



Study on Percutaneous Intramedullary Nailing In Adult Diaphyseal Humeral Fractures

**Mohsin Aijaz Soomro¹, Ajmal Khan Silro², Raheel Akbar Baloch³,
Najeeb Ur. Rehman⁴, Muhammad Faraz Jokhio⁵, Niaz Hussain Keerio^{6*}
and Syed Shahid Noor⁷**

¹Suleman Roshan Medical Collage Tando Adam Pakistan.

²Dibba Hospital Fujairah, United Arab Emirates.

³Liaquat University Hospital, Hyderabad, Pakistan.

⁴Peoples University of health and Sciences for Women, Nawabshah, Pakistan.

⁵Liaquat University of Medical and Health Science, Jamshoro, Pakistan.

⁶Muhammad Medical College and Hospital, Mirpurkhas, Pakistan.

⁷Liaquat National Hospital and medical College Karachi, Pakistan.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Objective: The objective of this research was to evaluate close fixation techniques for fractures of humerus via percutaneous intramedullary nailing.

Methodology: This was a prospective study, carried out in Suleman Roshan Medical College Tando Adam Pakistan from January 2019 to January 2020. About 60 patients with humeral shaft fractures were made part of this study with a follow-up period of about 1 to 2 years. The inclusion criteria were humeral fractures that were of less than 7 days prior to surgery, the displacement of fracture >20° in sagittal as well as coronal plane, and the distance measuring >2cm between the two fragments. All patients were treated via the closed fixation technique. Multiple nails that were slender as well as flexible (3-5) were used in the close fixation technique including rush nails (45 patients) and ender nails (15 patients). All the patients within their follow-up periods were evaluated for ROM, pain, or any kind of deformity, and all the patients were assessed radiographically to check the process of bone union.

Results: The outcome was analyzed before implant i.e at six months and after the implant was removed. About 86% patients (n= 52) revealed satisfactory outcomes at six months. About 5 patients revealed non-union or delayed union that was healed after 2nd surgery of bone grafting in 3 patients and injections associated with bone marrow in 2 patients. Stiffening of the shoulder was found to be a frequent complication that decreased significantly when the position of nail insertion was changed during the research.

Conclusion: The technique of intramedullary nailing displayed many benefits including minimum tissue stress, a quick surgery time, decreased period of hospital stay, and rapid bone union.

Keywords: Intramedullary nails; percutaneous intramedullary nailing; diaphyseal humeral fractures; humeral shaft fractures.

1. INTRODUCTION

The humerus is a long bone of the upper extremity that is attached from the distal end to the forearm bones taking part in the elbow joint and from the proximal end to the shoulder joint. If there is any discontinuity in the middle of the bone, it is referred to as a fracture of the humeral shaft or diaphyseal. Injuries from collision accidents or maybe football tackle or due to any pathological condition like metastatic bone cancer can lead to humeral fractures [1].

The humeral fractures account for 1 to 7 percent of all fractures in the elder population and it was found to be 3rd most prevalent fracture followed by the fractures associated with the hip as well as wrist [2]. Closed injury is the cause of several independent humeral diaphyseal fractures, which account for 1 to 3 percent of all fractures. Patients having humeral diaphyseal fracture present with a disability, deformity as well as painful and swollen arm [3]. Conservative intervention, open reduction as well as internal fixation (ORIF), plating, or closed reduction as well as IM nailing are all possibilities for Humeral diaphyseal fracture treatment. Any external fixator is however a possibility, but it is seldom implemented [4].

Many fractures of humeral diaphysis respond well towards the conservative intervention. To choose optimal therapy, a detailed understanding of anatomy, the fractural pattern, and the physical activity in patients is strictly required. The main objective of humeral fracture management is to promote bony union and realign the bone perfectly as well as to make the patient function normally. There are many ways to fix humeral diaphyseal fractures. Some of them include casting, bracing, or U slab. But these can cause delayed union or malunion and nonunion thus requiring further treatment [5]. To fix humeral fractures, compression plating and

intramedullary nailing are preferred interventions. But Patients who were fixed using the plating technique required additional reoperations including secondary bone grafting interventions. For humeral diaphyseal fractures, Intramedullary nailing is a viable treatment strategy. A skilled surgical procedure, as well as soft tissue manipulation, are essential to get a successful result. Presently, patient needs are being given more attention. In the age, in which rapid complete range of motion, as well as quick restoration of activities of daily living with minimum scarring, are required for the majority of patients, the utilization of Intramedullary nailing is anticipated to grow more prevalent in the future [6]. The closed fixation technique requiring multiple IM nails is one of the treatments of choice. Hence, this study was conducted to evaluate this treatment.

2. METHODOLOGY

This prospective study includes 60 participants. The participants were chosen on the basis of fractures associated with humeral diaphysis. All these patients were treated with closed fixation technique via multiple intramedullary nailing (3-5) that were flexible as well as slender. The inclusion criteria were humeral fractures that were of less than 7 days prior to surgery, the displacement of fracture >20° in sagittal as well as coronal plane, and the distance measuring >2cm between the two fragments. The fractures that were simple and compound (grade: 3) with evidence or no evidence of injury associated with radial nerve were also made part of this study. In Humeral shaft fracture, radial nerve palsy (RNP) is not a surgical sign because it has a greater likelihood of healing spontaneously. Any vascular damage needing healing or bypasses, on the other hand, is an unequivocal criterion of surgical fracture treatment since the firm fixation preserves the vascular anastomosis [7]. The supine lying was preferred during operation.

About 5cm of skin incision was made distally to lateral acromion border. After splitting the deltoid, a hole distally to rotator cuff muscles was made and monitored under IITV. If the fracture was inferior to surgical neck of humerus, the nailing was done retrogradely via lateral condyle or window proximally towards the olecranon fossa. The rush, as well as the ender, were measured for length on the unoperated arm and 3mm diameter was chosen. The bending of the tip was done while introducing in the medullary cavity, across the humeral fracture. The fracture was bridged to connect the distal segment via IITV guidance. About 3 nails were passed in the cavity to fill it. The nails were spread at the end in such a way that helps in rotatory movement. The impaction of fracture was carried out and final seating was completed under IITV. 45 patients were fixed via rush nails while the rest of the 15 patients were fixed via ender nails.

2.1 Procedure for Post-Operative Care

U-slab made of plaster of Paris as well as sling was provided till three weeks. The removal of the slab was done at 3rd week while the sling was not removed until full radiographical, as well as the clinical union, was confirmed.

The exercises of fingers, wrist, and forearm were prescribed. The mobilizations at shoulder level were initiated at the third week, yet patients were not allowed to move their arms fully until the bony union is not confirmed. The X-rays were taken at intervals till complete union. The outcome was evaluated to monitor union or deformity through Constant and Murley Score given below:

According to the Table: 1,

Excellent= primary bony union with no deformity, no pain in shoulder or elbow while moving. (Score: >80).

Good= primary bony union with deformity of <100° and 2mm shortening, good ROM at the shoulder as well as elbow level, painless ADLs, and resting phase. (Score: 60-80).

Fair= primary or delayed union corrected after grafting or injection, deformity of <300° and <5mm shortening, fair ROM, and painless resting phase. (Score: 30-60).

Poor= no bony union with deformity >300° and >5mm shortening, fair ROM, and painful resting phase. (Score: 30-60).

3. RESULTS

About 60 patients with humeral diaphyseal fracture from which 20 patients were female (33.3%) while 40 patients were males (66.6%), were included. The outcome was analyzed before implant i.e at six months and after the implant was removed. The right humeral involvement was displayed by 35 patients while 25 cases revealed left humeral fracture. Patients with both-sided humerus involvement were not made part of this research. 14 patients out of 60 (23.3%) were with compound type of humeral fractures. The majority of the patients with humeral fractures were within the age group of 21 to 30 as shown in Table: 2 is given below.

6 cases showed radial nerve injury (10%) while the injury like Holstein Lewis i.e a fracture associated with distally 1/3 of the humeral diaphyseal spiral fracture involving proximal as well as radial dislocation of the distal fragment, the type was not managed through intramedullary nailing, but they were fixed via DCP [8]. The follow-up period was one to two years. About 4 cases showed superficial infection at the site where the nail was inserted while 2 cases were with deep infection. All the cases were treated aggressively for wound exploration curettage as well as with Intravenous antibiotics and all of them showed complete healing. However, no chronic staged infection was determined afterward. In few cases, the nail was backed out. About 5 patients revealed non-union or delayed union that was healed after 2nd surgery of bone grafting in 3 patients and injections associated with bone marrow in 2 patients. The interval of 3 to 8 months was kept between the first and second intervention. All humeral fractures showed healing. Stiffening of the shoulder was found to be a frequent complication that decreased significantly when the position of nail insertion was changed during the research. The stiffness, as well as pain, was due to impingement of injury to RC muscles. This complication was faced by 4 patients that were managed through physical therapy as well as analgesics.

The average duration of the bony union on radiographs was found to be 7-18 weeks. The X-rays were used to determine the union as all cases revealed callus formation.

4. DISCUSSION

Closed injury is the cause of several independent humeral diaphyseal fractures, which account for

Table 1. Results

Excellent	40	66.6%
Good	12	20%
Fair	5	8.3%
Poor	3	5%
Total	60	100%

Table 2. Age groups

16 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	>70
3	30	15	5	4	2	1

1 to 3 percent of all fractures. Humeral diaphyseal fractures commonly occur more in males and the frequent cause of these types of fractures is road traffic accidents. The humeral diaphyseal fractures are treated via various interventions. Many fractures are managed conservatively through casting, bracing, U-slab, or sling but despite the presence of malunion, the patient remains functional. However, many types of humeral fractures need plating or IM nailing. Plating offers the benefit of precise reduction as well as tight fixation while causing no damage to the shoulder or elbows joint. Since the arm is not often a weight-bearing limb, hardware failure is uncommon, therefore the bony union is comparable to compression plates as well as fixation through the screws. Soft tissue stripping, lengthy operation, and improper surgical skill are among issues associated with plating. Infection can lead to a tragedy that is exceedingly difficult to recover from. It is tough to control[9].

Intramedullary nailing is a simple technique in contrast to other interventions like plating. According to Wang Y's study [10], the procedure is less invasive thus decreasing the duration of hospital stay as mentioned in this study as well. According to the literature [11], patients having quicker healing periods were found to be the ones that were managed via closed reduction, like in the case of Intramedullary nailing fixation that hardly needs open reduction.

Similar as above [12], which involves two groups. The one was treated via IM nailing and the other through plating. The IM group revealed fewer bleeding issues, short surgical procedures, and the period of hospital stay was also reduced (P-value =<0.001) in contrast to the plating group.

Interlocking nailing has been common in lower extremity fracture, thus it was decided to try over humerus. Russel Taylor, AO Unreamed Humeral Nails, & Sirius Nails were always useful

and successful. Prospective investigations indicated that plating & IL nailing provide similar effects. Perhaps this method, unfortunately, wasn't without flaws [13]. Fragmentation as well as splitting associated with fractal ends, missed interlocking, jamming, as well as a distraction at the fractal site are all possible intraoperative problems. Stiffness in the shoulders and elbows (on retrograding insertion of nails) was found to be a prominent issue.[14].

The closed fixation technique of IM nailing has been studied by many researchers. Since this intervention is percutaneous, it causes reduced trauma to soft tissues, decreases the bleeding problems, reduces the surgical procedure duration as well as the hospital stay. The tips of the nails spread or fans out to support the rotatory movement of the arm. The technique's outcomes are equivalent to locking IM nails as well as plates, in accordance with this research. Although that approach is not utilized in all types of humeral fractures, yet it was found to be treating a substantial percentage of patients with careful selection. Hence, such a technique of fracture repair is assisted conservative management in which the fractal healing is aided via fairly minor treatment.[15]

5. CONCLUSION

The technique of intramedullary nailing displayed many benefits including minimum tissue stress, a quick surgery time, decreased period of hospital stay, and rapid bone union. The tips of the nails spread or fans out to support the rotatory movement of the arm. The technique's outcomes are equivalent to locking IM nails as well as plates, in accordance with this research. But Patients who get fixed using the plating technique required additional reoperations including secondary bone grafting interventions. We propose this intramedullary nailing technique or therapy for humeral Diaphyseal fractures, but

only if the particular criteria, as well as restrictions, are satisfied.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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