

A PROSPECTIVE STUDY ON FUNCTIONAL AND RADIOLOGICAL OUTCOME OF LATERAL END OF CLAVICLE FRACTURES TREATED BY HOOK PLATE

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Abstract

Background: Clavicle fractures are common, constituting 2.6-4% of adult fractures and 35% of shoulder girdle injuries. Lateral clavicle fractures account for 12-15% of all clavicle fractures and are often caused by direct force during athletic activities, affecting younger males. Distal clavicle fractures are often surgically treated due to instability and non-union risk. The study is aimed at evaluation of the functional and radiological results of clavicle fractures at the lateral end that were treated with hook plates. **Materials and Methods:** The 15 instances of lateral end clavicle fractures admitted to Govt Mohan Kumaramangalam Medical College and Hospital, Salem, Tamilnadu, India between October 2020 and March 2022 are the subject of this prospective research. Patients were classified according to NEER'S categorisation. Patients with neurovascular damage were not included in this investigation. Through direct or indirect approaches, instances were reduced with open reduction, and hook plate fixation was completed. The result was evaluated using the DASH score and the Constant Murley score. **Result:** The average age of the participants was 40.26 years, and most men had a left-sided inclination. RTA was identified as a frequent cause. NEER'S type II fractures predominate. The average time from injury to operation is 5.66 days. The surgery lasts, on average, 63 minutes. The typical length of a union is 15 weeks. **Conclusion:** Clavicle hook plate fixation yields a high percentage of union with a good objective and subjective shoulder function, making it an effective primary therapy for displaced lateral clavicle fractures. It also allows for early mobilisation of the shoulder following surgery.

INTRODUCTION

Clavicle fractures are frequent, accounting for between 2.6 and 4% of adult fractures and 35% of shoulder girdle injuries. Among those, only 15% to 25% of all clavicle fractures are lateral, making them relatively uncommon.^[1] Resulting from a direct force delivered to the location of the shoulder during sports activities, they often affect young guys. Falls, especially in women with osteoporosis, are associated with an additional incidence peak in older patients.^[2] Clavicle fractures are frequently detectable by history and physical examination itself. To categorise the fracture, assess for additional injuries, and establish a baseline exam for follow-up, radiographs continue to be a staple of initial examination. The categorisation of the fracture determines how to treat distal clavicle fractures.

Though there are many systems the Neer categorisation is the most popular of these.

Most displaced fractures need to be corrected surgically,^[3] since pseudarthrosis often occurs in nonoperative therapy of these fractures, with rates ranging from 22% to 30%. It has been demonstrated that conservative care of these fractures is linked to the comparatively high incidence of nonunion, delayed union, and malunion.^[4] Acromioclavicular (AC) joint arthritis is also linked to it. Many surgeons agree regarding treating displaced Neer Type II lateral-third clavicle fractures surgically. There are several different surgical procedures and implants available if surgery is necessary to treat distal clavicle fractures, including Kirschner wires, coracoclavicular screw fixation, hook plate fixation, or locking plate fixation.^[5] However, there is no agreement on the best fixing technique.

Open reduction and internal fixation are frequently necessary for unstable distal clavicle fractures. Due to the rarity of this particular injury, most studies only discuss the use of hook plates and locking plates in a handful of cases.^[5] Even though there is widespread agreement among writers about the need for surgical intervention, the best approach is still up for debate.^[6] The rotation of the clavicle during flexion and abduction, which places significant stress on the implant device, makes it difficult to fix these fractures.^[7]

Because they have the lowest risks of complications, intramedullary screw fixation, coracoclavicular stabilisation, and interfragmentary fixation should be used to treat lateral clavicular fractures.^[8] While the hook plate's maker (Synthes Stratec Medical, Solothurn, Switzerland) advises removal upon the union, there have been cases of patients successfully retaining the implant without significant complication. The timing of the implant's removal has generated deliberation as a result.^[9] The clavicle hook plate has seen widespread application in recent years. Even though this plate, like most other surgical procedures, results in a high proportion of union and a low percentage of problems, worries about long-term repercussions persist, especially when the acromioclavicular joint is included.^[10]

This study uses stainless steel, dynamic compression clavicle hook plate which has a broader anterolateral end and a lateral extension into a hook positioned below the acromion. 3.5 mm cortical bone screws and 4.0 mm cancellous bone screws can be inserted into the holes. The lateral metaphyseal portion of the clavicle can be screw-fixed in multiple ways thanks to the anterolateral screw holes. The study aims to examine the functional and radiological results of clavicle fractures at the lateral end that were treated with a hook plate.

MATERIALS AND METHODS

This is a prospective study of 15 cases of lateral end of clavicle fractures in the age group 20-60 years admitted in Govt Mohan Kumaramangalam Medical College and Hospital, Salem, from October 2020 to March 2022.

Inclusion Criteria

Patients with the lateral end of clavicle fractures of age 20 to 60, with Intra articular, displaced and comminuted fractures, were taken up for the study after getting valid and informed written consent.

Exclusion Criteria

Patients with neurovascular injury, local site infection, associated injuries of the humerus, forearm, Stroke patients with little extremity usage and those who did not give consent were excluded.

Preop Planning

When the patient was admitted, a thorough history was taken from the patient or visitors to learn about the damage mechanism and the severity of the trauma. Patients are clinically evaluated to determine

their overall health and any local injuries. They were given analgesics. In all cases of acute fracture, Jones strapping was done with a cuff and collar to reduce discomfort. Patients were informed about the kind of fracture, the need for fixation, and the potential problems of lateral end clavicle fractures if surgery was delayed.



Figure 1: Preop X-ray

Routine examinations were conducted to evaluate the patient for anaesthesia. Patients are instructed on post-operative physiotherapy and rehabilitation procedures such as shoulder mobilisation exercises. Patients were also informed of the benefits and drawbacks of using hook plates for fixing. All patients and at least one of their immediate relatives provided valid, signed consent. All the patients underwent surgery after completing routine blood tests, serology, ECGs, chest X-rays, and CT chest scans.

If their course of therapy is conservative, associated injuries are sought out and given an opinion on their suitability for surgery by the consent specialist.

Open reduction and internal fixation by Hook plate
All three of the hook plate's potential depths are provided, along with 3.5 mm cortical and cancellous screws in all sizes of locking and non-locking varieties. [Figure 2]. Patients were followed at weeks 2, 6, 12, 16, 24 and one year after surgery. Patients were assessed using Constant MURLEY and DASH scores.



Figure 2: Instruments used

RESULTS

In our study, fractures were more RTA-related than patients who experienced unintentional falls. The majority of the research participants fit within NEER'S Type II. The patients ranged in age from 21 to 60, with the majority falling into the early fourth decade with a mean age of 40.26 years.

Males comprised most of the population, and a left-sided inclination was dominant. Injury to surgery time was less than a week in most patients (53.38%). Surgery duration was within 55 minutes in 26.64% of patients [Table 1].

The mean time of union of fractures in our study is 15 weeks. One case went for delayed union and union seen around 24 weeks post-surgery [Figure 4].



Figure 3: Postop Xray A) Immediate; B) 6 month follow up

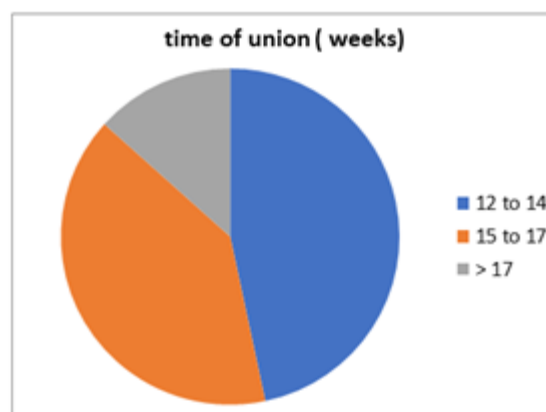


Figure 4: The mean time of union of fractures

Table 1: Patient demographics and baseline operative data

Parameters		Frequency	Percentage
Age	21-30	3	19.98
	30-35	2	13.32
	36-40	2	13.32
	41-45	4	26.64
	46-50	1	6.66
	51-55	2	13.32
	56-60	1	6.66
Gender	Male	12	80
	Female	3	20
Side involved	Right	3	20
	Left	12	80
Mode of injury	RTA	9	60
	Accidental fall	6	40
Fracture type	I	2	13.32
	II	8	53.28
	V	5	33.30
Injury to surgery interval	< 3 days	4	26.64
	4 – 7 days	4	26.64
	> 7 days	7	46.62
Surgery duration (min)	50-55	4	26.64
	56-60	3	19.98
	61-65	3	19.98
	66-70	3	19.98
	> 70	2	13.32

Table 2: Post-operative patient parameters

	Mean value
Follow up time	Eighteen months
Time of union	15 weeks
DASH score	4
CONSTANT MURLEY score	88.06

DISCUSSION

When a direct force is delivered to the location of the shoulder during sports activities, lateral end of

clavicle fails and they often affect young guys. Lateral end of Clavicle fractures is suspected based on the patient's history and the doctor's observations. However, radiographs remain a staple of the first assessment to categorise the fracture, assess for

additional injuries, and get a baseline exam for further follow-up. About 12 to 15% of all clavicle fractures are lateral end fractures. Among their types, type III fractures have a higher incidence of osteoarthritis due to intraarticular involvement, although type I fractures are frequently managed not operatively. Neer Type II fractures have been surgically treated so often in the past. These operations have had substantial hardware failure and migration issues including coracoclavicular screws, Kirschner wire fixation, and stiff metal plating. Furthermore, lateral clavicular plate fixation is not an option if comminution or the distal fragment cannot hold two to three cortical screws.

Skeletally mature patients (n=15) with lateral end clavicle fractures repaired with hook plating were included in our study. They were followed up for an average of 1 year. The patients ranged in age from 21 to 60 years, with the majority falling into the early fourth decade with a mean age of 40.26 years. Males made up the most vulnerable of the population in our research. In a prior investigation, Zhang et al. showed that the demographics and mean age of the participants were comparable.^[5] In our investigation, a left-sided predominance was identified, with more RTA-related fractures than patients who experienced unintentional falls. The majority of the research participants fit within NEER'S Type II. Tiren et al.'s study also note a tendency for type II fractures to occur more frequently on the left side of the body.^[11] In our study, the mean time between an injury and surgery was 5.66 days, and a procedure lasts an average of 63 minutes. The mean time for fracture union was 15 weeks, roughly in line with the figures provided by Manchanda et al.^[12] These results followed that of Tiren et al.^[11] We followed up the patients for an average of eighteen months. The Constant Murley score was 88.06, and the mean DASH score was 4. Tiren et al. reported a comparable DASH score.^[11] The Murley score we consistently achieved was comparable to that of Manchandra et al.^[12]

Five patients experienced restrictions in their range of motion following surgery, resolved by removing the plates after a radiological union. Patients who experienced skin tethering and implant prominence had their plates removed following radiological union. Analgesics and physical therapy were used to treat three individuals with impingement syndrome, which was diagnosed using an impingement test. An impingement test, or local injection of 2% lidocaine into the subacromial region beneath the acromion, alleviates immediate pain. A likely impingement in patients who received hook plates was also reported by Manchandra et al.^[12]

One patient had implant failure which led to nonunion due to significant comminution intended for compression plating and who neglected to show up for routine follow-up. In 4 patients, radiological union and complete range of shoulder motion were attained without any issues. Lee et al. had compared tension band wiring with K-wires for hook plate

fixing.^[13] According to their findings, the group with the hook plate had earlier recovered to pre-injury activities. 30% of the problems in the K-wire fixation group were due to hardware failure. According to Neer, lateral clavicle fractures are unstable clavicle fractures that require surgical intervention due to a higher frequency of nonunion and a higher rate of delayed union. He explains it by saying that the deforming forces around the fracture, interposition between the fracture fragments, and continuing motion at the fracture ends, all contribute to the prognosis mentioned above.^[14] Positive findings regarding bone union and shoulder function have been reported in several studies.^[15,16] Constant-Murley & DASH scores are used to evaluate shoulder function. The Constant-Murley score is close to 90, whereas the DASH score is less than 5. Rarely, less than 10%, which is equivalent to our data, had nonunion.^[11]

CONCLUSION

All fractures at the lateral end of the clavicle should be considered disturbances of the AC joint, and only hook plate fixation can give enough stability for this particular fracture morphology. Using this plate for fixation may lead to implant prominence, subacromial osteolysis, and impingement. To avoid these difficulties, we can treat the issue early with routine follow-up and recommend exit of the implant following radiological union. Clavicle hook plate fixation is an effective primary treatment for displaced lateral clavicle fracture. It allows for early shoulder mobilisation after surgery and yields a high union rate with good results for restoring the affected shoulder's functional range of motion.

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