

The Present Study Examined the Functional and Radiological Results of Mid-Shaft Clavicle Fracture Using a Titanium Elastic Screw Nail: A Prospective Study

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ABSTRACT

Introduction: Upper extremity fractures, or clavicle fractures, make for 35 to 44% of shoulder girdle fractures and 2 to 5% of adult fractures. They're one of the most common broken bones in emergency rooms. This study assessed the functional and radiological outcomes of treating a mid-shaft clavicle fracture using a titanium elastic screw nail.

Materials and Methods: From February 2021 to July 2022, all patients with middle one-third clavicle fractures were studied at SRMS Institute of Medical Sciences, Bareilly. Written informed permission and institutional ethical committee approval were required to enroll patients.

Results: About 44.44% had surgery after 2 to 3 days, 33.33% after 4 to 5 days, and 22.22% after 6 to 8 days. In 83.33% of patients, radiation exposure was 21 to 30 shots, 10 to 20 in 5.56%, and 31 to 40 in 11.11%. Constant score improved significantly from baseline at 2, 6, 12, and 24 weeks ($p < 0.05$). In 50% (9) of the fracture joined at 24 weeks, 44.40% (8) at 12 weeks, and 6.60% (1) non-union.

Conclusion: Titanium elastic intramedullary nailing improves mid-shaft clavicle fracture function.

Keywords: Clavicle fractures, Injury, Mid Shaft.

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INTRODUCTION

About 35 to 44% of shoulder girdle fractures and 2 to 5% of all adult fractures are clavicle fractures, often known as upper extremity fractures. They are among the most frequent broken bones seen in hospitals' emergency departments.^{1,2} Direct trauma to the clavicle, which

can happen in contact sports or accidents involving motorcycles and bicycles, is the most common reason for fractures. Patients under 30 are more frequently affected by clavicle fractures than patients over 30, and males are more likely to be affected than females. Although 88.2% of clavicle fractures occur in younger people, a bimodal increase in senior patients is caused by simple falls from a moderate height or falls from a bed.³

Midshaft clavicle fractures account for over 80% of all clavicle fractures; distal and medial fractures rank second and third, respectively.⁴

The annual incidence of clavicle fractures ranges from 24 to 71 per 100,000 persons worldwide, and it has been increasing in recent years.⁵ Men experience clavicle fractures roughly three times more commonly than women.

The objective of the current study was to evaluate the functional and radiological outcomes of treating a mid-shaft clavicle fracture with a titanium elastic screw nail.

MATERIALS AND METHODS

The present study was conducted in the Department of Orthopedics of SRMS Institute of Medical Sciences, Bareilly, from 1st February 2021 to July 2022 in all patients with middle one-third clavicle fracture. Patients were enrolled in the study after obtaining written informed consent and approval from the Institutional Ethical Committee. All patients with mid-clavicle fracture shafts presented to the Department of Orthopedics at SRMS Institute of Medical Sciences, Bareilly.

Inclusion criteria were included age >16 and <65 years of age, duration <2 weeks, displaced mid-shaft clavicle fractures with a displacement defined as at least one shaft width difference in height between the fracture parts, shortening of over 2 cm, the threat of skin perforation. Exclusion criteria included patients with pre-existing morbidity concerning arm, shoulder, moderate to severe head injury (GCS <12), polytrauma patients, pathological fractures, segmental fractures, and fractures with associated injuries of blood vessels or nerves.

Data Analysis

Data were recorded into Microsoft® Excel 2019 and exported into SPSS. Quantitative data were expressed as

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median [interquartile range (IQR); Q1, Q3] and analyzed using the Mann-Whitney U test. Categorical variables were compared using the Chi-square test with or without Yate's correction. Receiver operating characteristic (ROC) curve analysis was used, and the area under the curve (AUC) was calculated. Sensitivity, specificity, and cut-offs for the were estimated using the 24-hour urinary protein excretion as the gold standard. The *p*-value < 0.05 was considered significant. Statistical analysis was performed using SPSS v21.0.

RESULTS

Baseline Characteristics

Table 1 shows that the mean age of the patients was 45.88 ± 10.50 years. About 50% (9) patients aged between 41 and 50 years, and approximately 27.77% (5) of the patients aged above 50 years and 22.22% (4) patient aged below 41 years. Males predominated females with a ratio of 3.5:1. Fall from height was the most common mode of injury in 89% (16) of the patients, while in 11.1% (2) patients, road traffic accident was the mode of injury. The left side was affected in 61.1% (11) patients, while the right was affected in 38.9% (8). Simple and oblique fractures were included: 55.5% of fractures were simple fractures and 44.44% were oblique.

Time Period Between Injury and Surgery (Days)

About 44.44% were operated after 2 to 3 days of injury, 33.33% after 4 to 5 days of surgery and 22.22% after 6 to 8 days after injury (Table 2).

Table 1: Baseline characteristics

	Frequency (n = 18)	Percentage (%)
Age Group (Years)		
31–40	4	22.22
41–50	9	50
51–60	5	27.78
Age Mean	45.88 ± 10.50	
Gender		
Male	14	77.78
Female	4	22.22
Mode of Injury		
Fall	16	88.88
RTA	2	11.12
Side Affected		
Left	11	61.11
Right	8	44.44
Fracture Pattern		
Simple	10	55.55
Oblique	8	44.45

Table 2: Time period between injury and surgery (Days)

Time period	Number of patients	percentage (%)
2–3 days	8	44.44
4–5 days	6	33.33
6–8 days	4	22.22

Table 3: Radiation exposure

Radiation exposure (Shots)	Frequency (n = 18)	Percentage (%)
10–20	1	5.56
21–30	15	83.33
31–40	2	11.12

Radiation Exposure

Table 3 shows that the majority of radiation exposure was 21 to 30 shots in 83.33% patient, 10 to 20 shots in 5.56% and 31 to 40 shots in 11.11% of patients.

Functional Outcome Constant Score

Table 4 shows a significant improvement in constant score at 2, 6, 12, and 24 weeks compared to baseline (*p* < 0.05).

Radiological Union

About 50% (9) of the fracture united at 24 weeks, 44.40% (8) at 12 weeks, and 6.60% (1) patients had non-union (Tables 4 and 5).

DISCUSSION

One of the most frequent injuries to the shoulder girdle is the clavicle fracture. According to a report, clavicle fractures are thought to make up about 2.6% of all fractures. Male incidence often peaks in the second and third decades and declines as people age. It typically has a bimodal distribution in females, peaking in the young and elderly. Based on where the fractures occurred along the bone, Allman divided clavicle fractures into three kinds.

The mean age of the patients was 45.88 ± 10.50 years. About 50% (9) of patients aged between 41 and 50 years, and approximately 27.77% (5) of the patients aged above 50 years and 22.22% (4) patient aged below 41 years. Males predominated over females with a ratio of 3.5:1. Fall from height was the most common mode of injury in 89% (16) of the patients, while in 11.1% (2) patients, road traffic accident was the mode of injury. The left side was affected in 61.1% (11) patients, while the right was affected in 38.9% (8). Simple and oblique fractures were included 55.5% of fractures were simple fractures and 44.44% were oblique. In a study by Giorgi *et al.*⁶ was 38.9 years (SD = 13.3), with 37.2 years (SD = 10.9) for females and 39.6 years (SD = 14.1) for males. In a study by Lazarides *et al.*⁷ out of 34 patients 70.59% of patients were male and 29.41% of patients were

Table 4: Trend in constant score

Score	Mean \pm SD
Baseline	19.76 \pm 5.42
2 Weeks	30.06 \pm 6.45
6 Weeks	46.33 \pm 6.89
12 Weeks	64.16 \pm 7.11
24 Weeks	85.31 \pm 8.17

Table 5: Radiological union

Radiological union	Frequency (n = 18)	Percentage (%)
12 Weeks	8	44.40
24 Weeks	9	50
Non-union	1	6.60

female. In a study by Dhakad *et al.*⁸ 48 patients (96%) suffered direct injuries; of them, 14 patients (28%) fell on their shoulders from a two-wheeler, 32 patients (64%) were involved in a traffic collision, and two patients (4%) were assault victims. Due to a fall on an outstretched hand, two patients (4%) experienced an indirect injury. In a study by Hehn *et al.*⁹ thirteen patients on the left side and 21 patients on the right experienced side effects. In the study of Stegeman *et al.*¹⁰ in 111 individuals, the right side was damaged, whereas in 121 cases, the left side was affected. In a study by Verma *et al.*¹¹ 46.7 and 53.3% of the participants receiving plating and TENS had BI and B2 fractures according to OTA categorization.

About 44.44% were operated after 2 to 3 days of injury, 33.33% after 4 to 5 days of surgery and 22.22% after 6 to 8 days after injury. In a study by Verma *et al.*,¹¹ 3 to 5, 6 to 10 and >10 days of time between injury and surgery was reported among 40, 6.7, 13.3, 40, 53.3, and 6.7% of the subjects in plating and TENS group, respectively.

The majority of radiation exposure was 21 to 30 shots in 83.33% patient, 10 to 20 shots in 5.56% and 31 to 40 shots in 11.11% of patients. In a study by Verma *et al.*,¹¹ Between the plating and TENS groups, the mean radiation exposure (number of shoots) was 10 ± 2.61 and 18.67 ± 6.31 , respectively, with a statistically significant difference.

There was a significant improvement in constant score at 2, 6, 12, and 24 weeks in comparison to baseline ($p < 0.05$). In a study by Naveen *et al.*¹² at constant scores of 94 were discovered in surgically treated patients at the end of the follow-up, and similar findings were made in the current study. The mean constant scores in their investigation were 91.59 and 31.29, respectively.

A total of 50% (9) of the fractures united at 24 weeks, 44.40% (8) at 12 weeks, and 6.60% (1) patients had non-union. In this study, Deb *et al.*¹³ the meantime for the radiological union was 19.6, 16.67 weeks, while the clinical union was observed at 7.3 3.06 weeks (range 6–12 weeks) (range 12–24 weeks).

CONCLUSION

The results of this study demonstrated that titanium elastic intramedullary nailing produces a great functional outcome for the treatment of mid-shaft clavicle fractures.

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