



Surgery

COMPARISON OF PLATE OSTEOSYNTHESIS WITH INTRAMEDULLARY FIXATION IN TREATMENT OF DISPLACED MID SHAFT CLAVICULAR FRACTURES

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ABSTRACT **Introduction** Fracture of the clavicle are common and account for 5–10% of all fractures. Majority of clavicular fractures (70–80%) are located in the mid-diaphyseal region. The treatment choices available are conservative or operative viz. plate fixation or intramedullary nail fixation.

Aims and Objectives The objective of this study is to assess the outcome and functional results of adult Displaced mid shaft clavicular fractures treated by closed or open intramedullary nail and to compare the results with open reduction with plate fixation.

Material and Method A total number of 64 patients were included from 2013 to 2016 out of which 30 patients were managed by plating and in remaining 34 patient by intramedullary fixation. We evaluated the results in terms of length of incision given, surgical time taken, union time taken, and functional ability in terms of Constant score and DASH score.

Result Average mean time taken for clinico radiological union was (10-14 weeks) in both the groups. The implant irritation was observed 36% in the plating group and 14.1% in the nailing group. The length of incision and surgical time was more in the plating group as compared to nailing group. There was a more rapid improvement in both the DASH scores and Constant Murley scores in both the groups.

Conclusion Intramedullary nail has a longer union time but it is beneficial in terms of shorter surgical time, smaller incision, minimal chance of supraclavicular nerve injury and similar functional outcome as of plate in terms of Constant- Murley and DASH score.

KEYWORDS : Tooth extraction, pain management, analgesic drugs.

Introduction

Clavicle derives its name from Latin origin word *clavis* from which has been derived the word 'clavicular' referring to a similar shape musical symbol. The upper limb articulation evolved from a weight bearing joint in a quadruped to a non-weight bearing joint when man evolved as a biped giving the need to evolve a clavicle as a means to keep the upper limbs away from the midline for the more specialized function like holding, grasping and climbing^{11,20}.

Fracture of the clavicle are common and account for 5–10% of all fractures^{8,14,27}, men are more commonly (68%) affected.²³ Although the incidence in our country is not available, the yearly incidence of clavicle fracture is 71 in 100,000 males to 30 in 100,000 females.²⁵ Whereas low velocity injuries are more likely not to get severely displaced, it is likely that fractures of clavicle caused by high energy accidents are more likely to be severely displaced. Majority of clavicular fractures (70–80%) are located in the mid-diaphyseal region²⁷. Conventionally, acute mid clavicular fractures are not severely displaced in an adult is successfully treated non-operatively with either a sling or a figure-of-eight bandage, with non union reported in less than 1% fractures.^{12,15,17} The recent reports of non union rates of 29% and malunion rates of 14-36%^{3,6,12,15}, with displaced clavicle fractures treated non-operatively have made many prefer operative treatment in displaced midclavicular fractures. Shoulder biomechanics are reported to get significantly altered by malunion of the clavicle.^{1,17} The patient based outcome studies emphasize on complaints of weakness, rapid fatigability, loss of endurance, numbness, and paraesthesias with overhead activities and deficits in functional cosmesis, making unsatisfactory outcome rates of 25–30%, with complications including neurologic symptoms and functional deficits.^{3,12,15,17}

Material and Method

We conducted hospital based prospective with retrospective cases from the period of 2013 to 2016, a total number of 64 patient were included in the study of our hospital. Out of which 30 patients were managed with plating and 34 with intramedullary nailing.

Patients with mid clavicular fractures with displacement > 100%

between 18-60 years age.

Robinson type 2, irrespective of comminution or bending were included in the study. Patients were excluded if prior surgery over the same side shoulder or any co-existing shoulder disease or fracture is there.

30 patients were included in the study which were managed by plating retrospectively during the period of 2013 to 2015 and 34 patients were managed by intramedullary nailing prospectively from the period of 2015 to 2016.

The cases selected for intramedullary fixation were investigated for pre anaesthetic fitness and X-ray and clinical records were maintained.

After anaesthesia, patients were placed in supine position with a bolster between scapula and head turned away from the operative side. C-arm images in 45° cephalad and 45° caudad directions were viewed to provide images in two planes. The sternoclavicular joint was palpated and marked on the affected side. A small incision was made approximately 1 cm lateral to the sternoclavicular joint on the antero-inferior aspect of medial end of clavicle. The anterior cortex was opened using a 2.8 mm drill bit on a low speed drill and the opening widened with a diamond awl. A 2.5 to 3 mm TEN was inserted, Closed reduction was attempted under fluoroscopy. The nail was then advanced manually until it was just medial to the acromioclavicular joint. In the post operative care the limb was supported in an arm pouch. Active assisted shoulder joint movements and isometric shoulder strengthening exercises were started as soon as pain allowed after 3-4 days.

Statistical Analysis:

Statistical analyses were performed using SPSS software. A *p* value of <0.05 was considered statistically significant.

Result and Observation

In our study during a period from August 2013 to July 2016 a total number of 64 patients were included as per the inclusion criteria and underwent surgical fixation.

Surgical time and length of incision

The mean length of incision in the intramedullary nailing group was 6.87 cms as the incision was aimed to achieve optimum reduction for insertion of TENS under vision or by fluoroscopy where as in the plating group it was 12.20 cms. which shows a variable consideration and a value of 0.00034. The duration of surgical procedure accordingly was longer in the plating group 75.53 mins while it was lesser 35.20 mins in the intramedullary nailing group. In this scenario also the p value is considerable and comes out to be $p=0.00079$. Similar observations have been made by *Braun KF and co-workers* (2014)² in their study.

Union time in the two groups

The mean union time was comparable in the two groups with mean of 10.96 weeks and 12.76 weeks in the plating and nailing group. The difference was not statistically significant ($p<0.0005$)

Complications

There was no major implant related problem like breakage or failure in our study. There was 1 (0.03%) case of non-union in the plating group. There were no complications related to infection or neurovascular injury. Implant related soft tissue irritation was significantly more ($p<0.036$) in the plating group (n=11) than nailing group.

The Constant-Murley score⁷ and DASH score¹³ was obtained at 6-8 weeks, 3-4 months, 6-8 months, 9-10 months and 12 months or more after surgery. The Constant-Murley score was 70.1, 74.33, 82.53, 90.13 and 95.26 in plating group and 67.94, 73.88, 81.64, 90.11 and 95.58 in intramedullary nailing group at respective follow-ups at 6-8 weeks, 3-4 months, 6-8 months, 9-10 months and >12 months.



Figure 1

The mean DASH scores were 33.89, 15.11, 15.11, 12.21 and 8.71 at 6-8 weeks, 3-4 months, 6-8 months, 9-10 months and >12 months respectively in the plating group and 21.08, 21.08, 8.97 and 8.35 at 3-4 months, 6-8 months, 9-10 months and >12 months on respective follow ups in intramedullary group.



Figure 2

The DASH score was not recorded in the 6-8 weeks follow up in the nailing group as >900(overhead) movement was permitted only after union.

Discussion

Clavicular fractures have traditionally been treated non operatively with either a sling or figure of '8' bandage with less than 1 percent rate of non-union¹⁰. Many studies stated that almost all simple DMCF can be treated non operatively and healed with little or no complications²⁴. However, in most of the publications, the functional outcome was not taken into account. Malunion of clavicle has been associated with residual deficit in strength of shoulder girdle muscles and their

fatiguability^{25,26}. More recent studies have shown significantly higher non-union rates in conservatively treated patients, hence the current recommendation for treatment of DMCF is operative fixation³⁰. Open reduction and internal fixation with plate or intramedullary nail are two of the most commonly used surgical techniques for treating DMCF^{9,16,18}. With advanced implants, prophylactic antibiotics, and better soft tissue handling plate fixation is the standard operative technique for DMCF which can be applied antero-superior or antero-inferior surfaces⁶. Another emerging mode of fixation is intramedullary fixation, in clavicles with well-developed medullary cavity²¹. Although plate fixation gives a more rigid stabilization and stronger construct to allow early rehabilitation, the disadvantages include the increased exposure and soft tissue stripping, increased risk of damage to supraclavicular nerve, slightly higher infection rates, hypertrophic scars and re-fracture after plate removal. On the other hand intramedullary nailing has advantages of being less invasive requiring less soft tissue stripping, lesser risk of damage to supraclavicular nerve, lesser infection rates and lower risk of re-fracture^{4,5,21,22}.

This study compared the functional results of DMCF treated by open or closed intramedullary nailing (n=34) with those treated with ORIF with plate fixation (n=30). The sample selected was comparable in the two groups in terms of side involved, hand dominance and fracture type. The mean age of patient was 33 years and 34.7 years in the plating and nailing group respectively which was also comparable.

Table 1 Comparison of our operative time and union time with the Saha P and co workers study²⁸

	Saha P and co-workers ²⁸			This study		
	Plating group	Intramedullary group	p value	Plating group	Intramedullary group	p value
Mean operative time(min.) ±SD	75.73±12.20	51.16±16.23	$p<0.001$	75.73±12.20	35.20±7.12	$p=0.00079$
Mean union time(week s) ±SD	22±6	18.7±5.96	$p=0.025$	10.96	12.76	$p=0.00237$

Table 2 Comparison in improvement of DASH scores and Constant Murley scores with study by van der Meijden OA and co-workers 2015.²⁹

	This study		van der Meijden OA and co-workers ²⁹	
	6-7 months (mean)	12 months or above(mean)	6-7 months (mean)	12 months or above(mean)
Constant Murley score Plating group	82.53	95.26	96	99.2
Constant Murley score Nailing group	81.64	95.58	95.5	96.3
DASH score Plating group	15.11	8.71	3	2.4
DASH score Nailing group	21.08	8.35	5.6	3.9

Conclusion

Plating by open reduction and intramedullary nailing with open/closed reduction are the two common surgical methods for treatment of DMCF. The duration of surgery was longer in the plating group as compared to intramedullary nailing. The length of incision was much smaller in the nailing group than in plating group. The clinical union achieved in plating group was earlier than the nailing group. There is no case of post-operative infection while one case of non-union was noticed in the plating group. Although the functional scoring in terms of Constant-Murley and DASH score showed rapid recovery in first six months in plating group but at the end of final follow up of our study (1

year or more) there was no difference in functional recovery in both the groups in terms of both the scores.

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