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Evaluation of the Functional Outcome and Complications of Intramedullary Nailing Through Medial Anterograde Technique in Displaced Midclavicular Fractures

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What to Learn from this Article?

Newer technique and functional outcome of intramedullary nailing through medial anterograde technique.

Abstract

Aims: The aim of this prospective study was to evaluate the effectiveness and complications of intramedullary nailing in displaced midclavicular fracture through medial anterograde technique.

Settings and Design: This was a prospective study.

Methods and Materials: This prospective comparative study was conducted at the tertiary center between October 2013 and September 2015 after being approved by the local ethical committee. Total 19 patients ranging between 18 and 60 years of age included in this study. They were treated by intramedullary nail through medial anterograde technique. Clinical and radiological assessments performed at 3rd week and 6th week and 3rd, 6th, and 12th month postoperatively. Outcomes and complications compared to 1-year follow-up.

Results: Good result achieved regards to functional outcome after fracture union. Although lower blood loss, less duration of hospital stay, and better cosmetic appearance noted in the nailing group done through medial anterograde method. Constant shoulder scores were fairly good after 6 months of follow-up. Infection and revision surgery (nonunion) rates were insignificant in nailing done through medial anterograde method group.

Conclusions: Functional outcome remains fairly good in intramedullary nailing done through medial anterograde technique. Infection and complications were infrequent. Intramedullary nailing done through anterograde method is advantageous concerning better cosmetically appeared scars.

Keywords: Clavicle, intramedullary nailing, anterograde.

Introduction

Fracture of clavicle accounts for approximately 3.2% of all the fractures and about 35% of all injuries of shoulder girdle [1]. About 80% of fractures involved the middle 3rd region and about 50% are displaced. The mean age of patients sustaining clavicular fracture is about 33 years, and males are more commonly involved [2, 3]. Most common mechanism of injury is a fall or direct blow to shoulder leading to axial compressive force. Displaced midclavicular fractures were treated conservatively because early reports suggesting that nonunion are very rare and malunion are without any functional deficit and for radiographic interest only [4, 5, 6]. Clavicle keeps upper limb away from torso for efficient function so work as "strut." However, recent studies concern about higher rates


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of delayed union, shoulder weakness, residual pain and deficits, and terminally affected movements associated with nonoperative treatment. Internal plate fixation and intramedullary nailing are essential operative techniques. Either technique provides superior functional results compared to the conventional method. In recently, reported randomized studies regarding significant lower nonunion, a new union, residual pain, and deficits, the clavicular length maintained which is very crucial regarding the functional outcome of terminally affected movements. However, prospective RCT comparing these practical techniques for displaced midclavicular fractures were lacking [4, 7, 8]. The aim of this study was designed to examine the effectiveness and complications of intramedullary nailing in displaced midclavicular fractures through medial anterograde technique.

Materials and Methods

This prospective comparative study was to compare functional outcome and complications of displaced midclavicular fractures treated by intramedullary nailing through medial anterograde method. Between October 2013 and September 2015, a total of 33 unilateral displaced midclavicular fractures were admitted, 19 patients included in this study along with 1-year follow-up protocol. Intramedullary nailing included tense elastic nail and rush pin used through anterograde technique. Robinson classification treasured in choosing therapy as well as it is prognostically significant.

Inclusion criteria

1. Complete displacement.
2. Age between 18 and 60 years.
3. Unilateral clavicular fracture.
4. Marked shortening of the clavicle (<2 cm).
5. Angulation 30.
6. Fractures <2 weeks of duration.

Exclusion criteria

1. Age below 18 and above 60 years.
2. Undisplaced fractures.
3. Bilateral clavicular fractures.
4. Severe communication.
5. Former surgery to shoulder.
6. Multi trauma patients.
7. Former chronic illness of shoulder.
8. Nonunion and malunion.
9. Pathological or open fractures.
10. Neurovascular injury.

Operative procedure

Intramedullary nailing through anterograde technique

After giving general anesthesia, patients positioned in a supine position. A small skin incision of approximately 1-1.5 cm lateral to sternoclavicular joint. Fluorographic images were taken in 45° cephalad and 45° caudal direction to provide the picture in two planes 90° apart. Cortex was opened using sharp awl pointed posteriorly on anterior surface, angulated in line with the clavicle. Single tense elastic nail or rush pin varying from 2 to 2.5 cm depending on the width of bone inserted under fluorographic control. Closed reduction performed using two pointed reduction clamps percutaneously. Tense elastic nail or rush pin passed through medial fragment in reduced retypes; image intensifier should use for precise maneuvering of nailing to avoid the dorsolateral cortex perforation. The fracture ends were compressed, and the nail cut and bent close to the skin on medial end of clavicle. Dissected tissue closed in layers. The postoperative sling applied to all the patients, pendulum range motion exercise advocated as soon as pain allowed. Active range of shoulder movement training promoted after 2-3 weeks postoperatively. Patients were encouraged to resume activities of daily living around 6 weeks postoperatively. Heavy work and athletic activities allowed after 12 weeks postoperatively (Figure 1). All patients were examined and reviewed on OPD basis during their follow-up visits. Clinical and radiological assessments were done on every visit. Constant shoulder score was used to assess functional outcomes based on objective and subjective criteria. Secondary outcomes such as operative time, incision length, blood loss, and hospital stay were included. Pain on visual analog scale on 1st postoperative day documented for each patient. Complications were recorded which includes nonunion, malunion, neurovascular injury, wound infection, implant migration, implant failure, hardware prominence, and cosmetic aspect. Implant removal was routinely done in all the cases after fracture union.

Results

At the end of this prospective study, a total of 19 patients were analyzed who completed at least 1 year of complete follow-up and as per inclusion criteria. We had 19 patients operated through medial anterograde technique. We had 11 (57.89%) male patients, whereas there were 8 (42.11%) female patients in the group. Statistically, there was no significant difference in outcome and complications on basis of gender ($P = 0.398$). Mean age of female patients in Group (31.79 ± 11.05 years) was slightly higher as compared to that of male patients (28.88 ± 7.89 years), but the difference between two groups was not statistically significant ($P = 0.223$) (Table 1). Majority had involvement of the right side. Left side was involved in 36.8% of patients. Statistically, this difference did not account for a significant difference ($P = 0.800$). Mean injury time was 3.61 ± 2.28 days in male as compared to 4.64 ± 2.76 days in females. Statistically, this difference between two groups was not significant ($P = 0.968$). The perioperative evaluation and postoperative complications and follow up findings shows insignificant result (Tables 2 and 3). Time taken for union ranged from 3 to 9 months with a mean value of 5.91 ± 1.89 months. Constant-Murley score was noted (Table 4).

Discussion

Conventionally, displaced midclavicular fractures had been managed nonoperatively. Neer and Rower found minuscule incidence of nonunion (0.1% and 0.8% respectively) in their studies in 1960 and recommended conservative treatment for clavicular fractures [9, 10, 11]. Although these results never been reproduced by anyone. Recent studies have shown higher nonunion rates in nonoperatively treated patients is approximately

Table 1: Demographic profile of the patients

Parameter	*n* (%)
Mean age±SD (range) in years	31.79±11.05 (18-64)
Gender	
Male	11 (57.89)
Female	8 (42.11)

SD: Standard deviation

Table 2: Perioperative evaluation

Parameters	*n* (%)
Implant used	19
Time taken during procedure (min)	40.09
Length of incision (cm)	1.38
Pain (VAS)	2.91
Hospital stay (days)	2.36
Average blood loss (ml)	12.30

Table 3: Postoperative complications and follow up findings

Parameters	*n* (%)
Infection	2 (10.5)
Wound dehiscence	0 (0)
Nonunion	1 (5.2)
Delayed union	1 (5.2)
Symptomatic malunion	2 (10.5)
Major revision	1 (5.2)
Hypertrophic scar	2 (10.5)

Table 4: Final functional outcome (Constant-Murley score)

Final outcome	*n* (%)
Excellent	11 (57.8)
Good	4 (21.0)
Fair	2 (10.5)
Poor	2 (10.5)

5%. Recent studies also show poorer functional outcome in displaced midclavicular fractures that treated traditionally when compared to surgically treated patients. Furthermore, the best treatment for displaced midclavicular fractures remains unclear and becomes a topic of debate. However, the current recommendation for displaced midclavicular fractures treatment is by operative fixation. Many authors advocate plate fixation as a standard operative procedure for displaced midclavicular fractures. Plate fixation choice included 3.5 Mm, dynamic compression plates, anatomically pre-contoured locking plates [12, 13]. Locking reconstruction plates applied either anterosuperiorly or anteroinferior and fixed by three screws on either side of the fracture. Recent emerging mode of fixation is intramedullary nailing fixation either by anterograde or by retrograde technique.

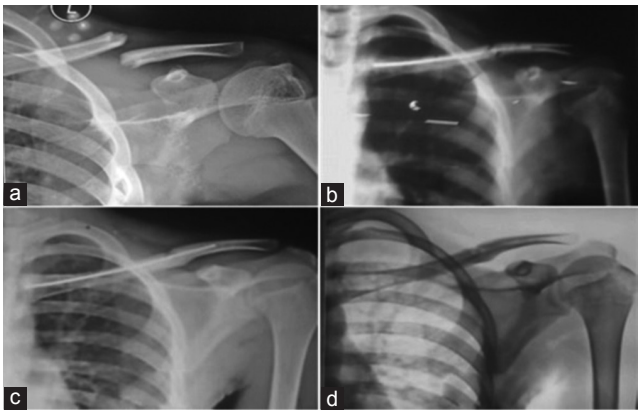

Figure 1: Skiagrams of a left clavicle of 30-year-old male patient showing (a) midshaft clavicle fracture, (b) immediate postoperative X-ray with nail *in situ*, (c) 3-month postoperative with fracture union, (d) after implant removal.

Biomechanically, nailing is weak regarding better rotation control of fragments during early movement of the shoulder and thus allows the primary union. Patients can be allowed full range of motion as soon as soft-tissue healing occurs. The disadvantage of plating includes damage to the supraclavicular nerve, slight higher infection rates, more soft tissue stripping and significant refracture after plates removal. The advantage of intramedullary nailing is less soft-tissue trauma and enhanced bone healing [5, 6, 14, 15]. The higher advantage of intramedullary nailing is ease in implant removal and lesser scar in cosmetically conscious patients. In our study, constant shoulder scores were fairly good in patients treated through medial anterograde technique. There were no significant complications after 12 months of follow-up period.

The limiting factor of our study is small sample size and study done at a single center. Longer RCT are needed at the various center to evaluate the outcomes and complications further. What we can conclude from our study is that medial anterograde technique of intramedullary nailing is the equally alternative method for treating displaced midclavicular fractures as for as functional outcome is concerned. Although, from our study, we recommended use of minimally invasive anterograde intramedullary nailing in displaced midclavicular fractures in the light of better cosmetic result in cosmetically conscious patients.

Clinical Message

Functional outcome remains fairly good in intramedullary nailing done through medial anterograde technique. Infection and complications were infrequent. Intramedullary nailing done through anterograde method is advantageous concerning better cosmetically appeared scars.

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