Original Research

OUTCOME OF INTERLOCKING NAILING IN HUMERAL SHAFT FRACTURE: A LONGITUDINAL STUDY

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ABSTRACT

Introduction: Fractures of shaft of humerus are a major cause of morbidity, especially with increasing vehicular traffic and rising incidents of road traffic accidents (RTA). While conservative management is associated with higher morbidity and high rates of non-union, open reduction is often associated with postoperative pain, soft tissue and neurovascular injury. With carefully selected patient, proper operative procedure and planned postoperative rehabilitation, the postoperative complications and morbidity following intramedullary nailing may be minimized. Therefore, the present study was conducted to assess the effectiveness of intramedullary nailing in patients with fracture of shaft of humerus.

Materials and methods: This prospective, interventional study was conducted after obtaining approval from the Institutional Ethics Committee. A total of 62 patients with radiologically confirmed fracture of shaft of humerus were included in the study, provided they met the inclusion and exclusion criteria and provided voluntary, written and informed consent. Demographic details and relevant histories were noted. Intramedullary interlocking nailing was done under aseptic precautions. Postoperatively, physiotherapy was done with shoulder and elbow exercises. The patients were followed up till 6 months postoperatively and radiological and functional outcomes were assessed.

Results: In the present study, the mean age of the patients was 42.6 ± 10.4 years with a male preponderance (43 patients, 69.35%). Right sided injury (52 patients, 83.87%) was commonly seen. 61.29% (38 patients) had recovered within 8 to 16 weeks. 40 patients (64.52%) had no complications. Excellent to moderate radiological outcome was seen in 95.61% patients. Poor functional outcome was observed in 3 patients (4.84%) in terms of range of motion (ROM) and 4 patients (6.45%) in terms of Visual Analog Scale (VAS) score.

Conclusion: Intramedullary interlocking nail is an effective and less invasive treatment modality for fractures of shaft of humerus. It has lower complication rates with no incidence of postoperative wound infection and favourable recovery profile. Careful selection of patient coupled with proper intraoperative procedure and planned postoperative rehabilitation results in good recovery rates, in terms of both, radiological and functional outcomes.

Keywords: Complications, Fracture, Functional Outcome, Intramedullary Nailing, Shaft of Humerus, Treatment, Visual Analog Scale.

INTRODUCTION

Fractures of shaft of humerus due to a trauma are a leading cause of morbidity. It is estimated that fractures of shaft of humerus account for 3% of all the fractures[1] and 63% of which are of a simple fracture pattern (AO/OTA 12-A and B)[2,3]. With increase in vehicular traffic and accidents, this number is expected to rise further.[4] The therapeutic goal of management of fracture of shaft of humerus is to gain a union with an acceptable alignment and to restore the pre-injury function level.[5] Both surgical and non-operative treatment were widely applied for fracture of shaft of humerus.[6-8] Classification of the fracture can guide in choosing the treatment modality·Conservative treatment of fractures of shaft of humerus is well established, but has limitations in cases of nerve and extensive soft-

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tissue injury, multiple fractures, non-compliance or obesity, the need for continued follow up, longer time of hospital stay etc.[9-10] Open reduction with internal fixation is the gold standard of surgical treatment, but problems such as excessive soft tissue stripping, radial nerve injury and difficulty with complex fracture patterns are well recognised.[11]

Intramedullary nailing was an effective alternative. However, it was associated with higher rates of shoulder pain and impingement and non-union. With improvement in the design of nail and advancement of surgical techniques, there has been recent surge of interest in this procedure, due to less invasiveness and lower morbidity. It controls rotation and maintains length of the humerus shaft.[12] Therefore, the present study was conducted to assess the effectiveness of intramedullary nailing in fracture of shaft of humerus.

MATERIALS AND METHOD:

This prospective, interventional study was conducted under the Department of Orthopedics at Dr Balasaheb Vikhe Patil Rural Medical College, Loni, after obtaining approval from the Institutional Ethics Committee (PIMS/DR/RMC/IEC-UG-PG/2023/58) on 6th February 2023. The study was conducted from February 2023 to March 2025. After obtaining a voluntary, written, informed consent, 62 patients with fracture of shaft of humerus were included in the study. Patients of either gender, aged above 19 years (with closed physis) having radiologically confirmed closed fracture of humeral shaft from 3 cm proximal to the olecranon fossa to 2 cm distal to the surgical neck of the humerus and having unacceptable alignment after closed reduction of the fracture were included in the study. Patients with either open fractures or pathological fractures or compound fractures were excluded from the study. Patient having evidence of vascular or neurological disorders, associated radial nerve injuries, pregnant women and those refusing to give consent to participate in the study were also excluded.

Demographic details and baseline characteristics were noted. Relevant history of injury was recorded. General and physical examination were done. The vital signs, degree of injury and extent of associated injuries were noted. Any neurovascular deficit was recorded. Fracture site and extent were confirmed radiographically by the anteroposterior and lateral views of the upper arm, shoulder and elbow joints. Range of motion was assessed. The affected limb was immobilized and analgesics were given.

All the patients were prepared for intramedullary interlocking nailing. Routine preoperative investigations were done and preoperative fitness was done. The patients were placed in supine position with arm hanging by the side. Aseptic precautions were taken. Preoperative antibiotics were given. Anterolateral approach was used and oblique incision of 2 to 3 cm was made at the anterolateral border from acromion, followed by splitting of deltoid muscle. Entry point was through greater tuberosity and was made using hand awl. Guidewire was inserted under C-arm guidance. Appropriate sized nail was inserted and proximal locking was done. Distal locking was done using freehand technique through a distal incision made avoiding neurovascular bundle. Closure was done by suturing rotator cuff and deltoid muscle, followed by closure of superficial layers.

Postoperatively, the affected arm was immobilized. Shoulder and elbow exercises were started as soon as operative pain subsided. Patients were discharged on 4th or 5th postoperative day and sutures were removed on 14th postoperative day. Complications, if any, were noted. The patients were followed up at monthly intervals till 6 months. Radiological evaluation was done alongwith assessment of range of motion (ROM) and Visual Analog Scale (VAS) score. The outcomes were recorded.

Data was analyzed using IBM SPSS software, version 21. The categorical data was and presented as number and percentages while the numerical data was presented as mean and standard deviation.

RESULTS

The mean age of the patients was 42.6 ± 10.4 years (range: 21 to 60 years). There was a male preponderance in the study population (43 patients, 69.35%). Right sided injury (52 patients, 83.87%) was commoner than left sided injury (10 patients, 16.13%). RTA was reported as mode of injury by 37 patients (59.68%) while fall was reported by 25 patients (40.32%). Fracture of middle third of shaft of humerus was the most common site (31 patients, 50%), followed by proximal one third (25 patients, 40.32%) and distal one third (6 patients, 9.68%).

Majority of the patients showed union in 8 to 16 weeks (38 patients, 61.29%) (Table 1).

Table 1: Distribution of Time to Union in the Study Population

Time to union in weeks	Frequency	Percentage
Upto 8 weeks	6	9.68%
8 to 12 weeks	18	29.03%
13 to 16 weeks	20	32.26%

16 weeks and above	12	19.35%
Non union	6	9.68%
Total	62	100.00%

There were no complications in 40 patients (64.52%). Delayed union was the commonest complication observed in the study population (12 patients, 19.35%) (Table 2).

Table 2: Distribution of Complications in the Study Population

Complication	Frequency	Percentage
Non-union	6	9.68%
Delayed union	12	19.35%
Superficial infection	4	6.45%
No Complication	40	64.52%
Total	62	100.00%

The range of movement in the postoperative period is shown in Table 3.

Table 3: Distribution of Range of Movement (in Degrees) at Postoperative Follow up in the Study Population

Range	Mean	SD
Flexion	120.1	2.8
Abduction	116	6.3
External Rotation	52	1.8
Internal Rotation	57.1	1.8

When assessed in terms of radiological outcome, majority of the patients had good outcome (31 patients, 50%) while only 3 patients (4.84%) had poor outcome (Table 4).

Table 4: Distribution of Radiological Outcome in the Study Population

Outcome	Frequency	Percentage
Excellent	12	19.35%
Good	31	50.00%
Moderate	16	25.81%
Poor	3	4.84%
Total	62	100.00%

When assessed according to functional outcome according to range of motion, majority of the patients had good outcome (37 patients, 59.67%) while only 3 patients (4.84%) had poor outcome (Table 5).

Table 5: Distribution of Functional Outcome as Per ROM in the Study Population

Outcome	ROM	Frequency	Percentage
Excellent	Upto 5° loss of ROM in direction	6	9.68%
Good	5°-10° loss of ROM in direction	37	59.67%
Moderate	10°-30° loss of ROM in direction	16	25.81%
Poor	More than 30° loss of ROM in direction	3	4.84%
Total		62	100.00%

When assessed according to functional outcome as per VAS score, majority of the patients had good outcome (35 patients, 56.46%) while only 4 patients (6.45%) had poor outcome (Table 6).

Table 6: Distribution of Functional Outcome as Per VAS Score in the Study Population

Outcome	VAS score	Frequency	Percentage
Excellent	0	8	12.90%
Good	1 to 3	35	56.46%
Moderate	4 to 6	15	24.19%
Poor	7 to 10	4	6.45%
Total		62	100.00%

DISCUSSION

The mean age of the study population was 42.6 ± 10.4 years with male preponderance. Right sided limb involvement with RTA were the commonest. Reunion in 13 to 16 weeks (20 patients, 32.26%) was commonly reported, followed by 8 to 12 weeks (18 patients, 29.03%). Non-union was observed in 6 patients (9.68%). Delayed union was the commonest complication reported. Majority of patients had excellent to moderate outcome (93 to 95%) as per the radiological union, ROM and VAS score. Poor outcome was observed in minority of the patients according to all the assessment methods.

In the study by Singh et al.,[13] they included a total of 25 patients with fracture of shaft of humerus. The mean age was 38.4 ± 9.6 years with a male preponderance (17 patients, 68%). Right side was reported to be involved in 15 patients (60%). RTA was the commonest mode of injury (16 patients, 64%), followed by fall (7 patients, 28%) and assault (2 patients, 8%). Mean hospital stay was 4.3 days. They reported the mean reunion time as 15.7 weeks with majority of the patients showing union in 14 to 16 weeks (18 patients, 72%). Rest were beyond 16 weeks. Based on the Constant-Murley Score, they reported excellent to fair outcome in 96% of the patients. These findings were almost similar to the present study.

In another study by Chandrashekhar et al.,[14] they included 30 patients of traumatic fractures of shaft of humerus. They reported that majority of the patients belonged to the age group of 26 to 35 years with a male preponderance (22 patients, 73.33%). Fall was the commonest mode of injury (!8 patients, 60%), followed by RTA. Mean duration of radiological union was reported to be 13.97 ± 3.78 years. Majority of the patients were reported to have excellent to good functional outcome with poor outcome in 4 patients (13.33%).

In the study by Raghavendra,[15] 20 patients of fracture of shaft humerus were included with a male preponderance (12 patients, 60%) and age range of 21 to 75 years [201]. Majority of the patients reported union between 10 to 12 weeks (15 patients, 75%). Non-union was reported in only 1 patient (5%). Functional outcome was reported to be excellent in 15 patients (75%) and moderate in 4 patients (20%). Only 1 patient (5%) was reported to have poor outcome. Complications were observed in 6 patients (30%) with nail impingement being the commonest complication (4 patients, 20%), followed by shoulder stiffness and non-union in 1 patient each (5%, each). These findings were almost similar to the present study.

In the study by Bhat et al.,[16] they included 41 patients and reported male preponderance (33 patients, 80.49%) with a mean age of 41.1 years. They followed 37 patients till 18 months and reported that 28 patients (84.84%) had shown union within 4 months with a 6-month union rate of 91.89% (34 patients). Non-union was reported in 3 patients (8.10%) at the end of follow up period. Functional outcome was excellent to fair with poor rating being reported in 3 patients (8.10%). Amongst the postoperative complications, they observed 4 patients (10.81%) with radial nerve palsy. They reported no wound infection in the postoperative period. These findings were similar to the present study. Good to excellent functional recovery of muscle strength and complete recovery of range of motion was reported in the study by Mocini et al.[17] El Ghazoui et al,[18] also reported improved anatomical and functional outcomes. Rommens et al,[19] also reported excellent to good functional outcome in more than 95% patients [207]. Intramedullary interlocking nail has been associated with shorter length of hospital stay and early postoperative recovery with minimal or no incidence of infection in the postoperative period. Studies have surmised that this might be due to nailing being less invasive procedure.[13,14] Other factors which lead to shorter recovery time and better recovery profile may be due to burying of the nail inside and repair of rotator cuff.[13] Lower intraoperative blood loss coupled with favourable morbidity profile may allow for early mobilization in the postoperative period[14] leading to faster and better recovery. Selecting the appropriate size of nail is crucial to the procedure. A carefully planned rehabilitation programme in the postoperative period leads to better results.

Limitations

The present study was a single center study with limited number of patients having fracture humerus. Also, the study was limited by the Outpatient Department (OPD) attendance of the patients, therefore, the results may not be generalized.

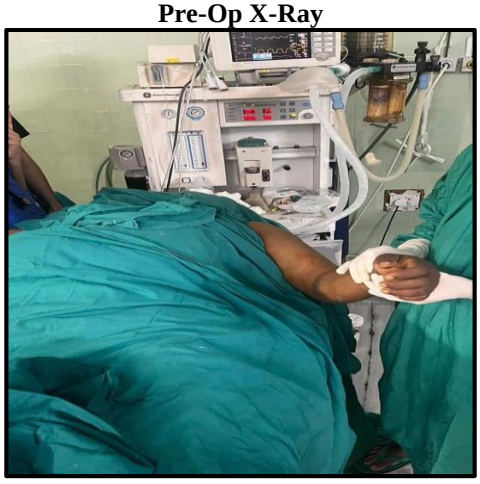
CONCLUSIONS

Intramedullary interlocking nail is a safe and effective procedure for treatment of fractures of shaft humerus. Majority of the patients have excellent to moderate outcomes in terms of radiological union and functional outcomes in terms of ROM and VAS score. The rate of non-union is extremely low with fewer complications.

Intramedullary interlocking nail in carefully selected patients coupled with postoperative immobilization and physiotherapy is an effective treatment modality for fractures of shaft humerus. It is the least invasive surgical procedure with lower rates of postoperative infections and complications, thereby resulting in reduced hospital stay. Further multicentric studies comparing its efficacy with other treatment modalities, like conventional plating, maybe required to establish its efficacy and recovery profile.

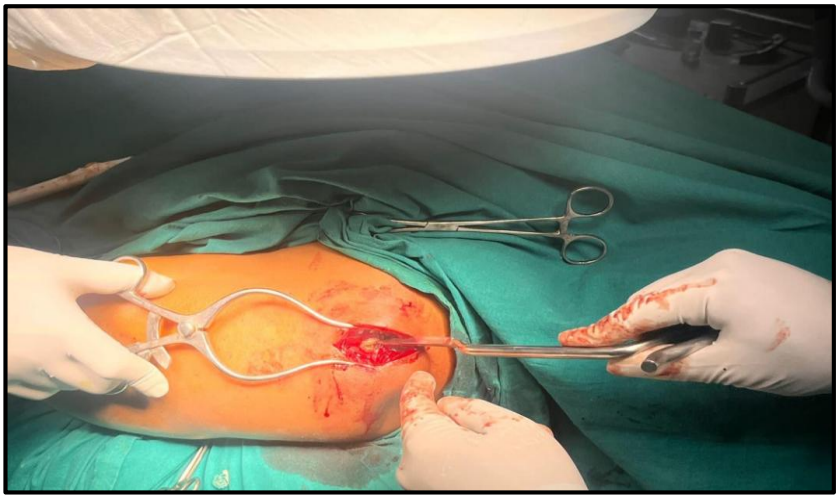
Operative Case Photos

Pre-Op X-Ray



Position of Patient

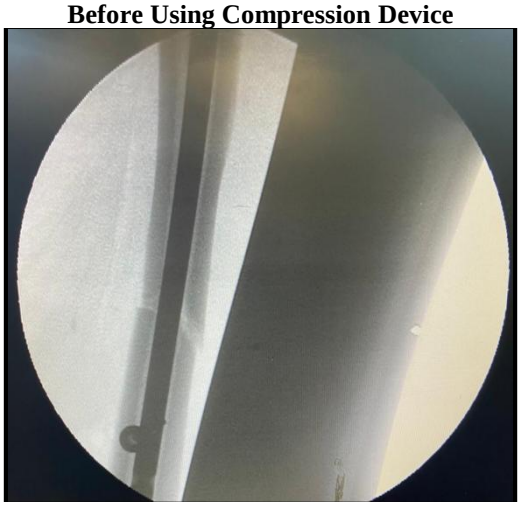
Skin Incision



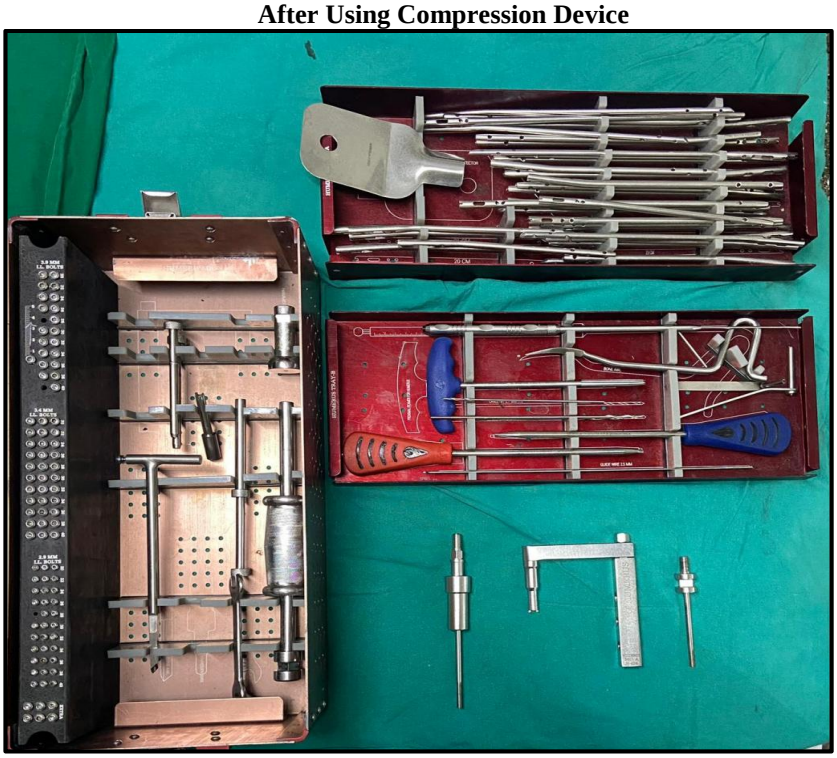
AWL Incision

Nail Passing Thr0ugh Fracture Site

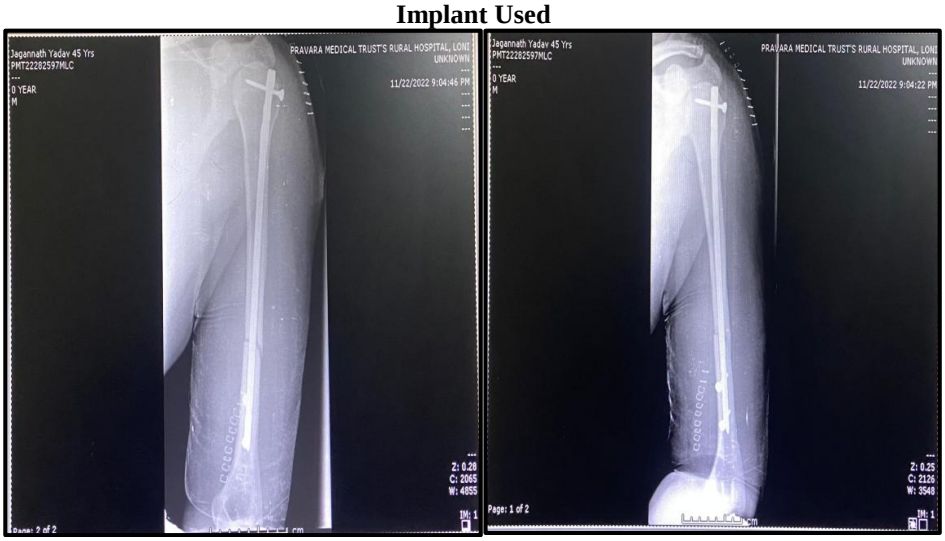
Before Using Compression Device



After Using Compression Device



Implant Used



Immediate Post-Operative X Rays

Range of movements

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