

- OG III fractures.
- multiple trauma patient.
- Pathologic fracture.
- Fractures in skeletally immature patients.
- Old neglected fractures.
- Fracture with neuromuscular disorder/ neurovascular insufficiency.
- Refusal to provide informed consent.

Operative Methods: Patient is placed in Supine position and the entire limb in prepared and draped appropriately. A radiolucent side arm board table is placed under the arm with the shoulder abducted 90° and the elbow flexed to 90°. A 1-2 cm longitudinal liner incision was put on both side of epicondyle of distal humerus. The superficial and deep fascia was divided. The muscles were split to approach the distal humerus. Using a 3.2 mm drill bit, 2 holes were made on either side of the epicondyle of distal humerus. Using flexible reamers, reaming done and track was made. Then depending upon the diameter of medullary canal, 2/2.5/3 mm flexible nail was introduced using universal T-handle or Jacobson chuck. The nail was pre-bent and hammered by using rotator and mallet. Progression of the nail was checked under image intensifier tv in both AP and lateral views. When the nail reached at the fracture site, reduction was achieved by manipulation and the nail progressed proximally. By same method, second/third/fourth nail was introduced as the first one, through the second entry point. Nails were driven up into the humeral head and an effort in made to make that the ends of the enders nails diverge into the head. The number, size and shape of nails were determined by the fracture pattern and the size of the medullary cavity. The ends of the nails should protrude just enough to attach with the extractor possible. Finally, the placement of nails was confirmed under image intensifier. The wound was closed in layers. Sterile dressing applied.

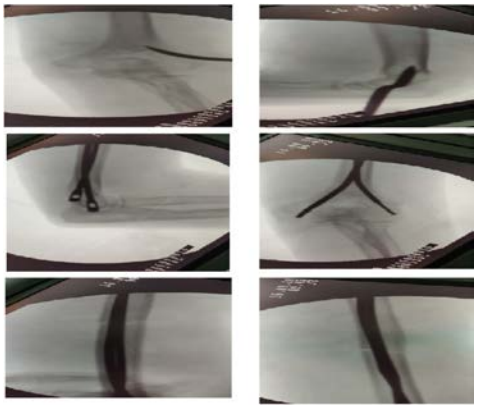

Fig. 1: Operative Positioning and Draping

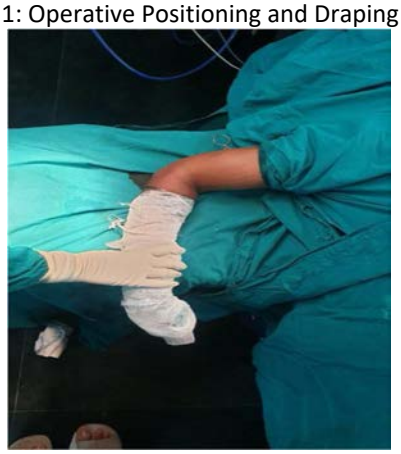

Fig. 2: Intra-Operative IITV Images

Post Operative Care: High AE slab/humerus brace was applied over the affected arm. In immediate postoperative physiotherapy the patients were asked to move their fingers and wrist joint. Appropriate oral analgesics and oral antibiotics were given to the patient till the time of suture removal at around 12 days post operatively. Patients were discharged with the arm in a high AE slab/humerus brace for a period of 1.5 months and then advised to perform physiotherapy for shoulder, elbow, wrist and finger movements. They were restricted for lifting weight or putting additional work stresses on the affected limb.

Fig. 3: Pre Operative Radiograph, Immediate Post Operative Radiograph, Radiograph at 6 Months Follow Up

Fig. 4: Shoulder Range of Motion

Fig. 5: Elbow Range of Motion

Follow-Up and Record of Results: All the patients were followed up on interval of 30 days for the first 3 months, later at 2 monthly periods till fracture union and once in 6 months till the completion of study. They were examined in detail clinically and special stress was laid on shoulder and elbow range of movements and subjective complaints. F/up radiographs were obtained in anteroposterior and lateral views and looked for signs of union. The fracture was considered to be radiographically united, when there was no noticeable fracture line and by the presence of bridging callus at the fracture site. Clinically fracture union was defined by the relief from functional pain and local tenderness at the previous fracture site. A detailed observation is recorded using a standard protocol and the American Shoulder and Elbow Surgeons(ASES) Score was used for comparing the functional outcome.

Interpretation:

Score:	**Outcome:**
76-100	Excellent
51-75	Good
26-50	Fair
<26	Poor

Fig. 6: ASES Score

RESULTS AND DISCUSSIONS

In our study 35 patients were included. Age of these patients ranged from 20-70 years with 16 (maximum) patients in 4th decade. The average age was 40 years, 25 were males and 10 were females. 21 patients had right sided injury and rest (14) had left sided injury. 7 proximal third, 21 middle third and 7 lower third shaft fractures were seen. 31 fractures were closed, 3 were OG-1 and 1 was OG-2. 18 fractures were transverse, 10 were oblique, 4 were spiral and 3 were comminuted. In 20 cases, 2 enders nails were used for fracture fixation, in 11 cases, 3 enders nails were used and in 4 cases, 4 Enders nails were used. 24 patients had sound union in <18 weeks, 4 patients had sound union by up to 22 weeks, 6 patients had union delayed >22 weeks, 1 patient showed non union of the fracture. 32 patients recovered full range of motion of shoulder and elbow joint while 3 patients recovered good range of motion (within 10-15% of full range). No patients showed severe restriction of shoulder or elbow ROM. 1 patient had radial nerve palsy, which was diagnosed as neuropraxia and recovered by 6 weeks. No patients showed any signs of superficial or deep infections.

Table 1: ASES Sore Results

Results	Number of patients
Excellents	24
Good	6
Fair	4
Poor	1

The aim of management in these fractures is to maintain length and alignment and produce favourable environment for bone and soft tissue to heal. The conventional method of treatment of shaft of humerus fractures has been the use of U-plaster cast. Although satisfactory results can be achieved with this method but residual angulation, malrotation and limb length inequality is well documented. Although plate osteosynthesis of fracture shaft humerus using 4.5mm narrow DCP/LC-DCP/LCP has its undebatable place in operative management, in view of outcome it requires extensive dissection of fracture site and also disturbing the biology of fracture with due risk of iatrogenic radial nerve injury. Another stable internal fixation can be also obtained by interlocking intramedullary nail but as its anterograde method the major disadvantage of nailing is rotator cuff injury. Hence Ender's fixation using retrograde method requires very less soft tissue exposure and as it is a closed method, the biology of fracture is also undisturbed. Thus, early fracture union can be anticipated. Another added benefit of Ender's nail fixation is it requires very minimal operative instrumentation and less surgical skill than plate fixation. The results observed by other authors using different modalities of treatment have varied from 75% good or excellent results to 100% good or excellent results. Our study had a 70% excellent result.

CONCLUSION

In conclusion, this study demonstrated significant improvements in functional outcomes following retrograde ender's nailing for humerus shaft fractures. Majority of the patients, predominantly in the 31-40 age group, experienced substantial gains in abduction, forward flexion and external rotation postoperatively. Improvements were most pronounced in forward flexion. Pain levels were significantly reduced, with 45.71% reporting no pain postoperatively and patient satisfaction increased notably, with 85.71% expressing high satisfaction. Transverse fracture was the most common fracture type and two ender's nails were used in the majority of cases. The retrograde ender's nailing technique was effective in restoring function, with 80.00% of patients recreate preoperative functionality. Overall, the retrograde ender's nailing yielded excellent results, enhancing patient mobility, reducing pain and improving quality of life. It provides distinct advantage over plate osteosynthesis by requiring minimal soft tissue handling, by being a closed procedure, showing low rates of radial nerve palsies and infections, having low cost to patients and requires minimal operative instrumentation and less surgical skill.

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