

# Titanium Elastic Nailing in Adult Humerus Diaphyseal Fracture

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Nailing in  
Humerus  
Diaphyseal  
Fracture

## ABSTRACT

**Objective:** To study the union, joint stiffness, deformity and incidence of infection after humerus diaphyseal fracture.

**Study Design:** Quasi experimental prospective study.

**Place and Duration of Study:** This study was conducted at the Sheikh Khalifa Bin Zayed Al-Nahyan Hospital Rawlakot Azad Kashmir from 01.08.2016 to 01.08.2017.

**Materials and Methods:** Thirty patients of either gender with age range between 18 years to 65 years with closed diaphyseal humerus fracture were included in study. Titanium elastic nailing was used to treat these patients. Outcome was measured in terms of union, infection rate, angulation and range of motion at shoulder and elbow joints.

**Results:** 30 patients were operated including 21 male and 9 female. We observed union in 23 patients. 07 patients had superficial infection around the margins of protuberant nail while 2 patients developed deep infection. Among the united fractures all patient had angulation in acceptable range. Seven patients who had delayed union or non-union showed limitation of range of movement at shoulder and elbow joints.

**Conclusion:** Adult humerus fracture fixed percutaneously takes less time, losses less blood, disrupts minimum tissue and the healing is natural. Selection criteria and procedure expertise make the best results outcome for this method and should be strictly observed.

**Key Words:** Titanium elastic nails, diaphyseal fracture adult humerus, trauma.

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## INTRODUCTION

The fracture of humerus is relatively uncommon but recently the incidence of this fracture in adults has increased, mainly due to the ageing of the population and increase in number of automobile accidents.<sup>1</sup>

The humerus fractures account for 3% to 5% of the skeletal injuries. The method of treatment of humerus fractures depends on many factors including the patient's general health, age of the patient, severity of trauma, the time from fractures to treatment and concurrent medical treatment.<sup>2</sup>

Conservative management is still considered the ideal method for the treatment of humerus shaft fractures.<sup>3,4,5</sup> Numerous authors apply short period of skeletal traction and then fracture bracing in ambulatory patients. Most surgeons believe that surgery intervention carries risk of infection.<sup>6</sup>

There is still controversy over implant selection when surgical intervention is considered in the management of diaphyseal fractures of the humerus.

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Methods for Surgical treatment of the fracture humerus include close manipulation and fixation with intramedullary nail, open reduction and internal fixation with dynamic compression plate, external fixator and elastic intramedullary nails.

In our study, titanium elastic nails were used for adults having humerus diaphyseal fractures and the patients were followed up for one year. Percutaneous fixation of adult humerus with titanium elastic nails is time saving procedure with minimal soft tissue damage and infection.

## MATERIALS AND METHODS

This study was carried out at department of orthopedic surgery, Sheikh Khalifa Bin Zayed Al-Nahyan Hospital Rawlakot Azad Kashmir from 01.08.2016 to 01.08.2017. Adult patient of 18 to 65 years of either gender with diaphyseal fracture of humerus were selected for the study. Only patients with closed or Gustilo type I open fracture were included in this study. On admission, information regarding patient biodata, mechanism of injury, pattern of fracture and associated injury were recorded on a Performa.

After patient counselling and consent, pre-op preparation carried out. Operation was performed under general anesthesia on a fracture table under fluoroscopy guidance.

After short hospital stay, during which patient was educated about the care of operated limb, patient was discharged. Each patient was followed up at every two weeks interval for three months and then four weekly there after until completion of one year.

## RESULTS

Thirty patients, complying with the inclusion criteria were included in the study. The mean age of patients in the study was 33.50 + 11.08 years and age rangewas 18 –65 years with 70% male and 30% female patients. There were 4 (13.3%) patients who had fracture with butterfly segment, 7 (23.3%) patients had short oblique fractures and 16 (53.3%) patients had transverse fracture. The 11 union was seen in 76.7% patients and non-union in 23.3%.It was slightly higher in female patients.

**Table No.1: Distribution of patients by union.**

	Yes		No	
	No.	%	No.	%
Clinical Union	23	76.7	7	23.3
Radiological Union	23	76.7	7	23.3

Nonunion (total seven patients) was seen among 02 (6.66%) patients in age group of 18 – 30 years, 3 (10.0%) patients in age group of 31 – 40 years, 1 (3.33%) patients in 41 – 50 years age group and 1 (3.33%) patients in 51 – 65 years.

**Table No.2: Age group distribution of Nonunion (n=7)**

Age (Years)	Nonunion	
	No.	Percentage
18-30	2	6.66
31-40	3	10.0
41-50	1	3.33
51-65	1	3.33

The surgical site infection was observed in 9 (30%) patients. Among these patients, Deep infection was observed in only two patients while superficial infection was observed in seven patients.

Two patients with deep infection were treated with intra venous antibiotics according to culture and sensitivity test of discharge, removal of nails and temporary external fixator followed by fracture brace. Superficial infection was treated successfully in all seven patients with short course of oral antibiotics after culture and sensitivity test of discharge.

There were 23 (76.7%) patients in whom 0 ° Angulation was observed after surgery, 5 (16.7%) patients with 5° Angulation and 2 (6.6%) patients with 10 ° Angulation and none of the patients had > 10° Angulation. So, all the patients in our study had acceptable angulation.

**Table No.3: Distribution of patients by Angulation at fracture site**

Angulation	No.	Percentage
0 ° Angulation *	23	76.7
5 ° Angulation *	5	16.7
10 ° Angulation *	2	6.6
> 10 ° Angulation **	0	0

Shoulder stiffness was observed in 7 (23.3%) patients, while in other 23 (76.6%) patients, range of movements were in normal range.

At elbow joint, there were 23 (76.6%) patients in whom the flexion was in normal and in rest of 7 (23.3%) patients were labeled to have flexion lag. Elbow extension was normal in 23 (76.6%) patients, while in rest of 7 (23.3%) patients were labeled as extension lag.

**Table No.4: Distribution of patients by the range of motion at the end of follow up**

			No.	%age	
Shoulder Joint	Flexion	145 ° – 165 °	23	76.66	
		< 145 °	7	23.33	
		> 40 °	23	76.66	
	Extension	< 40 °	7	23.33	
		Abduction	> 140 ° - 170 °	23	76.66
			< 40 °	7	23.33
Elbow Joint	Flexion	> 125 ° – 145 °	23	76.66	
		< 125 °	7	23.33	
	Extension	0 ° - 10 °	23	76.66	
		> 10 °	7	23.33	

## DISCUSSION

The humerus fractures account for 3% to 5% of the skeletal injuries.<sup>1,2</sup> The method of treatment of humerus fractures depends on many factors including the patient’s general health, age of the patient, severity of trauma, the time from fractures to treatment and concurrent medical treatment.<sup>1</sup>

Incidence of polytrauma is on rise due the high speed of transportation and mechanization. The treatment of humerus shaft fractures includes various methods from conservative to operative.<sup>3</sup>These fractures are more common in adults and middle aged group. Road traffic accidents are the predominant mode of injury.

A thorough knowledge of anatomy is important for the successful treatment of humeral shaft fractures.<sup>4</sup>

Union with shortening of the shaft less than 1 cm, angulation in antero-posterior view and lateral view of less than 20 degree and rotation of less than 30 degree are considered as acceptable criteria as it does not cause any functional and cosmetic deficiency.<sup>5</sup>

Conservative management is still considered the ideal method for the treatment of humerus shaft fractures.<sup>6</sup>

Historically, methods of conservative treatment included U plaster slab, skeletal traction, abduction casting, Velpeau dressing and hanging arm cast. Each with its own advantages and disadvantages.<sup>6-8</sup>

Non-operative treatment of these fractures requires longer period of immobilization, resulting in stiffness of shoulder and elbow joints.<sup>9-10</sup> Furthermore, non-union may result in about 10% of cases which may become difficult to treat without surgical intervention.<sup>11-13</sup>

There is recent trend to treat even simple humeral fracture with surgical stabilization to avoid these

problems of conservative treatment and to allow early mobilization and rapid return to work.<sup>14,15</sup>

Operative stabilization is required in patients with open fracture, multiple injuries, segmental humeral fractures, fracture with vascular injury, radial nerve palsy after fracture manipulation, fractures with ipsilateral forearm fractures and inability to maintain fracture alignment with non-operative treatment either due to angulation or noncompliance in obese or elderly patients.<sup>4</sup>

Fixation of a fracture of the humerus shaft in the multiple-injury patient allow increase in the mobility of the patient, helps in the difficult nursing care in intensive care unit and permit full access to the patient for pulmonary physiotherapy. Fracture fixation also controls the angulation and length of the fracture in a supine, unconscious patient and allows early mobilization of the upper extremity.<sup>16</sup>

Plate osteosynthesis is a familiar technique with advantages<sup>17</sup> of anatomical reduction, rigid fixation allowing early mobilization and more patient satisfaction but at the cost of larger incision, more periosteal stripping, loss of fracture hematoma and risk of radial nerve injury, infection and non-union.<sup>18</sup>

Rush nails were introduced by rush brothers for intramedullary fixation of long bones fractures. Later on Enders nails were designed and used in place of the Rush nails successfully, but usually multiple Enders nails were required to achieve fracture stability.<sup>19</sup>

Locked IM nails have been associated with postoperative shoulder pain and stiffness, the possibility of impingement from proximally prominent hardware and risk of further fracture comminution during reaming or nail insertion are complications of the rigid nailing.<sup>20</sup>

Reports in which plate fixation is directly compared with intramedullary fixation, the rate of complications associated with locked intramedullary nails has appeared to be higher than that associated with plate fixation.<sup>21-23</sup>

In the 1980s, JP Metaizeau and Jean Prevot in France designed Titanium Elastic Nails (TEN) based on the idea of the Rush nail. This nail was also designed on the principles of three point fixation to control rotation of the bone.<sup>24</sup> Two pre-tensioned nails are inserted from opposite sides of the bone. With this design, surgeons were able to create an elastic and stable fixation device.

Three point support and inner bracing Titanium elastic nails reduce chances of angulation in both anteroposterior and Varus/valgus by achieving axial and rotatory stability.<sup>24</sup>

It offers

- Stable fracture fixation
- Rapid, biological healing with external callus
- Easy implant removal with reduced risk of re-fracture
- Respect for the growth plate and blood supply of bone
- Early discharge from hospital and mobilization.<sup>25</sup>

Numerous studies are available on the use of titanium elastic nail in the femoral fractures of children with excellent results.<sup>25-26</sup>

The study on femoral fractures of children with excellent results encourages the use of titanium elastic nails in other long bone fractures.

This technique shows very good functional and cosmetic results. It allows an early functional and cast-free follow-up with a quick pain reduction. The elastic nailing of humeral shaft fractures is a minimally invasive, simple and well reproducible technique.<sup>27</sup> It preserves fracture hematoma that promotes early callus formation with less chances of infection. Removal of implant is quick, easy and less time consuming.<sup>28</sup>

Insertion site of the elastic nails remains controversial. Anti-grade or retro grade insertion was studied in 2008. This study showed that the insertion site morbidity is always due to the technique used by the surgeon. If proper attention is paid at the time of insertion of nail, the complication can be avoided altogether.<sup>29</sup>

There are limited studies available on the elastic nailing in adults.<sup>24</sup>

In this study we used titanium elastic nailing for adult humeral diaphyseal fracture with retrograde entry and evaluated the outcome in terms of union and complications rate.

## CONCLUSION

Titanium elastic nailing is a very good alternative treatment option for adult humeral diaphyseal fractures with good clinical and functional outcome and minimal complications.

### Author's Contribution:

Concept & Design of Study:	Abdul Karim
Drafting:	Abdul Karim, Malik Asrar Ahmed
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Final Approval of version:	Abdul Karim

**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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