Research Paper

Volume : 3 | Issue : 2 | February 2014 • ISSN No 2277 - 8179

Surgical Versus Conservative Treatment in The Management of Displaced Mid Shaft Clavicular Fractures: A Clinical Study

Medical Science

KEYWORDS : Clavicle, midshaft , fracture , surgical , conservative, functional score

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ABSTRACT

Aim: To compare the results of surgical treatment of Acute displaced midshaft clavicular fracture with those treated conservatively in terms of rate of fracture union, complications and functional out come.

Background: Traditionally majority of mid shaft clavicular fractures unite with good functional outcome following conservative treatment, may be no longer valid for all mid shaft clavicular fractures. Many studies have shown a relatively high incidence of non union and limitation of shoulder function.

Material & methods: 50 patients of Acute displaced mid shaft clavicular fractures were treated either by surgical methods (plate osteo synthesis, n 25, group I) or conservative methods (n 25, group II). Patients were followed up on 3,6,12 weeks, 6 months, and 1 year, Time taken for fracture union, complications were compared and Functional outcome was assessed using DASH score and Constant shoulder score.

Results: All the fractures in group I united with two cases of asymptomatic mol union (8%) and one case of delayed union (4%). Whereas in group II, 4 cases of nonunion (16%), 6 cases of asymptomatic mol union (24%) and delayed union in 2 cases (8%) were observed. Time taken for fracture union was shorter in group I compared to group II. Functional outcome was significantly good in surgically treated group at follow-ups.

Conclusions : In this study ORIF with plate osteosynthesis of acute displaced mid shaft clavicular fractures resulted in faster fracture union with less complications and good Functional outcome in group I compared to those who were treated conservatively. (Group II).

Introduction

Clavicle fractures frequently occur in young adult patients after a traffic accidents or sports injury and comprise of 5-10% of all fractures.[1,2] Although there is uniform consensus regarding non operative treatment of undisplaced mid shaft clavicular fractures, the optimal treatment option for isolated acute displaced mid shaft clavicular fractures remains controversial. Most of the earlier studies used radiographic and surgeon based outcomes to justify non operative methods.[3] A meta-analysis of recent studies revealed that the rate of non union for displaced midshaft clavicular fractures was 2.2% (10 of 460 patients) after plate fixation compared with 15.1% (24 of 159 patients) after non operative care. Further studies have shown even higher incidences of asymptomatic malunion (31%-42%) after non operative management of displaced mid-shaft clavicle fractures.[4] Robinson reviewed 1000 clavicle fracture and showed that displaced mid-shaft fractures were 18.5 times more likely to result in delayed or non union as compared with undisplaced fractures. For non-operatively managed displaced fractures, some degree of shortening and deformity is inevitable. In addition some trials have used patient-based outcome questionaries and objective muscle strength testing and detected residual deficits in shoulder strength and indurance, which resulted in significant dysfunction.

Although non operative management of displaced mid shaft clavicle fractures is the standard of care, the definitive role of primary operative intervention has not been clearly established. Numerous studies have examined the safety and efficacy of primary open reduction and internal fixation for completely displaced mid shaft clavicular fractures and noted a high union rate with few complications.[5,6]

The classic conservative treatment rarely obtains anatomic reduction. It involves immobilization which is always relative with bandages and uncomfortable postures, that are not well accepted by the patients.[4]

Extensive review of the literature would lead to conclude that immobilization of clavicular fracture is nearly impossible to achieve and the deformity and shortening are usual.[7,8]

Displaced middle third clavicle fractures were treated conservatively with figure of '8' harness in the past. Current management trend in treating displaced clavicle fractures with internal fixation provide rigid immobilization and pain relief avoiding non-union, shortening and deformity.[9]

The objective of this study is to compare patients with displaced clavicle fractures treated either by primary internal plate fixation or non operatively in terms of the rate of non union, malunion and overall local complications as well as functional outcome.

Materials and Methods

50 cases of acute displaced mid-shaft fracture clavicle were selected for this study & followed up for 18 months. 25 patients in each group. In group I study, 23 were male and 2 are female. Average age was 33.84 years. In 10 cases, fractures were on right side and 15 were on left side. Mode of injury in this group is as follows, RTA – 23 cases, self fall and sports injury each one case.

In group II, there were 22 males and 3 female patients. Average age was 35.60 years. 11 patients had fracture clavicle on right side and 14 patients on their left side. Mode of injury in this group, RTA – 15, self fall 8 and sports injury in 2 patients.

The inclusion criteria's for doing surgery were as follows.

- Acute mid shaft fracture clavicle with displacement of fragments more than 2 cm (with no contact between two ends).
- Skin perforation or tenting.
- Floating shoulder.
- Bilateral clavicular fractures.
- Age between 20-60 years.
- Absence of co-morbidities for General Anaesthesia.
- Patients who have consented for both conservative and for surgical treatment.

Fractures are classified as type A (simple fractures, two fragments), Type B (fractures with bending wedge) and type C (complex fractures) as per the classification by OTA (Orthopaedic trauma Association) Fig –1

Surgical Technique

All the group I patients are operated under G.A and in supine position. Small sand bag was kept under the shoulder before starting surgery. Fracture was opened with curved incision along the clavical, centering the facture site.

Fracture fragments were reduced carefully by removing interposed soft tissue if any and with minimal stripping of perios-

tium. Precontoured RCP (for comminuted and oblique fractures), semi tubular plate (for severe comminuted fracture) and DCP (for simple transverse fractures) are fixed on the superior surface of bone using (3.5mm) minimum 3 screws on either sides of fracture. An inter fragmentary 3.5 mm lag screw is used in some of the cases for additional fixation. Primary bone graft was not used in any of our patients in this group. Iannotti et al demonstrated that fixing the plate superiorly provide better stability of fracture.[10]

Post operatively cuff and coller sling is used for 3 wks. Later active exercises were started gradually. Shoulder strengthening exercises were started after 6 weeks depending on the clinical and radiological evidence of fracture healing. At 3 months pre-injury light exercises and at 6 months unrestricted regular activities were allowed.

Conservative Treatment

Patients belong to group II are treated with "Figure of '8' clavicular bracing" with Cuff and Coller sling for 6 weeks. They are advised to start out of sling active exercises after 3 weeks, during day time. All underwent physiotherapy depending on the status of fracture healing. At 3 months patients are allowed pre-injury light activities and after 6 months activities without restriction except sports activities.

Patients were followed at 3, 6, 12 weeks and at 6,12 months after treatments in both the groups.

Evaluation of fracture healing was done by clinical and by X-ray. Functional scores were assessed at each follow up by **Constant shoulder scores and DASH Score.**[11]

Disabilities of the arm, shoulder and hand (DASH) score, outcome measure is a 30 item, self report questionnaire designed to measure physical functions and disorders of the upper limb. Testing has shown that the DASH performs well in both roles.

The DASH disability score (maximum score = 100) is calculated using the following formula.

DASH disability/symptom score = { (sum of n responses) – 1} /n x 25.

Where "n" equals the number of completed responses. The higher the score (on a scale 0-100) indicates greater disability.

In Constant shoulder score – there are 8 questions like pain, activity level, arm positioning, strength of abduction, ROM like forward flexion, lateral elevation, External Rotation and Internal Rotation.

The Constant shoulder score is zero.

Grading of the Constant shoulder score -

> 30	poor
23-30	Fair
11-20	Good
< 11	Excellent

Statistical analysis

Distribution of patients demographics and injury data, including fracture type, mode of injury, side involved (dominant or non-dominant), age and sex, injury severity score, complications and functional scores were studied and compared between the two groups. (Table 1 and 2).

Table - 1

Mode of Injury	No.	%
RTA	38	76
Self fall	09	18
Assault	00	00
Sports injury	03	06
Total	50	100

Table – 2

Patients demographic and Injury characteristics for the two groups.

	Surgical. n-25 (group I)		Conservative. n-25 (group II)	
t	n %	avg	n %	avg
Age (yrs)	33.84		35.60	
Sex- Male	23	92	22	88
Female	02	08	03	12
Mode of injury				
RTA	23	92	15	60
Self-fall	01	04	08	32
Assault	00	00	00	00
Sports injury	01	04	02	08
Side involved				
Right	10	40	11	44
Left	15	60	14	56

Results

50 patients (25 in each group) were screened and treated in our institution, after using inclusion criteria's for each group. In group II, 4 cases of non-union were treated by ORIF with bone graft to achieve union. But they were considered as non-operative cases for statistical purpose.

Follow up rate was 99% at 6 months and at one year it was 95%.

Mode of injury in group I, 23 cases are due RTA (92%), 1 self fall (4%), 1 case is due to sports injury (4%). In group II 15 cases are due to RTA (60%), 8 self fall (32%) and 2 sports injury (8%).

92% of the fractures are in males and 8% in females in group I, where as 88% are in males and 12% females in group II, suggesting clavicular fractures are more common in males than in females..

In group I, 10 cases were on Right side and 15 were on the left, where as in group II , 11 fractures are on the right side and 14 are on the left. So fractures are more common in left side than on the right side, that is non-dominant side in both groups in this study.

All the fractures united in group I within 12-14 weeks (average 13weeks) one case of delayed union which was treated by RCP (Reconstruction plate) is because of bent plate due to fall post operatively. But it went on to unite after 5 months. Two cases of mol union were well accepted. One case of surgical site infection was treated by specific antibiotics after culture and sensitivity and the fracture united.

In group II, of the 4 cases of non-union, 3 cases were comminuted fractures (patients were not willing for surgery) and 1 case was associated with diabetes mellitus. All of them under went ORIF with bone grafting and united well. Six cases of mal union were well accepted, functionally and cosmetically. Two cases of delayed union in this group united at 24 weeks. The remaining 13 cases got united at 15-18 weeks (Average 16 weeks).

DASH score was in the range of 10-15, (average 12.6) in group I and is acceptable functionally. In group II, DASH score was in the range of 15-20, (average 16.4). So functionally group I patients fared better than group II patients at the end of the study as evidence by both DASH and Constant shoulder scores.

In our study we found that overall complications were less and functional outcome was better in group I Compared to group II patients.

Volume : 3 | Issue : 2 | February 2014 • ISSN No 2277 - 8179

Complications – Comparison between two groups.

Complications	Surgical group I (n-25)		Conservative group II. (n-25)	
	N	%	n	%
1) Non union	0	0	4	16
2) Delayed union	1	4	2	8
3) Mal union	2	8	6	24
4) Infection	1	4	0	0

All the four patients with nonunion in group II underwent ORIF with bone graft and subsequently they united.

One patient of delayed union is because of bent reconstructive plate following fall post operatively went on to unite after 5 months in group-I, delayed union of 2 cases in group-II were comminuted fractures subsequently they too united.

All the patients with malunion in both the groups were comminuted fractures were well accepted both functionally and cosmetically.

One case with surgical site infection in group -1 was controlled by specific antibiotics after culture and sensitivity.

DISCUSSION

All mid-shaft clavicle fractures have traditionally been treated non-operatively, this was based on early reports which suggested clavicular nonunion was extremely rare.[12] However, more recent studies have shown that the union rate for displaced mid-shaft fractures is not as favorable as once thought. Only Smekal et al reported DASH scores at 3 months after surgical treatment and showed significant superior outcome for the operatively treated group.[13] COTS [9] and Smekal et al reported both significant and clinically relevant better out comes in the operated group after 6 months, for both the DASH and Constant score.[1] Our study also showed almost the same results.

One must take into account the fact that there are several disadvantages for the operatively treated group. The main disadvantage of surgery is the using of general anesthesia and implant removal. Besides, operative treatment is more expensive than conservative treatment. On the other hand, patients benefit from rapid posttraumatic pain relief, early mobilization, return to daily activities and improvement of shoulder function after surgical treatment.

Although plating of isolated, closed displaced mid-shaft clavicle fractures has been undertaken in some institutions, primary management of these fractures remained a therapeutic dilemma. A prospective cohort study was designed to compare the outcomes of operative against non-operative management. Their study showed that all fractures in the operative group united compared with a nonunion rate of 29% in the non-operative group. Robinson and coworkers reported a non- union rate of 21% for the displaced, comminuted midshaft fractures when managed conservatively. In addition, Brinker et al analyzed the same data and showed a nonunion rate ranging between 20% and 33% for displaced, comminuted fractures in young males.[14] Our results were better when comparing with these published outcomes. Malunion was a common outcome in the nonoperative group; however, focus was only placed on those that were symptomatic. Patients managed non-operatively were eight times more likely to have symptomatic malunion and this factor increased to 12 times for fractures OTA type C (B3). Their results compare well with the study by Nowak et al, in which 46% of patients with displaced clavicle fractures experienced symptomatic outcomes when managed conservatively.

In terms of functional outcome, Constant scores for patients receiving surgery were significantly better with a 10-point difference at the 6-month follow-up; this has previously been shown to be clinically relevant. Although the scores of the conservatively managed patients improved during the 18-month period, they remained significantly less than those of the operative group. A recently conducted randomized controlled trial showed that early primary plate fixation of completely displaced mid-shaft clavicular fractures results in improved patient-oriented outcomes, improved surgeon-oriented outcomes, earlier return to function, and decreased rates of nonunion and malunion.[9] Our results compare well with this study.

They concluded that surgical treatment is the favorable treatment in patients with acute displaced mid-shaft clavicle fractures.

Benefits of surgical fixation

Treating displaced midshaft clavicle fractures with open reduction and internal fixation (ORIF) can offer several benefits compared to conservative treatment, and athletes can get back on the field sooner.

In a prospective, randomized, multicenter study of more than 100 patients with displaced mid-shaft clavicle fractures, for example, the nonsurgical group healed at an average of 28 weeks, while the surgical group healed at an average of 16 weeks, where as it is 16 wks & 13 wks respectively in the present study.

Researchers found that patients treated nonsurgically had higher malunion and nonunion rates and worse outcomes.

Those conclusions were reinforced by another prospective, observational study by Mullis that also found higher nonunion rates in patients treated nonsurgically. Both the Constant and the American Shoulder and Elbow Surgeons (ASES) scores were worse in the nonsurgical group at all time points in the study.[15]

Like Dr. Mullis, Dr. McFarland believes that ORIF can be the best treatment option for displaced mid-shaft clavicle fractures in competitive athletes , but cautions that not every clavicle fracture needs surgical fixation.

While treating fracture clavicle, degree of displacement, shortening, and comminution should be carefully considered. Other variables include location of the injury (dominant or non-dominant arm), the patient's activity level, status of the physis (open or closed), and the presence of associated injuries.

Studies support the risk of surgical complications. In one study, 53 percent of surgical patients required plate removal. In another study of 125 patients who underwent ORIF, 12 percent needed reoperation, 4 percent had plate breakage, and 3.2 percent had loosening. Other complications included are infection and frozen shoulders.[14]

The rational for fixing displaced mid-shaft fractures in our study is to decrease non-union and reduce symptomatic mal-union. A variety of plating systems are available but there is little evidence to suggest which gives the best results.

Conclusion:

In the management of selected acute displaced midshaft clavicular fractures, surgical treatment is superior to conservative treatment. Surgery with plate osteosynthesis results in lower incidence of fracture non union, fewer symptomatic malunions and good functional outcome comapared with non operative treatment.

Figure I: Midshaft clavicular fracture classification by OTA

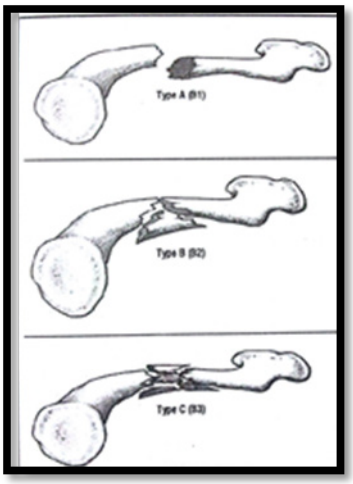
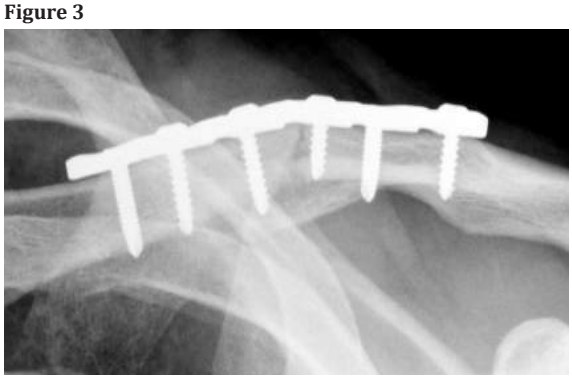


Figure 2

pre op x ray- mid shaft # clavicle with displacement.
Figure 3



Post op x ray showing fracture reduction & fixation with precontoured reconstruction plate.

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