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Original research article

Functional and radiological outcome of surgical treatment of displaced lateral end clavicle fracture using precontoured lateral end clavicle plate

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Abstract

Introduction: Lateral end clavicle fractures comprise of only 15-20% of the clavicle fractures. The rate of delayed union and nonunion for completely displaced distal clavicle fractures treated non-operatively is approximately 40%. Various treatment modalities are available but no consensus has been reached for optimal treatment of these fractures. Thus, objective was to study the functional and radiological outcome of lateral end clavicle fractures treated with precontoured lateral end clavicle plates.

Methods: From January 2020 to January 2021,30 patients of lateral end claviclefractures were operated with lateral end clavicle anatomical locking plate.The follow up duration was for 1 year. Functional outcome was assessed using Constant Murley scoring.

Results: The mean fracture healing time was 13 weeks (range 12-16 weeks).Functional outcome was assessed using Constant Murley scoring.The mean Constant-Murley score was 92.Excellent result were found in 21 patients(70%), Good results in 6 patients(20%),satisfactory results in 3 patients(10%).No major complication occurred in our study.

Conclusion: Lateral end clavicle plate enables stable angular fixation of distal fragment regardless of bone quality, reduces the risk of loss of reduction, requires minimal bending of plate and does not lead to iatrogenic rotator cuff injury or sub-acromial impingement. So, it is extremely useful to achieve successful union of fractures of the lateral third of clavicle with reduced rate of complications.

Keywords: Lateral end clavicle, precontoured plates, constant murley scoring

Introduction

Distal third fractures of clavicle accounts for (15% to 20%)of all clavicle fractures. They result from the same mechanisms of injury as that seen with midshaft fracture like fall on out stretched hand, high speed fall (bicycling, motorcycles), violent collisions (football, hockey)[1,2]. They tend to occur in more elderly individuals from simple falls[3,4,5].

The rate of delayed union and nonunion for completely displaced distal clavicle fractures treated nonoperatively is approximately 40%.Even minimally displaced fractures may take an excessive period of time to healor may develop a fibrous union. However, without displacement, they are often not symptomatic enough to warrant surgical intervention.

The major technical challenges in these injuries are purchase in the distal fragment and resisting the primary displacing forces, which draw the proximal fragment superiorly and the distal fragment (secured by the AC and coracoclavicular ligaments to the coracoid and scapula) inferiorly[6,7,8]. In addition, the cancellous bone of the distal fragment may be inferior in quality to that of the shaftand there may be unrecognized comminution[9,10,11].

Methods

Study design and sampling

From January 2020 to January 2021, a prospective study was done comprising of 30 patients admitted to CIMS Hospital, attached to Chamarajnagar Institute of Medical Sciences, Chamrajnagar.

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Inclusion criteria
1. Patients above 18 years.
2. Fractures coming under Neer's Classification of lateral end clavicle-Type I, IIa, IIb.

Exclusion criteria
1. Patient less than 18 years.
2. Open fractures.
3. Associated neurovascular injuries.
4. Established nonunion.
5. Associated acromioclavicular joint dislocation.

After stabilizing the traumatized patient, routine pre-operative evaluation was done including Antero-posterior of the involved clavicle was obtained and the fracture was classified using Neer classification of lateral clavicular fractures. The limb was immobilized withclavicle brace and arm sling.
All cases were taken for primary fixation with Precontoured Lateral end clavicle plate.

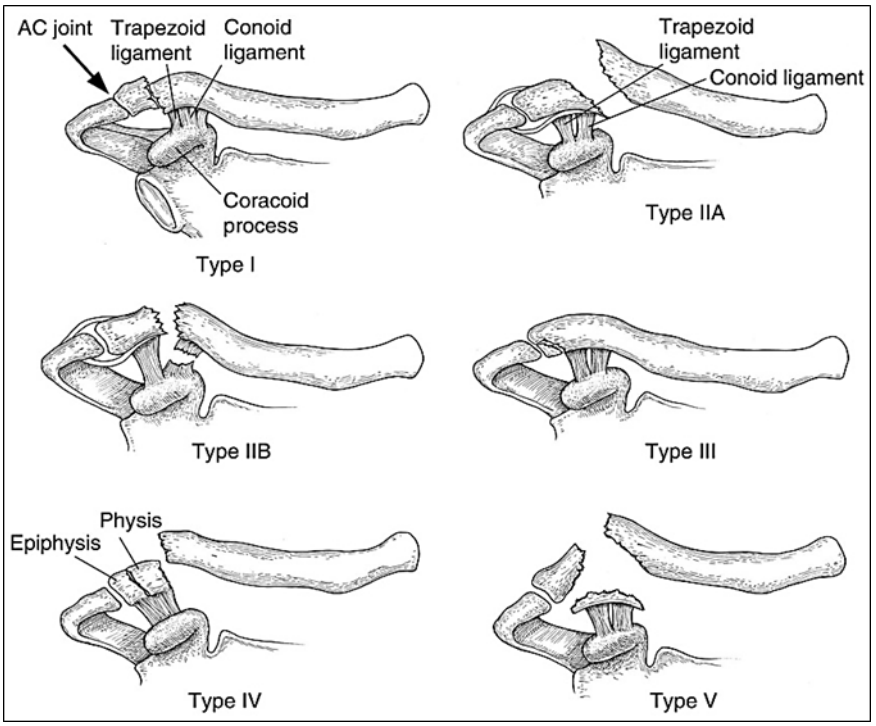

Fig 1: Neer Classification of lateral clavicle fractures

Surgical technique
A skin incision placed directly superiorly over the distal clavicle, extending approximately 1 cm past the AC joint is made. The skin and subcutaneous layer is developed, and the deltotrapezialmyofascial layer is incised directly over the distal clavicle and reflected anteriorly and posteriorly. The AC joint is identified. This can be done by inserting an 18-gauge needle into the joint from the superior aspect, and an arthrotomy can be avoided. The fracture site is identified and cleaned of debris and hematoma. The fracture is reduced and it may be held with either a K-wire or a lag screw. Elevating the distal fragment to meet the proximal fragment may aid in reduction. Once the fracture is reduced and provisionally stabilized, pre-contoured lateral end clavicle anatomical plate is placed and fixed using minimumfourbicortical, fully threaded, cancellous screws in the distal fragment and three cortical screws in proximal fragment. Wound closed in layers.

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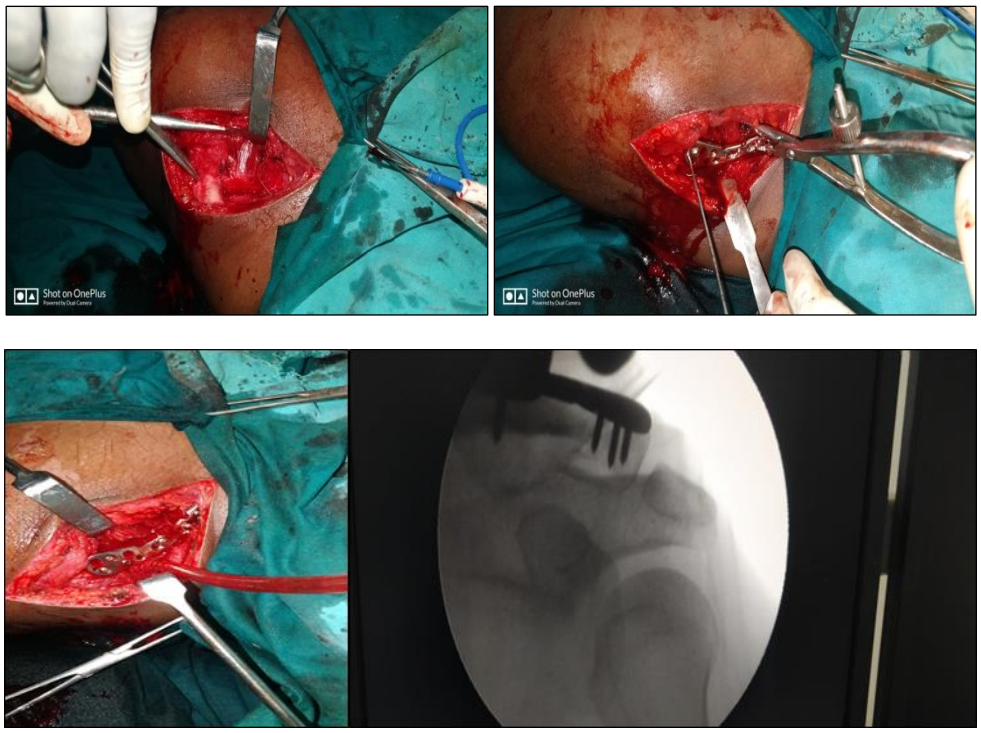

Fig 2: Surgical technique

Post-operative regimen

The arm is placed in a sling and the patient is allowed early active motion in the form of pendulum exercises. At 10 to 14 days postoperatively the wound is checked and the stitches are removed. The sling is then discarded and full range-of-motion exercises are instituted.

Follow up

The patients were followed up at intervals of 4 weeks,8 weeks,12 weeks, 16 weeks, and 24 weeksto assess the radiological union and functional outcome. Patients were assessed at the end of follow up period according to the DASH questionnaire andConstant Murley scoring system.

Results

All patients were followed up and evaluated clinically and radiologically till 6 months or till fracture union whichever came first.Most of the patients belonged to the age group of 25-40years. Males were common compared to females. All the fractures united with an average of 13 weeks. There were 2 cases ofdelayed union which healed at 20 weeks.

In our study 30 patients with lateral end clavicle fracture were surgically managed with open reduction and internal fixation using anatomical plates.

Table 1: Showing Age of patient

Age of Patient	No. Patients	Percentage
<45 years	20	66.6%
>45 years	10	33.4%

66% of patients were below the age of 45 in our study

Table 2: Sex of the patient

Sex	No. Patients	Percentage
Male	20	66.4%
Female	10	33.4%

66 % of patients were males in our study

Table 3: Side of Injury

Side	No. Patients	Percentage
Right	22	73%
Left	8	27%

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Right sided fractures were more common than left side in our study

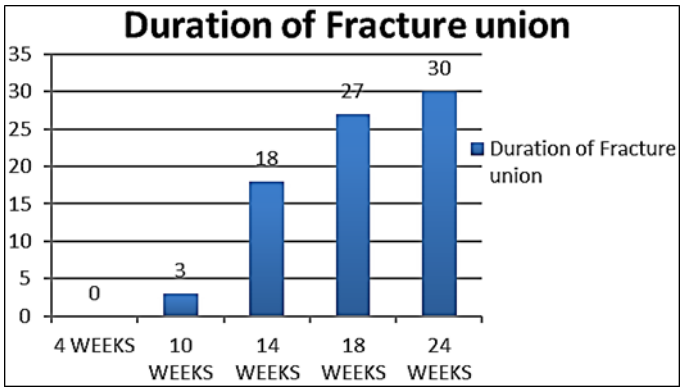

Fig3: Radiological union

Table 4: Radiological union

Duration (In Weeks)	No. Of patients	Percentage
10	3	10%
12	15	50%
16	9	30%
20	3	10%
Total	25	100

Fractures of 3 (10%) patients united in 10 weeks, 15 (50%) patients united in 12 weeks, 9 (30%) patients united in 16 weeks and 3 (10%) patients united in 20 weeks.

Table 5: Functional outcome

Outcome	No. Patients	Percentage
Excellent	21	70%
Good	6	20%
Fair	3	10%
Poor	0	0%

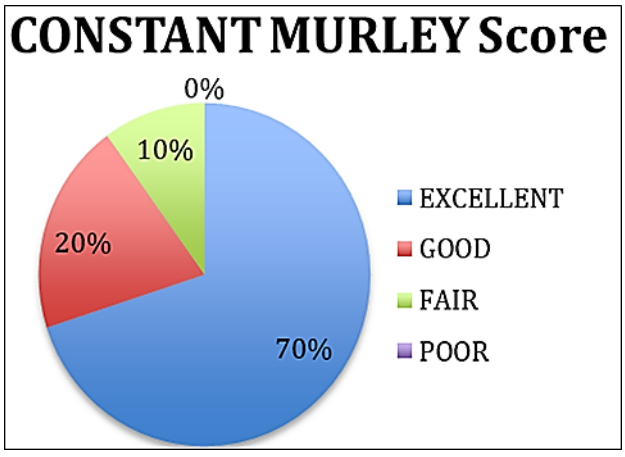

Fig4: Functional outcome

The average functional score in our study was 92%

Discussion

The rate of delayed union and nonunion for completely displaced distal clavicle fractures treated nonoperatively is approximately 40%. Even minimally displaced fractures may take an excessive period of time to heal, or may develop a fibrous union.

Hook plate fixation is an effective alternative to conventional plate fixation when faced with inadequate distal purchase. A high percentage of patients treated with hook plate fixation will require plate removal to regain full range of shoulder motion. One more major complication of hook plate fixation is subacromial impingement. Rigid transacromial fixation has a high rate of loosening and fatigue failure

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due to the intrinsic motion at the AC joint and is therefore not routinely recommended.
Rokito*et al*. who compared 14 patients treated operatively for displaced distal third fractures with 16 nonoperatively treated patients and found no difference in ASES, Constant, or UCLA shoulder scores despite the fact that 7 (of 16) patients in the nonoperative group developed a radiographic nonunion[12].
In a systematic review of 425 patients (21 studies), Oh *et al*. described a nonunion rate of 33% in the 60 patients treated nonoperatively. It is clear from these studies that the nonunion rate is relatively high following the nonoperative treatment of displaced distal third clavicle fractures. However functional deficit (especially in middle-aged and elderly patients) is minimal[13].
In direct comparisons of surgical techniques, Tan *et al*. reported equivalent union rates between hook plate fixation and small fragment anatomical plate fixation (100%), but that more patients in the hook plate group had residual shoulder pain that required hardware removal (15/23, 74%) for relief[14].
Klein *et al*. compared early versus late distal clavicle fracture repair with hook plate fixation (22 patients) and superior locked plate application (16 patients). They found a high rate of success (union in 36/38 patients), but that fractures repaired early (<4 weeks) had better outcomes than the delayed group (ASES score 78 vs. 65), with a lower complication rate (7% early vs. 36% delayed)[15].
Complications in our study included Superficial infection, delayed union. Superficial infection was treated with antibiotics which recovered after 1 week. Non-union, Deep infection, Residual shoulder painwere not seen in any of our cases.

Fig 4: Showing pre-operative and post-operative X-rays

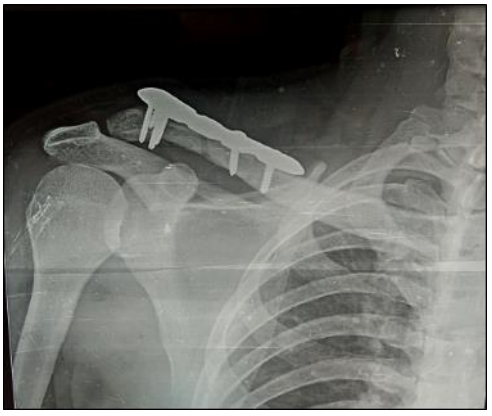

Fig 4b: Showing Radiological union at 14 weeks

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Fig5: Showing Functional range of movements

Conclusion

Anatomical lateral end clavicle plate provides stable construct to the lateral end clavicle fractures. The locking cancellous screws on distal end further provides good hold for the distal fragment and prevents it from inferior migration. Complications like subacromial impingement and implant irritation can be avoided. Thus, precontoured lateral end clavicle locking plates areconsidered superior and betterfor fixation of lateral end clavicle fractures.We Recommend the use of these plates in distal clavicle fractures.

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