

# Diaphyseal Fracture of Humerus Treated with Titanium Elastic Nails: Examine the Functional Outcomes and Complication Rate

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## ABSTRACT

**Objective:** To examine the functional outcomes of titanium elastic nails procedure in patients presented with diaphyseal fracture of humerus.

**Study Design:** Prospective/observational

**Place and Duration of Study:** Department of Orthopedic Surgery, Bolan Medical Complex Hospital Quetta from 1<sup>st</sup> January 2019 to 31<sup>st</sup> December 2019.

**Methodology:** Twenty six cases of both genders with ages 20 to 60 years presented with diaphyseal fractures of humerus were included in this study. Patient's detailed medical history including age, sex, residency, etiology of fracture, type of fracture, side of fractures and severity of fractures were examined after informed consent from all the patients. All the fractures were treated with titanium elastic nailing. Clinical outcomes were examined such as time of union, functional outcomes by DASH scoring and post-operative complications. Follow-up was taken at 3 to 16 weeks for union.

**Results:** Nineteen (73.07%) patients were male while 7 (26.92%) patients were females. 9 (34.62%) patients were ages 20 to 30 years, 6 (23.08%) patients were ages 31 to 40 years, 7 (26.92%) were ages 41 to 50 years and 4 (15.38%) patients had ages above 50 years. RTA was the most common cause of fracture found in 16 (61.54%) patients. 73.08% fractures were on right side, 22 (84.62%) patients had mid one third fracture and 15 (57.69%) patients had transverse fractures. Union was achieved in 24 (92.30%) patients while 1 patient had delayed union and 1 patient had non-union. Mean union time was 9.75±2.55 weeks (5 to 16 weeks). According to the DASH scoring 23 (88.46%) patients had no disability and 2 patients had mild to moderate.

**Conclusion:** Titanium elastic nail procedure is safe and effective treatment modality for treatment of fracture of humerus in term of less complications and union of bone.

**Keywords:** Diaphyseal fracture of humerus, Titanium elastic nail, Functional outcomes, Union of bone, Non-union

## INTRODUCTION

Trauma has been the leading cause of mortality and morbidity since the beginning of mankind and is on the rise in the present age. Humerus diaphyseal fractures account for 3-5% of all fractures.<sup>1</sup> With increasing road traffic accidents will make it more likely in the future. Conservative care requires extended limb immobilization, the need of consistent co-operation and enforcement and follow-up.<sup>2,3</sup> Secondly, unstable fractures (spiral/long oblique), comminuting fractures, segmental fractures, pathologies cannot always be prescribed in either case. Diaphyseal fractures of humerus cannot be treated with conservative methods as well as surgically. The interlocking closed clasp of the nail has the benefit of biological fastening, which protects the haematoma of the fractures and minimize the periosteal degradation.<sup>4,7</sup> However the rotational impingement of the rotating mango, rotor mango wounds, and reduced movement of the elbow have all been of disadvantage.<sup>8</sup> Osteosyntheses of the plate have always been gold standard, and have always been effective for bone union if they were correctly performed in accordance with the concept of open reduction internal fixation.<sup>9,10</sup> The DASH is divided into two components: disability/symptom questions (30 items, scores between 1 and 5) and the optional module contains the sport/music/work portion with high performance (4 items, scored 1-5). The results vary between 0 and 100. More impairment is seen in a higher ranking.<sup>11-13</sup> The aim of this study was to evaluate the functional outcome of titanium elastic nailing in the patients

presented with diaphyseal fractures of humerus and the outcome to be evaluated using DASH score.

## MATERIALS AND METHODS

This prospective/observational study was conducted at Department of Orthopedic Surgery, Bolan Medical Complex Hospital Quetta from 1<sup>st</sup> January 2019 to 31<sup>st</sup> December 2019. A total of 26 cases of both genders with ages 20 to 60 years presented with diaphyseal fractures of humerus were included. Patient's detailed medical history including age, sex, residency, etiology of fracture, type of fracture, side of fractures and severity of fractures were examined after taking informed consent from all the patients. The exclusion was made for patients with open shaft humerus fractures, polytrauma patients, non-operative patients and patients with other lesions of the same limb. Closed reduction and internal attachment of titanium elastic nail was treated for all patients. Titanium elastic nails with entry-point at the near part of the humerus may be inserted in antegrade fashion and retrograde with entry-point at the distal end of the humerus. We used the retrograde form of insertion in the humeral shaft in our study. Clinical outcomes were examined such as time of union, functional outcomes by DASH scoring system at 1 year after surgery and post-operative complications. Follow-up was taken at 3 to 16 weeks for union. All the statistical data was analyzed by SPSS 21.

**RESULTS**

Nineteen (73.07%) patients were males while 7 (26.92%) patients were females. Nine (34.62%) patients were ages 20 to 30 years, 6 (23.08%) patients were ages 31 to 40 years, 7 (26.92%) were ages 41 to 50 years and 4 (15.38%) patients had ages above 50 years. Fifteen (57.69%) patients had urban residency while 11 (42.30%) patients had rural residency. Causes of injury were notes as road traffic accidents, falling, violent act and others in 16 (61.54%) patients, 5 (19.23%) patients, 2 (7.69%) patients and 3 (11.54%) patients respectively. Nineteen (73.08%) patients were fracture on right side while 7 (26.92%) on left side. Level of fractures were recorded as upper third, middle third and lower third in 4 (15.38%), 22 (84.62%) and 0 patient respectively. The most common type of fracture was transverse in 15 (57.69%) followed by oblique 4 (15.38%), spiral 2 (7.69%), segmental 1 (3.85%) and comminuted in 4 (15.38%) patients respectively. Union was achieved in 24 (92.30%) patients while 1 (3.85%) patients had delayed union and 1 (3.85%) patient had non-union. Mean union time was  $9.75 \pm 2.55$  weeks (5 to 16 weeks). According to the DASH scoring method 23 (88.46%) patients had no disability and lies between the score 10 to 30 and 2 patients (31 to 60) had mild to moderate. Complications such as superficial infection found in 3 (11.54%), non-union in 1 (3.85%), 1 (3.85%) patient had delayed union and elbow stiffness in 2 (7.69%) patients respectively (Tables 1-4).

Table 1: Demographic information of the patients

Variable	No.	%
Gender		
Male	19	73.08
Female	7	26.92
Age (years)		
20 – 30	9	34.62
31 – 40	6	23.08
41 - 50	7	26.92
> 50	4	15.18
Residence		
Urban	15	57.69
Rural	11	42.3
Trauma		
RTA	16	61.54
Fall	5	19.23
Violent Acts	2	7.69
Others	3	11.54
Fracture side		
Right	19	73.08
Left	7	26.92
Level of fracture		
Upper third	4	15.38
Middle Third	22	84.62
Lower Third	-	-

Table 2: Frequency of types of fractures

Type of fracture	No.	%
Transverse	15	57.69
Oblique	4	15.38
Spiral	2	7.69
Segmental	1	3.85
Comminuted	4	15.38

Table 3: Average time taken for union and complications found in all the cases

Variable	No.	%
Union (weeks)		
5 – 10	8	30.77
11 – 16	16	61.54
> 16	1	3.85
Complication		
Superficial infection	3	11.54
Non-union	1	3.85
Delayed union	1	3.85
Elbow stiffness	2	7.69

Table 4: Functional outcome according to the DASH scoring

Dash score	No.	%	Level of disability
10 – 30	23	88.46	No Disability
31 – 60	2	7.69	Mild to Moderate
> 60	-	-	Severe

**DISCUSSION**

Diaphyseal fracture of humerus are the most common fractures found all over the world and it rates 5% of all the fractures.<sup>14</sup> The management of diaphyseal fractures of humerus has always been a concern, since those fractures require non-union, malunion, delayed union and reduction. In such cases surgical procedure is performed to achieve duration and alignment with active joint mobility, to prevent proximal and distal joint rigidity. The use of U plaster cast was the classical method of treating humerus shaft fracture. Although this approach can produce a satisfactory result, residual angulation, malrotation, joint rigidity and unequal limb length are well known.<sup>15-16</sup> In our study, total 26 patients were included whom were presented with diaphyseal shaft fractures, in which 73.08% patients were males while 26.92% patients were females. A study conducted by Farhan et al<sup>17</sup> regarding diaphyseal fractures of humerus reported that the male patients rate was high as compared to females 57.6% and 42.4%.

In this study, the mean age of patients was  $37.58 \pm 13.25$  years. Some other studies shows similarity to our study in which maximum patients were ages ranging from 20 to 50 years.<sup>18</sup> This study showed that road traffic accidents was the main cause of fracture and rated 61.54% followed by falling from height 19.23%. Many of other studies shows similarity to our study in which RTA was the most frequent cause of fractures followed by fall from height 50 to 65% and 15 to 30%.<sup>19,20</sup>

In present study we found a transverse fracture was the most common type of fracture 57.69%. A study conducted by Yousaf et al<sup>21</sup> regarding humerus shaft fractures reported transverse fracture was the most common type of fracture 61.54%. We found from our study that the normal union of bone rate was 92.30% 5 to 16 weeks, 1 patient had delayed union at after 16 weeks. Many of other studies shows similarity to our study in which union of bone rate was 80 to 95%.<sup>22-23</sup>

According to the DASH scoring method 23 (88.46%) patients had no disability and lies between the score 10 to 30 and 2 patients (31 to 60) had mild to moderate and no patient developed severe disability. A study conducted by Amit et al<sup>24</sup> regarding diaphyseal fracture of humerus treated with titanium elastic nail procedure, in which 20 patients were included and they reported 65% patients with

no disability and 15% with mild to moderate according to the DASH scoring system. In our study we found complications such as superficial infection found in 3 (11.54%), non-union in 1 (3.85%), 1 (3.85%) patient had delayed union and elbow stiffness in 2 (7.69%) patients respectively. These results shows similarity to other study in which superficial infection was found in 12.6% cases followed by non-union and stiffness.<sup>25</sup>

Thus this study proves that the use of titanium elastic nail treatment modality for diaphyseal fracture of humerus is a safe and very effective procedure,

## CONCLUSION

Titanium elastic nail system is a useful alternative in the treatment of humerus diaphyseal fractures in adulthood because the solution requires minimal invasion, is uniquely biologically friendly to the fracture site, and reduces chances of nearly no radial nerve injury but initially consideration is required for selection of the fracture type.

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