



Functional Outcome Of Midshaft Clavicle Fractures In Adults Treated With Anatomical Pre-Contoured Locking Compression Plate

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Abstract

Introduction: Most acute displaced clavicular fractures conventionally have been treated non-operatively with the expectation of a high probability of fracture union, good functional outcomes, and a high level of patient satisfaction. However, the outcome of non-operative treatment is not as favorable as once thought and there has been a growing trend to treat these fractures surgically. Comminuted fractures, oblique fractures, and spiral fractures can be treated with interfragmentary screw fixation through the plate or outside plate. Studies show that in fractures of the midshaft clavicle, internal fixation has better outcomes than conservative approaches.

Aim of the study: This study aimed to study the functional outcome of midshaft clavicle fractures in adults treated with an anatomical pre-contoured locking compression plate.

Methods: this prospective study was done from July 2021 to September 2021 at government kallakurichi medical college & hospital among 20 patients aged >18 years having Robinson Type 2B fractures treated with an anatomical pre-contoured locking compression plate. Detailed clinical examination was done to rule out other associated injuries and documented. Antero-posterior radiograph of the shoulder joint with clavicle was taken. Initially, patients were given analgesics and the limb was immobilized with an arm sling and clavicle strapping was applied. After completing the routine blood investigations, ECG, chest x-ray, and other relevant investigations, the patients were taken up for surgery. The functional outcome was based on the Constant and Murley scoring system. All patients were evaluated clinically and radiologically during their follow-up period.

Results: The average time for the union was 6.35 weeks. The average constant score was found to be 89.1. The overall outcome result was excellent in 16(80%) of patients and good in 4(20%) of patients. Nineteen (95%) patients had no pain and one (5%) patient had mild pain at the 6th month of follow-up.

Conclusion: Our study demonstrates early pain relief, early recovery of shoulder functions, and quick return to work in acute displaced clavicle fractures treated in an anatomical pre-contoured locking compression plate.

Keywords: Midshaft Clavicle Fractures, Surgical Management, Locking Compression Plate

Introduction

The clavicle is the bony link from the thorax to the shoulder girdle and contributes to movements at the shoulder girdle. A clavicle fracture is a common traumatic injury around the shoulder girdle due to its subcutaneous position.[1] It is caused by either low-energy or high-energy impacts. The traditional view

that most clavicular fractures heal with good functional outcomes following nonoperative treatment is no longer valid.[2] Recent studies have shown a higher rate of nonunion and shoulder dysfunction in subgroups of patients with clavicle fractures. Because of this, these fractures should therefore be considered as a spectrum of injuries with

various functional outcomes, each requiring cautious assessment and individualized care[3]. Fracture of the clavicle is common, accounting for 5 to 12% of all fractures. About 80 to 85% of these fractures are in the middle third of the bone, where the typical compressive forces applied to the shoulder and the narrow cross-section of the bone combine and result in bony failure.[4] Displaced midshaft clavicle fractures are common and are generally treated non-operatively. Non-operative treatment of these fractures with axial shortening is associated with nonunion, delayed union, and malunion. Other complications are severe pain, neurological complications, loss of shoulder function, and protuberant callus forming swelling and stretching of the skin which is cosmetically unacceptable.[5] The proponents of early fixation of fresh clavicular fractures to prevent complications like malunion and nonunion emphasize the value of accurate reduction and rigid fixation in affording quick pain relief and promoting early functional recovery. Persons with high activity levels will hesitate to accept prolonged recovery and impaired shoulder function, therefore may require more aggressive treatment of middle third clavicle fractures. [6] Prompt fixation of these clavicle fractures permits increased patient comfort and early shoulder mobility. In cases of associated scapula fractures, fixation of the clavicle provides restoration of shoulder mechanics leading to improvement of function.[7] Operative treatment of displaced midshaft clavicular fractures can be achieved successfully using plates or intramedullary implants like rush pins, Kirshner wires, or nails. Open reduction and internal fixation with 3 platings provide rigid fixation, early functional recovery, and low rates of nonunion, and malunion. Management of clavicle fractures is predominantly non-surgical But surgical management may be required in a few cases where there is a high risk of nonunion, residual pain, and shoulder dysfunction.[8] Acute surgical intervention may be required when there are open fractures, skin tenting, multiple trauma, neurovascular compromise, and floating shoulder. Studies show that in fractures of the midshaft clavicle, internal fixation has better outcomes than conservative approaches. [9,10]

Methods

this prospective study was done from July 2021 to September 2021 at government kallakurchi medical

college& hospital among 20 patients aged >18 years having Robinson Type2B fractures treated with anatomical pre-contoured locking compression plate. Patients with open fractures and with neurovascular injuries were excluded. The patients presented with pain and difficulty in using the involved limb following injury. Detailed clinical examination was done to rule out other associated injuries and documented. Antero-posterior radiograph of the shoulder joint with clavicle was taken. Initially, patients were given analgesics and the limb was immobilized with an arm sling and clavicle strapping was applied. After completing the routine blood investigations, ECG, chest x-ray, and other relevant investigations, the patients were taken up for surgery. The time interval between the injury and the surgery was 1 to 8 days with an average of 3.15 days. The functional outcome was based on the Constant and Murley scoring system. All patients were evaluated clinically and radiologically during their follow-up period.

Results

The mean age is 36.7 years. Table 1 shows the sociodemographic and clinical characteristics of the patients. Robinsons type 2 B1 fracture (displaced, simple, or with a single butterfly) was the most common type (65%). Postoperative mobilization was started in all patients within two days as tolerated. The shortest follow-up was 4 months and the longest being 20 months with an average of 11.35 months. All patients went for the union. For two patients, postoperatively we found that the plate was not seated well on the lateral aspect of the clavicle, but ultimately they went for union with a good functional outcome. The results were evaluated during follow-up by taking into consideration the following factors: 1) Pain (Table 2) (Post-op pain was recorded on a scale of 0-5points, where points were given accordingly) 2) Range of motion (Table 3) 3)Strength (Table 4) 4)Function 5) Roentgenographic documentation of fracture healing 6) Anatomic restoration. The primary outcome results measured were Constant score and radiological union. The secondary outcome results measured were early pain-free movements, complications, and cosmetic results. In our study group, all patients went for union, as determined by clinical and radiological examination. Six patients in our study had complications. Three of our early

patients had hardware irritation that did not warrant implant removal. Two developed irritation probably due to non-seating of the implant on the lateral aspect of the clavicle. Subsequently, we learned about the contouring of the plate. Though it is a pre-contoured plate, due to the variable morphology of the clavicle, four patients in our study group required minimal contouring of the plate to match the shape of the clavicle. The average time for the union was 6.35 weeks. Among which type 2B1 patients and type 2B2

patients were found to be 6.07 weeks and 6.85 weeks respectively. The average constant score was found to be 89.1, ranging between 74 and 94. The average constant score in type 2B1 and type 2B2 patients was found to be 91.5 and 84.5 respectively. The overall outcome result was excellent in 16(80%) of patients and good in 4(20%) of patients. Nineteen (95%) patients had no pain and one (5%) patient had mild pain at the 6th month of follow-up.

Table :1 Sociodemographic And Clinical Characteristics Of The Patients

S.No	Variable	Category	Frequency	Percentage
1	Age	20-29	5	25%
		30-39	8	40%
		40-49	5	25%
		50-59	1	5%
		60-69	1	5%
2	Gender	Males	14	70%
		Females	6	30%
3	Mode of injury	Road traffic accidents	13	65%
		Fall at ground level	3	15%
		Fall from height	2	10%
		Fall from stairs	2	10%
4	Side Involved	Right	8	40%
		left	12	60%
5	Associated injuries (n=6)	Fracture both bones leg	2	10%
		Fracture shaft of the femur	1	5%
		Bimalleolar fracture	1	5%
		Distal femur fracture	1	5%
		Fracture metacarpal	1	5%
6	Fracture Classification Robinson Type	Type 2B1	13	65%
		Type 2B2	7	35%
7	Time interval between injury and surgery (days)	0 – 3	12	60%
		4 – 6	7	35%
		7 – 9	1	5%

8	Complications (n=6)	Hardware irritation	3	15%
		Hypertrophied scar	2	10%
		Numbness	1	5%

Table-2 Evaluation Of Pain

Pain scale	Points	No. of patients	
		At 3 months	At 6 months
No pain	5	14 (70%)	19 (95%)
Mild pain	4	4 (20%)	1 (5%)
Pain after unusual activities	3	2 (10%)	-
Pain at rest	2	-	-
Marked pain	1	-	-
Complete disability	0	-	-

Table-3:Range Of Movements

S.no.	Shoulder movements	Average (mean ± standard deviation)
1.	Flexion	158.75 ± 6.25
2.	Abduction	167.5 ± 6.38
3.	External rotation	74.5 ± 6.04
4.	Internal rotation	76.75 ± 5.68

Table-4:Muscle Strength

S. No.	Muscle strength	No. of patients	
		At 3 months	At 6 months
1.	Normal	13(65%)	19(95%)
2.	Against resistance	7(35%)	1(5%)
3.	Against gravity	-	-
4.	With the elimination of gravity	-	-
5.	Flicker	-	-
6.	paralysis	-	-

Table-5:Occupation Limitation

s. no.	Occupation status	No. of patients	
		At 3 months	At 6 months
1.	Regular work	11(55%)	19(95%)
2.	Restricted work	9(45%)	1(5%)
3.	Unable to work	-	-

Discussion

Studies show that a specific type of clavicle fracture has to be managed operatively to avoid long term complications. Although most middle-third clavicular fractures can be treated conservatively, several recent studies have demonstrated a poorer outcome in association with displaced, comminuted midshaft fractures that were treated conservatively. Therefore, surgical treatment is recommended for selected patients. [11] Most surgeons prefer contoured two-dimensional plates on a superior surface. However, concerning three-dimensional morphology and anatomy, a superior plate cannot completely limit displacement. [12] In clavicle fractures, the weight of the arm creates a cantilever force that increases screw pull-out, especially on the lateral aspect. Therefore screw pull-out strength can be improved with the use of locking plates.[13]An anatomical pre-contoured locking compression plate provides rigid fixation without compromising plate stiffness and fatigue strength.[14] It can also serve as an anatomical template when reconstructing highly comminuted fractures. In our study, we had no case of nonunion or delayed union which is a better result than the previously published studies.[15] In our study, hardware irritation was reported in three of twenty patients (15%), which seemed to be lower than the previously published literature.

Conclusion

Therefore using pre-contoured locking compression plates that improve fixation biomechanics permit early non-weight-bearing activities, as long as the general biomechanics of locking plates are followed. The anatomically pre-contoured plates reduce the

need to bend the plates and thus concurrently weaken the fixation device. Though long-term follow-up may be needed, our initial results tend to support fixation with a pre-contoured locking compression plate. Our study demonstrates early pain relief, early recovery of shoulder functions, and quick return to work in acute displaced clavicle fractures treated in an anatomical pre-contoured locking compression plate. We believe that operative fixation of the displaced comminuted midshaft clavicle fractures inactive adults is a valuable option despite a significant risk of complications. The study is limited by its smaller sample size and being a single-centric study. Future studies should focus on large multicentric Randomised control trials for better reliability of the results.

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