Section: Orthopaedics

Original Research Article

A STUDY OF FUNCTIONAL OUTCOME IN LATERAL THIRD CLAVICLE FRACTURE TREATED WITH OPEN REDUCTION AND INTERNAL FIXATION WITH LATERAL END PLATE

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ABSTRACT

Background: Lateral third clavicle fractures are having high non-union rates with conservative treatment. This study analyse functional outcomes and complications of open reduction and internal fixation (ORIF) using lateral end plates. **Materials and Methods:** This prospective study included 20 patients with lateral third clavicle fractures treated with ORIF with plating using lateral end plates between 2022 and 2023. Functional outcomes were assessed using the Constant and Murley score at 6-month follow-up. Post operative complications were also analysed. **Result:** The study group comprised 17 males and 3 females, with road traffic accidents accounting for 85% of injuries. All fractures united within the follow-up period. Post-traumatic arthritis occurred in 2 patients. At 6 months, 75% of patients achieved excellent, 15% had good and 10% had fair outcome. The mean Constant and Murley scores was 91.55**.** **Conclusion:** lateral end plate fixation provides effective treatment option for lateral third clavicle fractures, with high union rates and excellent functional outcomes. Our findings support the role of surgical management for these fractures, though larger studies with longer follow-up are needed to further refine treatment recommendations.

INTRODUCTION

Clavicle fracture accounts for 2.6%-4% of the all adult fractures1-3, with an incidence of 29 to 64 per 100,000 population per year and more than two-thirds of these injuries occur at the diaphysis of the clavicle. Lateral-third fractures account for approximately 25% of all clavicle fractures. Medial-third fractures comprise the remaining 2% to 3% of these injuries.[4]

Nondisplaced lateral clavicle fractures can safely be treated nonoperatively with excellent functional outcome, quality of life and high union rates.[5]

Displaced lateral clavicle fractures have a high risk of delayed or non-union. The reasons for non-union is multifactorial and are attributable to the opposing forces of muscles attached to the fragments, gravity, detached coracoclavicular ligament and small distal fragment with comminution.[6]

Therefore, surgical treatment for displaced lateral clavicle fractures is preferred. Surgical techniques include hook plates, locking plate, fixation with distal radius locking plate, coracoclavicular screws, Kirschner wires/ CC screws, tension band wiring, intramedullary fixation, suture and sling techniques along with reconstruction of the coracoclavicular ligament.[6-8]

The purpose of this study is to assess the functional outcome in lateral third clavicle fracture treated with open reduction and internal fixation using lateral end plates.

MATERIALS AND METHODS

This interventional study was conducted between May 2023 to October 2024 in the Department of Orthopaedics at Basaveshwar Teaching and General Hospital, affiliated with Mahadevappa Rampure Medical College, Kalaburagi, Karnataka.

Sample Size and Sampling Method

Using the formula $N = Z^2pq/d^2$ (with p = 4.8%, q = 95.2%, z = 1.96, and d = 10%), the calculated sample size was 17.54, rounded to 18. A total of 20 patients were included using the universal sampling method.

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Inclusion Criteria

- Radiologically confirmed lateral third clavicle fractures
- Patients >18 years of age of either sex

Exclusion Criteria

- Open fractures (Gustilo-Anderson type IIIB/IIIC)
- Pathological or undisplaced fractures
- Polytrauma cases
- Severely comminuted lateral third clavicle fracture involving AC joint.

Methodology

Following institutional ethical clearance, informed consent was obtained from 20 patients with displaced lateral third clavicle fracture. Patients underwent detailed clinical evaluation and standard preoperative investigations. Radiographic assessment included chest and clavicle X-rays.AC joint integrity was evaluated to look for any disruption. Surgical indication was based on fracture pattern and comminution. All 20 patients under went ORIF with plating using lateral end plates, functional outcome studied using Constant Murley score9 at the end of 6 months, also post operative complications analyzed.

Procedure: Under appropriate anaesthesia, patients were positioned in a beach chair position. A curvilinear incision was made over the clavicle, deep dissection done between deltoid muscle anteriorly and trapezius posteriorly, periosteum on superior surface stripped off and fractures were reduced under direct vision using reduction clamps and temporarily held with inter-fragment screw or k-wires. AC joint located using k-wire and confirmed under fluoroscopy, and fixed using lateral end plates. Fixation and position of screws were confirmed using intraoperative fluoroscopy. After fixation wound closed in layers.

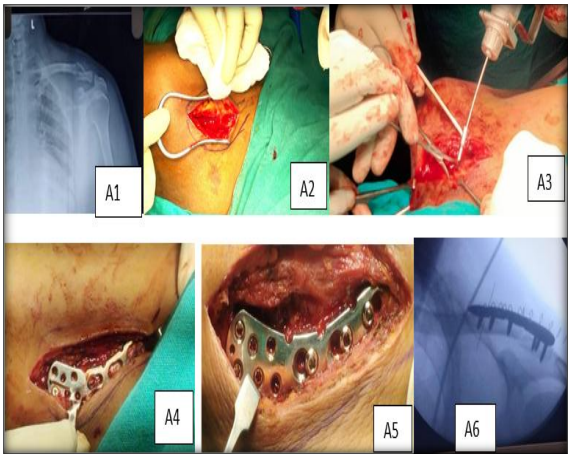

Figure A: showing pre op x ray(A1), intra op images showing deep dissection and reduction of fracture fragments(A2&A3), intra op images of fixation with plate(A4&A5) and c – arm shoot after plate fixation(A6)

weeks based on fixation stability. Sutures were removed between the 13th and 15th postoperative day.

Rehabilitation and Follow-up

Rehabilitation included early pendulum exercises started at 3-4 days post op, gradually progressing to passive and active-assisted and strengthening exercises over period of 2 months9, normal ROM achieved within 2 months. Patients were followed up at 6 weeks, 12 weeks, and 6 months. Functional outcomes were assessed using the Constant and Murley score (max score being 100) by evaluating pain, daily activities, shoulder range of motion, and abduction strength.

Statistical Analysis

Data were analyzed using IBM SPSS Version 25. Chi-square test was applied for categorical data, and t-test/ANOVA for continuous variables. A p-value <0.05 was considered statistically significant. Results were tabulated and interpreted to assess functional outcomes and complications

RESULTS

This study evaluated functional outcomes in 20 patients with lateral third clavicle fractures treated by open reduction and internal fixation using lateral end plates at Basaveshwara Teaching and General Hospital, Kalaburagi.

The study population consisted of 20 individuals. The majority of participants were between the ages of 21–40 years, accounting for 50% of the total sample (25% in each the 21–30 and 31–40 age groups). The next most common age group was 51–60 years, comprising 20% of participants. 15% of individuals were aged 41–50 years, while 10% were ≤20 years. The least represented group was >60 years, with only 1 participant (5%). This distribution indicates a younger to middle-aged skew in the study population. Out of 20 patients 17(85%) were male and 3(15%) were females.

The majority of injuries (85%) were due to road traffic accidents, while the remaining 15% resulted from other causes.

All patients (100%) achieved successful fracture union within 6 months post operatively. However, post-traumatic arthritis developed in 2 patients (10%), whereas The remaining 90% of patients did not experience any complications. At 6 months, 75% of patients achieved excellent outcome, 15% had good and 10% had fair outcome. The mean Constant and Murley score was 91.55.

Table 1: Functional Outcome at 6 Months using Constant and Murley score

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Outcome Rating	Number of Patients	Percentage (%)
Excellent (90-100)	15	75%
Good	3	15%

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(80-89)		
Fair (70-79)	2	10%

Figure 1: Functional Outcome at 6 Months

DISCUSSION

Lateral third clavicle fractures represent a challenging subset of clavicular injuries, accounting for approximately 10-30% of all clavicle fractures. These fractures are particularly complex due to the unique anatomical considerations of the distal clavicle and its relationship with the coracoclavicular ligaments. Unlike midshaft fractures, lateral third clavicle fractures, especially Neer type II, are associated with a higher incidence of non-union and functional impairment when treated conservatively. This has led to a growing consensus favoring surgical management through various fixation techniques to restore function and promote bone healing. Our study aimed to evaluate the functional outcomes of lateral third clavicle fractures treated with open reduction and internal fixation (ORIF) using lateral end plates in 20 patients, focusing on patient demographics, treatment efficacy, complication rates, and functional outcomes.

The demographic profile showed a male predominance (85%), consistent with existing literature by Good et al 10 attributing this to higher exposure to trauma in males. The predominant mechanism of injury was road traffic accidents (85%), aligning with findings by Borbas et al.[11]

All patients achieved fracture union, supporting surgical fixation as an effective treatment. Our 100% union rate parallels results from Stegeman et al,[12] who reported union rates above 90% for surgically managed distal clavicle fractures.

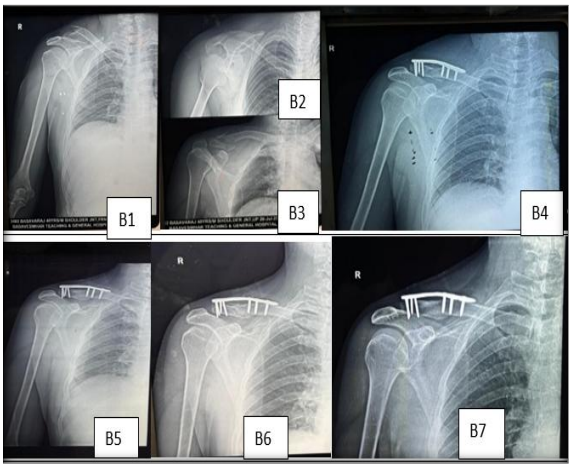

Figure B: images showing shoulder X RAYS pre op and post op (FIG B1-B3 showing pre op x rays and FIG B4 to B7 are post op x rays on POD-1, at 6 weeks, at 12 weeks and at 6 months respectively)

Complications were minimal, with post-traumatic arthritis noted in 10% of patients. This complication might be related to intra-articular extension of the fracture, technical aspects of the procedure, or patient-specific factors. Zhang et al. reported that locking plates had a lower incidence of implant-related complications compared to hook plates, though they noted different types of complications.[13] This contrasts with several published studies that report higher complication rates with hook plates, particularly acromial osteolysis, subacromial impingement, and rotator cuff injuries. For instance, Erdle et al. found that shoulder stiffness occurred in 22.9% of patients and subacromial erosion in 17.1% of patients treated with hook plates.[14]

The functional outcome assessed using Constant and Murley score. The functional outcome in our study were generally excellent, with 75% of patients achieving excellent scores (90-100 points) on both objective outcome measures and subjective assessment. Good outcomes (80-89 points) were observed in 15% of cases, and fair outcomes (70-79 points) in 10%. With mean Score 91.55.

Figure C: shoulder ROM at 6 months (fig C1 to fig C4)

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Lateral end plates, particularly precontoured locking plates, provide stable fixation without crossing the acromioclavicular joint, potentially reducing the risk of impingement and eliminating the need for routine implant removal. As Erdle et al. noted, locking plates allow for multi-planar fixation of the distal fragment and better stability for small fragments.[14] However, they may be less effective in cases with severe comminution or very small distal fragments.

In cases with severe comminution or very small distal fragments can be treated with hook plate, the potential complications associated with hook plate can be avoided by doing implant removal within 6 months postoperatively, provided that the fracture has healed.[10,15]

In summary, ORIF with lateral end plating provided excellent union and functional outcomes. Lateral end plates offer the advantage of avoiding subacromial complications, while hook plates may be preferred in comminuted fractures. Larger, randomized studies with long-term follow-up are needed to confirm these findings and guide optimal treatment selection

CONCLUSION

Open reduction and internal fixation with plating for lateral third clavicle fractures using lateral end plates provides excellent functional outcome, with a high rate of fracture union and minimal complications when compared to non-surgical management. This study supports the early surgical intervention for displaced lateral third clavicle fracture, particularly in younger, active patients, to achive better functional recovery and minimize the risk of long term disability. Larger studies with longer follow-up are needed to further refine treatment recommendations.

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