



A PROSPECTIVE STUDY OF FUNCTIONAL OUTCOME OF CLOSED DISPLACED SHAFT CLAVICLE FRACTURES TREATED WITH INTRAMEDULLARY NAILING

Orthopaedics

Sandeep Bhide*	Assistant Professor, Department Of Orthopedics, R.D.Gardi Medical, College ,Ujjain (M.P.) *Corresponding Author
Sunil Dhanger	Assistant Professor, Department Of Orthopedics, PGIMS, Rohtak, (Haryana)
Vivek Singh	Professor, Department Of Orthopedics, R.D.Gardi Medical, College Ujjain (M.P.)

ABSTRACT

Introduction: The clavicle is one of the most commonly fractured bones accounting for 2.5–4% of all fractures. 69–82% of these occur in the middle third of the clavicle, 73% of which are displaced midshaft clavicular fractures. Intramedullary fixation for clavicular fractures was first described by Peroni in 1950. The use of a TENS nail carries the advantages of less soft tissue compromise, less operative time, better cosmetic results, and load-sharing fixation with relative stability that encourages copious callus formation. **Material and Method:** A prospective review of 20 patients in our institute R.D.Gardi Medical, College, Ujjain (M.P.) between September 2019 to Dec 2022 with displaced midshaft clavicle fractures and treated with TENS nailing was carried out. All the patients had Functional evaluation using constant scores, which was done at 6 and 12 weeks. **Results:** Out of 20 patients, 6 (30%) patients had union time between 6-8 weeks, 10 (50%) patients had union time between 8-10 weeks, 3 (15%) patients had union time between 10-12 weeks, and 1 (5%) patients had union time between 12-16 weeks. Out of 20 patients, 12 patients (60%) functional evaluation using a constant score is excellent and 8 patients (40%) functional evaluation using a constant score is good. **Conclusion:** The intramedullary fixation using nails of midshaft clavicle fractures is a safe, minimally invasive technique in indicated cases, and in our hands, it provides good functional outcomes and cosmetic outcomes.

KEYWORDS

Clavicle Fracture, Intramedullary nailing, Closed, Titanium Elastic Nailing

INTRODUCTION

Clavicle fractures are the most common injuries in young and active individuals, especially those who participate in sports where high-speed falls (e.g., bicycling, motorcycles) or violent collisions (e.g., football, hockey) are frequent.⁽¹⁾ In contrast, in children and the elderly, they are related to falls, and they account for approximately 2.6% of all fractures. The most common site of fracture is the middle-third shaft; it accounts for 80% of all clavicle fractures.⁽²⁾ Older studies suggested that a fracture of the shaft of the clavicle, even when significantly displaced, was a mostly benign injury with an inherently good prognosis when treated non-operatively.⁽²⁾ Neer, reported a nonunion rate of 0.1% with conservative treatment, and Rowe corroborated these findings in 1968 and showed a nonunion rate of 0.8% in conservatively managed patients.⁽³⁾ Thus, displaced mid-shaft clavicle fractures can cause significant, persistent disability, even if they heal uneventfully. Therefore, there is a trend towards the surgical fixation of clavicle fractures based on the unsatisfactory data obtained from conservative treatment. Excellent results with high union rates and low complication rates have been reported from a variety of techniques for the primary fixation of displaced fractures of the clavicle. The clavicle, which is similar to other long bones, is usually best treated with intramedullary methods. So elastic stable intramedullary nailing (ESIN) is recommended for all simple displaced midshaft clavicle fractures to minimize the rate of complications like delayed union, non-union, and symptomatic malunion.

METHODOLOGY

The present study was a prospective evaluation of the outcome of closed, displaced shaft clavicle fractures treated by intramedullary elastic nail system which has been done in the Department Of Orthopedics, R.D.Gardi Medical, College, Ujjain (M.P.) from September 2019 to Dec 2022. Patients were enrolled based on the following inclusion and exclusion criteria. total of 20 patients who meet the following criteria are included in the study.

Inclusion Criteria

All skeletally mature patients, closed fractures, All the displaced diaphyseal non-comminuted/simple comminution clavicle fractures (>2 cm displacement) - AO 15 B1 and B2 fractures, fractures with shortening of over 20mm, middle third clavicle fractures, and fractures within one week.

Exclusion Criteria

marked comminution (complex comminution), brachial plexus injuries, fractures older than one week, pediatric fractures, pathological fractures, open fractures, congenital anomaly or bone disease, and any medical contraindication for surgery.

Approach

Patients were then positioned supine on the operating table with a folded operative drape placed between both scapulae. A 2 cm incision was made over the medial end of the fractured clavicle. The entry point for the nail was then made 1.5 cm from the sternoclavicular joint using an awl. Fractured segments were reduced percutaneously with the help of reduction clamps/ towel clips.

A titanium elastic nail, selected based on the diaphyseal diameter, was mounted on Jacob's chuck. The fracture ends were aligned under direct vision and the titanium elastic nail was inserted by hand in an unreamed fashion from medial to lateral across the fracture site under image intensifier guidance.

The medial end of the nail was cut close to the cortex to minimize soft tissue irritation yet leaving sufficient length for extraction later. Post-operatively, patients were immobilized in a sling and instructed to avoid overhead abduction and heavy lifting for the first six weeks. Patients then attended scheduled follow-up visits at two, six, and 12 weeks postoperatively. The wound was assessed by the surgeon weekly till suture removal. Full ROM of the operated shoulder was started at 6 weeks.⁽⁴⁾

Outcome Assessment

A constant score⁽⁵⁾ assesses the functional outcome. The evidence of bridging callus or obliteration of fracture lines defines the radiographic union.



Figure 1: Intra-op Image, Mid-shaft Clavicle Fractures Treated With Intramedullary Nailing

RESULTS

Out of the 20 patients, at 12 Weeks 13 (65%) patients experienced no pain. At 24 Weeks, 18 (90%) patients experienced no pain with 5 points, 7 (35%) patients experienced mild pain, and at 24 Weeks 1 (05%) experienced mild pain with 4 points, at 12 Weeks 4 (20%) patients experienced pain after unusual activities (heavy weight lifting), at 24 Weeks 1 (5%) patients experienced pain after unusual activities (heavy weight lifting) with 3 points.



Figure 2: Clinical Outcome After 3 Months Follow Up

Table 1: Sex Distribution

Sex	No. Of Patients	Percentage
Male	14	70%
Female	06	30%
Total	20	100%

Table 2: Side Affected

Side	No. Of Patients	Percentage
Right	11	55%
Left	09	45%
Total	20	100%

Table 3: Mode Of Injury

Mode of injury	No. Of Patients	Percentage
RTA	17	85%
Fall from height	02	10%
Assault	01	05%
Total	20	100%

Table 4: Evaluation Of Pain.

	Points	12 Weeks (%)	24 Weeks (%)
No Pain	5	13	18
Mild Pain	4	7	1
Pain After Unusual Activities (Heavy Weights Lifting)	3	4	1
Pain At Rest	2	0	0
Marked Pain	1	0	0
Complete Disability	0	0	0

Out of the 20 patients, at 12 Weeks 13 (65%) patients experienced no pain. At 24 Weeks, 18 (90%) patients experienced no pain with 5 points, 7 (35%) patients experienced mild pain, and at 24 Weeks 1 (05%) experienced mild pain with 4 points, at 12 Weeks 4 (20%) patients experienced pain after unusual activities (heavy weight lifting), at 24 Weeks 1 (5%) patients experienced pain after unusual activities (heavy weight lifting) with 3 points.

Table 5: Range Of Movements.

Shoulder movements	Average (mean±SD)
Flexion	163.25±8.80
Abduction	164.55±5.50
External rotation	75.40±4.55
Internal rotation	66.25±4.20

Out of 20 patients' shoulder range of movements, the average (mean±SD) in flexion is 163.25±8.80, abduction is 164.55±5.50, external rotation is 75.40±4.55, and internal rotation is 66.25±4.20. Out of the 20 patients, at 12 Weeks 16 (80%), patients' muscle strength was normal, at 24 Weeks 18 (90%) patients' muscle strength was normal. Out of 20 patients 2 (10%) patients have muscle

strength against resistance seen At 12 Weeks.

Table 6: Muscle Strength

	No of patients	
Muscle strength	At 12 Weeks (%)	At 24 Weeks (%)
Normal	16	18
Against resistance	2	0
Against gravity	-	-
Elimination of gravity	-	-
Flicker	-	-
Paralysis	-	-

Table 7: Occupation Limitations.

	No of patients	
Occupation Status	At 12 Weeks (%)	At 12 Weeks (%)
Regular work	18	20
Restricted work	2	0
Unable to work	-	-

Out of the 20 patients, At 12 Weeks 18 (90%) patients were able to do regular work. At 12 Weeks 20 (100%) patients are able to do regular work. Out of 20 patients, 2 (10%) patients were able to do restricted work.

Table 8: Time Taken For Fracture Union.

Average time for union (weeks)	No of patients	%
6-8 weeks	6	30%
8-10 weeks	10	50%
10-12 weeks	3	15%
>12 weeks	1	5%

Out of 20 patients, 6 (30%) patients had union time between 6-8 weeks, 10 (50%) patients had union time between 8-10 weeks, 3 (15%) patients had union time between 10-12 weeks, and 1 (5%) patients had union time between 12-16 weeks. Out of 20 patients, 12 patients (60%) had functional evaluation using a constant score is excellent and 8 patients (10%) had functional evaluation using a constant score is good.

Table 9: Functional Evaluation Using Constant Score.⁽⁶⁾

Result	Constant Score	No. Of Patients	%
Excellent	86-100	12	60
Good	71-85	8	40
Fair	56-70	0	0
Poor	1-55	0	0

DISCUSSION

In the present arena, displaced midclavicular fractures are no longer treated conservatively. Plate fixation has been considered the gold standard for clavicle fractures. Plate osteosynthesis fixation and intramedullary fixation are surgical options for fractures of the clavicle. Plate osteosynthesis is considered as a standard method for the surgical treatment of clavicle fractures⁽⁷⁾. The advantage of plate fixation is a sound reduction with compression and rigid fixation, but intramedullary nailing is always superior to plating in terms of minimal soft tissue exposure, minimal blood loss, and minimal periosteal stripping without disturbing the fracture hematoma. Moreover, removal of the nail can be done as an OPD procedure and so no second surgery is required. There were no significant complications in our follow up with only one case of local skin infection due to hardware prominence. No other complications like scar neuromas, non-unions, or perforation of the posterior cortex were reported. And there were no cases of refracture after implant removal.⁽⁸⁾

CONCLUSION

Intramedullary fixation of a displaced midshaft clavicle fracture is a safe minimally invasive technique. This study shows that fixation of displaced midclavicular fractures with Titanium Elastic Nailing System (TENS) is a technically demanding, minimally invasive for fixation of displaced mid-shaft clavicle fractures given, early pain relief, early functional recovery and 100% rate of fracture union. Cosmetic satisfaction (due to post-operative scar formation in minimum with patient's satisfaction) earlier rehabilitation, lesser morbidity, easier implant, removal and fewer complications although, for comminuted fractures plating remains the procedure of choice.

REFERENCES

1. Bentley TP, Journey JD. Clavicle Fractures. In: StatPearls [Internet]. Treasure Island

- (FL): StatPearls Publishing; 2020. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK507892/>
2. Song HS, Kim H. Current concepts in the treatment of midshaft clavicle fractures in adults. Clin Shoulder Elb [Internet]. 2021 Aug 30 [cited 2023 Aug 21];24(3):189–98. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8423531/>
 3. S Thyagarajan D, Day M, Dent C, Williams R, Evans R. Treatment of mid-shaft clavicle fractures: A comparative study. Int J Shoulder Surg [Internet]. 2009 Apr 1 [cited 2023 Aug 21];3(2):23–7. Available from: <https://europepmc.org/articles/PMC2904537>
 4. Nailing approach to the clavicle [Internet]. [cited 2023 Aug 21]. Available from: <https://surgeryreference.stg.aofoundation.org/orthopedic-trauma/adult-trauma/clavicle-fractures/approach/nailing-approach-to-the-clavicle>
 5. Evaluation of the Constant score: which is the method to assess the objective strength? | BMC Musculoskeletal Disorders | Full Text [Internet]. [cited 2022 Nov 8]. Available from: <https://bmcmusculoskeletaldisord.biomedcentral.com/articles/10.1186/s12891-019-2795-6>
 6. Bajuri MY, Maidin S, Rauf A, Baharuddin M, Harjeet S. Functional outcomes of conservatively treated clavicle fractures. Clinics [Internet]. 2011 Jan 1 [cited 2023 Aug 21];66(4):635–9. Available from: <https://www.sciencedirect.com/science/article/pii/S180759322014715>
 7. Smekal V, Irenberger A, Struve P, Wambacher M, Krappinger D, Kralinger FS. Elastic stable intramedullary nailing versus nonoperative treatment of displaced midshaft clavicular fractures-a randomized, controlled, clinical trial. J Orthop Trauma. 2009 Feb;23(2):106–12.
 8. Plate fixation versus titanium elastic nailing in midshaft clavicle fractures based on fracture classifications - Jun Sung Park, Sang Hyun Ko, Taek Ho Hong, Dong Jin Ryu, Dae Gyu Kwon, Myung-Ku Kim, Yoon Sang Jeon, 2020 [Internet]. [cited 2023 Aug 21]. Available from: <https://journals.sagepub.com/doi/full/10.1177/2309499020972204>