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Functional outcome of fracture shaft humerus treated with closed antegrade intramedullary nailing in adults

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Abstract

Background and objectives: The treatment of humeral shaft fractures might include plate osteosynthesis or intramedullary nailing. The fracture hematoma is maintained using intramedullary nails because they are placed in a closed way, allowing for early fracture consolidation and decreased infection rates. Interlocking provides rotational stability, allowing nearby joints to mobilize more quickly. Antegrade nailing, on the other hand, has the side effect of tightening the shoulder. In this study, we wanted to see how humeral shaft fractures treated with closed Antegrade Intramedullary nailing fared in terms of time to union, functional results, and comorbidities.

Methods: Twenty adult patients with acute humeral shaft fractures were treated using antegrade closed intramedullary nailing. With an average age of 38.4 yrs., there had been 17 men and 3 females (21-65 yrs.). These patients had tracked for two years as well as the outcomes were assessed.

Results: 1 (5%) fracture failed to union after an average consolidation time of 13.78 weeks (11-16 weeks). There were three occurrences of intraoperative fracture comminution (15%) that had no impact on fracture healing. 2 (10%) of the patients experienced nail impingement, 1 (5%) had shoulder stiffness, and 1 (5%) had a superficial infection. Functional outcomes were good in 17 (85%), moderate in 2 (10%), and poor in 1 (5%).

Conclusion: Closed Antegrade intramedullary nailing is a safe and easy way to fix fracture shaft of humerus, resulting in early fracture consolidation as well as a rate much higher of union. It allows for early recovery and shortens hospital stays.

Keywords: fracture shaft humerus, closed antegrade intramedullary nailing

Introduction

Human civilization history is primarily a record of man's conflicts with the negative element in his environment, Because of technical improvements in industry, a growth in the number of automobiles on the road, and an increase in the number of high-speed thorough fares, the prevalence of trauma has increased. The humerus shaft canal so be broken. The human body has the ability to heal fractures without the need for outside assistance, although functional healing is typically hampered by shortening, misalignment, and joint stiffness. The need to intervention in fracture healing developed as our understanding of fracture healing grew. Functional outcomes will improve when newer and better fracture treatment procedures become accessible. The fast improvement of orthopedic surgery has unquestionably marked a watershed point in the treatment of fractures. the humeral diaphysis accounts for around 3% of all fractures ^[1]. The what percentage of these fractures are treated According to reports, it ranges from 33 ^[2] percent to 93% ^[3] humeral intramedullary fixation ^[4-7] diaphyseal fractures as well as External fixation in the form of compression plating ^[8, 2, 9] or external fixation in the form of the term "open fractures" is used to characterize these types of fractures. Lin stated that there was a in 73 fractures treated, the union rate was over 100 percent. either intramedullary nails that are locked or intramedullary nails that are unlocked Screws and compression plates ^[11, 12]. Compressive locking Plate osteosynthesis and intramedullary nailing are the two modalities for internal fixation in humeral fracture shafts. The proximity of the radial nerve and the risk of mechanical failure in osteopenic bones complicate plate fixation, which necessitates extensive dissection. The fracture hematoma is preserved with closed reduction and nailing, which is critical for early fracture consolidation. The introduction of the interlocking nail technology has greatly expanded the scope of intramedullary nailing

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applications. Shaft fractures with substantial comminution or bone loss could now be treated utilizing interlocking nails that regulate length and rotational alignment. Rigid intramedullary nailing of a humerus fracture shaft seems to be the preferred treatment in polytrauma individuals, fracture due to fire, individuals having osteoporotic bone, pathologic fractured, and segmented broken bones.

Research Objectives

The goal of this study was to look at the statistics of close intramedullary interlock nails treating humeral shaft fracture in terms of fracture consolidation time, union rates, and functional outcome. To make a comparison between the findings and material from textbooks and publications.

Materials and Methods

Closed Antegrade intramedullary interlocking nailing was used to treat adults with humeral shaft fractures. Over the course of two years, this inquiry was undertaken as a prospective study (from November 2018 to November 2020). THE ORIGINAL SOURCE OF THE DATA Patients of both sexes in their adult years who present to the Orthopedics department at the government Medical College and affiliated hospitals in Kota with a fracture shaft of the humerus.

Inclusion Criteria

The following criteria were used to choose the patients: The age is more than 17 years when the physis is joined. Humeral shaft fractures can occur anywhere from 3cm proximal to the olecranon fossa to 2cm distal to the humeral surgical neck. Fractures with unfavorable alignment Following closed reduction Fractures suffered by poly trauma patients. All closed fractures, as well as grade 1 open fractures, are simple, segmental, comminuted, and pathological.

Exclusion criteria

Whenever the physis is open, patients must be 17 years old or younger. Both proximal 2cm and distal 3cm of a humerus is involved in humeral shaft fractures. Open humerus fractures which are heavily polluted (Grade 2, 3).

Pre-operative assessment: To determine the mechanism of damage and the level of trauma, patients and/or attendants were asked to provide a brief history. The individuals were then clinically evaluated to determine their overall health and local damage. There was no evidence of any related neurovascular impairment. Anteroposterior and lateral radiographs of the afflicted arm, including the shoulder and elbow joints, were obtained. The treatment, its benefits, and potential risks were all described to the patient, who gave his or her informed permission. All of the blood tests that are required.

Operative Technique

Under the scapula, a roll is inserted to expand the shoulder and expose the humeral head from behind the acromion. A 3 cm long longitudinal incision is made from the lateral tip of the acromion. Point of Entry The medullary canal is opened 1cm to 1.5cm medial to larger tuberosity at the intersection of tuberosity and the head of humerus using a sharp bone awl. The picture intensifier confirms the position. Over the larger tuberosity, the entry points Iatrogenic fracture of the greater tuberosity with rotator cuff damage. The proximal nail should be around 5mm below the articular surface, and the distal nail should be about 1–2cm from the olecranon fossa. The size of

the nail may be double-checked with a guide pin and an image intensifier. The mounted nail is inserted into the medullary canal through the entrance hole. Closed reduction of the fracture is performed under the supervision of an image intensifier, and the nail is navigated across the fracture ends. The nail is pushed distally until it is 2 to 3 cm away from the olecranon fossa. To avoid splintering the distal piece, care must be given when selecting the nail. Antero posterior and lateral images under image intensifier are used to check the nail location in the distal fragment by moving the arm externally and internally. Proximal Locking is a term used to describe the process of locking something close with the aid of a jig, proximal locking is performed from lateral to medial. The axillary nerve, which is 4 to 5 cm distal to the tip of the acromion must be avoided at all costs. Under an image intensifier, the screw's proper placement may be checked after it has been locked. Locking Distal A free hand method is used to lock the distal end in Antero posterior orientation. With the assistance of an image intensifier, a 2cm longitudinal incision is created just lateral to the biceps tendon and centered over the nail's distal locking groove. In the picture intensifier, spin the arm until the slot appears round.

Postoperative Management

In patients where there were no associated injuries or their presence did not warrant hospital stay, after instructing regarding range of motion exercises patients were discharged on 4th or 5th postoperative day and were asked to come for suture" removal on 14th postoperative day. Postoperatively the arm is placed in a sling and early range of motion exercises for shoulder and elbow were started as soon as pain subsides

Observation and Results

The functional results of our patients were examined using Rommens *et al.* [13] criteria. Their Ages varied from 21to 65, with a 38.4-year average. Only three cases (15%) were female, with the vast majority of patients being men. The most prevalent method of injury in our study was road traffic accidents, which accounted for 11 (55 percent) of the patients, while the remaining 9 (45 percent) had a history of falling. The most prevalent mechanism of damage was indirect injury, which accounted for 14 (70 percent) of the patients, while the remaining 6 (30 percent) had a history of falling. In our study, 11 patients (55%) had a fracture in the middle third of the humerus, 7 patients (35%) had a fracture in the lower third of the humerus, and 2 patients (10%) had a fracture in the upper third of the humerus. Seventy percent of the patients in our research had an oblique fracture, sixty percent had a transverse fracture, other sixty percent had a comminuted fracture, and one patient had a spiral fracture. 9 (45%) patients had associated injuries, including 3 (15%) patients who had radial nerve palsy, 1 (5%) patient who had rib fracture on the same side, 1 (5%) patient who had fracture both bone forearm on the contralateral side, 1 (5%) patient who had fracture shaft of femur on the same side, 1 (5%) patient who had mandible fracture, and 1 (5%) patient who had rib fracture on the same side. 1 (5%) patient had a distal end radius fracture, and 1 (5%) patient suffered a head injury. On average, the majority of the patients were operated on within a week of the incident, with a time interval of 6.5 days. The procedure was postponed due to the patient's late appearance and treatment of related injuries. Closed intramedullary nailing was used to treat 17 (85%) of the fracture patients. These nails were inserted in an antegrade

direction and secured in a static position. Because of the accompanying radial nerve palsy, three (15%) patients required open reduction, which was decompressed and the fracture was repaired with an interlocking nail in static mode. After surgery, you will be immobilized for a period of time. Except for one instance, which was immobilized for 3 weeks externally with a pop slab due to shoulder joint discomfort, all other patients were immobilized for 6 days after surgery. After surgery, the average length of immobility was 5.5 days. The average follow-up duration was 6.45 months. Except for one instance that had gone for non-union, the time of fracture union varied from 11 to 16 weeks, with an average of 13.78 weeks. In our research of 20 individuals, 17 (85%) had great shoulder function, 2 (10%) had intermediate shoulder function, and 1 (5%) had poor shoulder function. Elbow mobility was excellent in 18 patients (90%) and moderate in two others (10 percent). In general, 85 percent of patients had good functional outcomes, 10% had intermediate outcomes, and 5% had poor outcomes. In the majority of patients, the functional outcome was satisfactory. Joint mobility was limited in patients who had been immobilized for a long time. Complications A problem that occurs during surgery. Three (15%) patients had further comminution at the fracture site after nail placement, although this had no effect on fracture union. Joint stiffness: One patient (5%) had shoulder stiffness, mostly abduction, with a range of motion of 0-90°. Impingement: Nail impingement of the proximal end occurred

in 2 (10%) individuals because the nail was not completely buried into the bone. Complications that occur after surgery Infection: There was one incidence of superficial infection in our research (5%), which was treated with antibiotics and cleared completely. After 9 months, a further surgery was done using autologous bone transplant, which resulted in union. They reported shoulder discomfort on occasion, with terminal 200 and 150 degrees of abduction restricted, respectively. Patient was kept in distraction at the fracture site because of nonunion (5%).

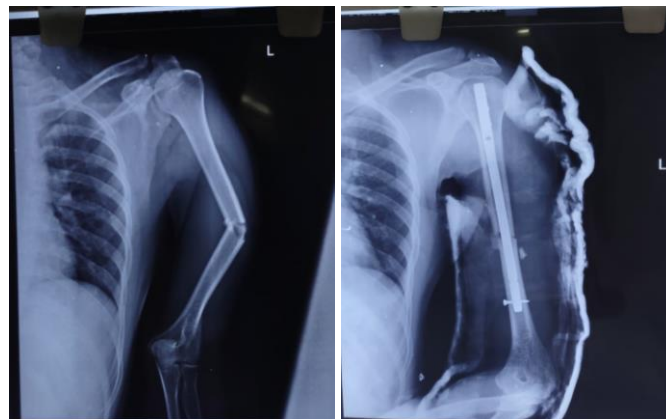


Fig 1: Pre-op and post op X ray

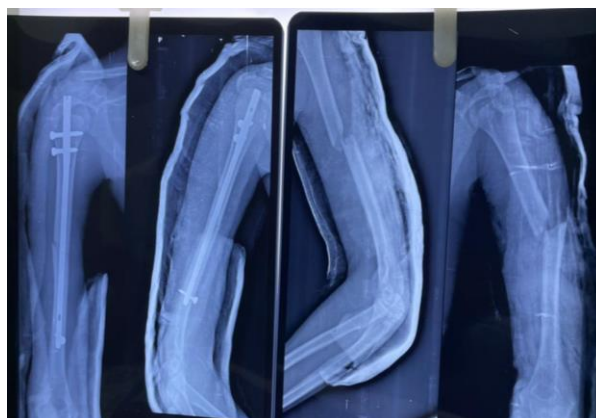


Fig 2: pre op and post op X ray

Discussion

Intramedullary nailing offers the benefit of generating less soft tissue damage and reducing the risk of radial nerve injury; however, the use of unlocked flexible nails has been hampered by poor rotational stability and the nails falling out, causing joint discomfort. We analyzed our findings and compared them to those of previous research that used different treatment methods for humeral shaft fractures. We used antegrade interlocking nailing to repair 20 acute humeral shaft fractures in this investigation. Plate osteosynthesis has a high success rate, but it necessitates considerable dissection, which might cause radial nerve injury and re fracture When the implant is removed. Crates and partners¹⁷ 73 traumatic fractures of the humeral shaft were repaired with intramedullary nail. In 71 people. 43 men and 28 women, with an average age of 32 years, 48 patients with acute fractures of the humeral shaft with humeral clinging have been reconstructed by Jinn Lin^[16]. Rommens and al^[13] utilized reverse locking nails to treat 39 persons with fractures of the shaft. The most prevalent mechanism for trauma in most investigations has been a car collision. Out of 39

patients in the Rommens *et al*^[13] study, 21 had a history of a road traffic collision. Road traffic accidents were the most prevalent method of injury in a research by Bell MJ,^[14] Jinn Lin^[16], and Tingstad¹⁸. In this investigation, 11 individuals with a history of traffic accidents were included." Crates *et al*,^[17] Rommens *et al*,^[13] Jinn Lin^[16] found that the middle third of the shaft is "The fracture's most prevalent site. Injuries had occurred in 9 of our patients. 60 individuals were injured in the Crates *et al*.^[17] series. 48 of 73 persons experienced road accidents in a research conducted by Crates *et al*¹⁷ 12 of the 48 patients in the Jinn Lin¹⁶ series had multiple injuries. Twenty individuals in the Rommens *et al*.^[13] study suffered poly trauma. The majority of the humeral shaft fractures in the series were classified as category A by the AO classification system. A total of 34 fractures were found in the Jinn Lin^[16] series. In the Rommens *et al*.^[13] study, 25 fractures were classified as category A. The majority of surgical techniques for humeral shaft fracture stabilization have satisfactory union rates.

Vander Griend *et al*.^[20] Bell *et al*,^[14] Dabezies *et al*.^{21]} all reported 97 percent union of humeral shaft fractures treated

with AO plating procedures, whereas Tingstad¹⁸ reported 94 percent union of humeral shaft fractures treated with AO plating techniques. Durbin *et al.*^[22] reported union in 92 percent of 30 humeral fractures treated by hackethal nailing, despite the fact that flexible intramedullary nails lack rotational control and are usually linked with nonunion. In 58 fractures treated with Rush and Ender nails, Brumback *et al.*^[24] were able to achieve union in 94 percent of cases. Flexible intramedullary nails provide greater rotational control than hard locked intramedullary nails, which should reduce the occurrence of nonunion. In 28 acute humeral shaft fractures treated with seidel nails, Riemer *et al.*^[23] discovered no nonunions. Rommens *et al.*^[13] found that 95% of fractures were healed in 13.7 weeks on average. In 16 patients, Jensen *et al.*^[25] found that seidel nailing resulted in a 92 percent fracture union. Jinn Lin^[23] claimed a 100% union rate and an 8.6-week average time to union. Crates *et al.*^[17] found that antegrade Russell Taylor nailing resulted in 97 percent fracture union in 3.2 months on average. In our study, 19 of the 20 fractures were successfully joined, with a mean duration of 13.8 weeks. Because the radial nerve is so near to the humeral shaft, every surgical approach to the humerus has the potential to damage it. In 2.9 percent of humeral fractures treated with plating, Vander Griend *et al.*^[20] and Bell *et al.*^[14] found temporary iatrogenic nerve palsies.

The most common complaint levelled towards antegrade humeral nailing has been that it may have a negative impact on shoulder function. In the majority of antegrade nailing trials, 80 to 95 percent of patients were able to restore their usual shoulder function. Crates *et al.*^[17] reported 90 percent of patients recovering complete shoulder function with Russell-Taylor antegrade nailing, whereas Petsatodes *et al.*^[15] reported 87.2 percent of patients regaining full shoulder function with Russell Taylor antegrade nailing. Kropfl *et al.*^[19] used undreamed antegrade interlocking nailing to repair 111 fractures in 109 patients, 19 of whom had limited shoulder mobility and none had limited elbow motion. 17 of the patients in our research showed good shoulder function and a near-normal range of motion. The shoulder function of two individuals was relatively excellent. The proximal end of the nail was impinged in both cases. One of the patients reported severe shoulder stiffness and considerable shoulder mobility limitation. It was discovered that the patient's commitment to the rehabilitation programmed determines the shoulder's motions and functional capacity, and that early intense physiotherapy expedited the return of shoulder function. The majority of our findings, such as the time it takes for a fracture to heal, the rate of union, complications, and functional outcomes, are comparable to studies in which intramedullary nailing was used to treat humeral shaft fractures.

Conclusion

We conclude that closed intramedullary nailing with an interlocking nail is a safe and reliable way of treating humeral shaft fractures based on our experience and findings. Closed intramedullary nailing can be used to fix almost all closed and Grade I open humeral shaft fractures that are 2 cm from the surgical neck to 3 cm proximal to the olecranon fossa. Closed nailing is the least intrusive surgical procedure and has the lowest risk of postoperative infection among the various surgical options. It shortens the time spent in the hospital. In order to minimize impingement and improve shoulder function, certain technical features such as burying the proximal nail end at the entrance portal are necessary. Early

intense physiotherapy, we believe, hastens the rehabilitation of shoulder function.

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