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Management and outcome of clavicle fracture at a tertiary care hospital

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Abstract

Fractures of clavicle are known since ancient time, earliest description of fracture clavicle is found in Egyptian literature in 3550 BC. Hippocrates described fracture clavicle, as early as 400 BC and recorded that it is impossible to maintain reduction without surgical fixation, similar observation have been made by many surgeons in the years to follow. Selected patients were randomly divided in Group I and Group II. Patients of group I were treated by, closed/open reduction & internal fixation by TENS and Group II by open reduction & internal fixation by plate & screws. Patients were followed periodically at 2 weeks, 6 weeks, 3, 6, 12 months, 18 months and 24 months. Clinicians use various criteria to define a nonunion. Nonunion usually describes a fracture that has not adequately healed between stipulated 6 and 9 months after injury; delayed union, a fracture that has not healed after 3 to 6 months. However, some clinicians believe that a clavicular fracture is non-united if the fracture has not adequately healed within 4 months after injury. The constant scores were not significantly different between the two groups in the follow-up period and there was not much alteration after 1 year postoperatively. At final evaluation, the overall results using the constant score were 29 excellent, 2 good in the plate group; while in the TENS group it was 29 excellent, 1 good and 1 poor results.

Keywords: Management, outcome, clavicle fracture

Introduction

Fractures of clavicle are common injuries with incidence of 2.6% of all fractures and 44% of all shoulder injuries. Clavicle fractures are more common in males (68%) as compared to females. Left side is involved in 61% of cases. Fracture of clavicle can occur at any site but middle third is commonly involved in 81% of cases [1].

Fractures of clavicle are known since ancient time, earliest description of fracture clavicle is found in Egyptian literature in 3550 BC. Hippocrates described fracture clavicle, as early as 400 BC and recorded that it is impossible to maintain reduction without surgical fixation, similar observation have been made by many surgeons in the years to follow.

“When a fractured clavicle is fairly broken across it is more easily treated, but when broken obliquely it is more difficult to manage”, Thomas D Donnelly *et al.* (2013) Clavicle is short long bone of Skeleton and helps in translation of weight from hand to axial skeleton and provides attachment to the various muscles [2].

Up to 20th century the aim of treatment was union of fracture in whatsoever position fracture unites. Many methods of conservative treatment namely triangular sling, cuff and collar sling, three sling method, figure of eight bandage, figure of eight POP shoulder Spica, clavicular brace, arm shoulder pouch and many others have been described from time to time.

All these methods did not involves the reduction of fracture or unable to hold the fracture reduced hence the end results was malunion (25%) nonunion (33.3%) in various cases [3].

The malunion resulted in shortening, deformation, disfigurement and poor cosmeses shortening (Reduced distance between sternoclavicular joint to the shoulder joint) resulted in biomechanical disadvantage, persistence of pain, limitations of functions and reduction of strength in upper limb in some of these cases.

With increasing awareness and demand of the patient and consumer protection court surgeons felt the need for operative intervention and perfect alignment of these fracture to achieve perfect alignment of fragments [4].

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Better operative technique; improve metallurgy and availability of image intensifiers made the operative techniques as a method of first choice by more and more surgeons.

Methodology

The study was conducted on 62 patients with fracture of clavicle, attending Emergency and Outpatient Department of Orthopedics, Medical College and Hospital.

Patients were clinically examined; first aid was given in the form of, cuff and color sling, analgesics, antacids and was subjected to A-P view, Lardotic view radiograph of full length clavicle to decide the plan of definitive management. If needed CT scan and MRI were also taken.

Those requiring surgery were classified as per Allman classification and investigated for fitness for anesthesia and surgery.

The relevant data were recorded in the working Proforma.

Selected patients were randomly divided in Group I and Group II. Patients of group I were treated by, closed/open reduction & internal fixation by TENS and Group II by open reduction & internal fixation by plate & screws. Patients were followed periodically at 2 weeks, 6 weeks, 3, 6, 12 months, 18 months and 24 months.

Results were evaluated by Constant scoring system given by Murley (1987)

Operative procedure

(a) TENS fixation

Instruments required for nailing

- Set of Titanium elastic nails (1.5 mm, 2 mm, 2.5 mm)
- Awl
- Impactor
- T- handle

The sternoclavicular joint was palpated and marked on the affected side. We used image intensification in 45° cephalad and 45° caudal directions. This provided us with images in two planes, 90° apart. A small incision was made approximately 1 cm lateral to the sternoclavicular joint. The anterior cortex was opened using a sharp, pointed awl. A TENS was inserted (the diameter varied from 2 to 3 mm depending on the width of the medullary canal). Closed reduction was performed under fluoroscopic control using two percutaneously introduced pointed reduction clamps. If closed reduction failed, an additional incision (Mini open) was made above the fracture site for direct manipulation of the main fragments. The nail was then advanced manually until it was just medial to the acromioclavicular joint. Accurate maneuvering of the nail tip was necessary under fluoroscopic control to avoid penetration of the thin dorsal cortex. After reaching the end point, the fracture was compressed and the nail was cut close to the entry point to minimize soft tissue irritation, at the same time leaving sufficient length behind for easy extraction later on.

The fascia and skin were closed in layers.

Postoperatively, patients will be given a sling, but were encouraged for early shoulder mobilization, starting with pendular exercises from the second day.

After 7 days, active range of movement exercises will be started. However, overhead shoulder abduction was allowed only after 2 weeks. Activities of daily living will start thereafter. But those requiring lifting heavy objects were delayed until union was achieved. All patients will be reviewed at 2 and 6 weeks, 3, 6, 12, 18 and 24 months after surgery. At each visit, patients will be

assessed clinically radiologically for primary and secondary outcome measures. Functional outcome was assessed by the Constant score.

Radiographic union was defined as evidence of bridging callus or obliteration of fracture lines.

Clinical union was considered as absence of tenderness at the fracture site. Time to achieve union was recorded. After union, shortening of clavicular length was measured clinically as the linear difference of clavicle lengths from sternal end to acromial end between operated and normal side.

Implant removal was not done routinely in our study. It was done as per need and will of the patient after fracture union.

(b) Plate fixation

Instruments Required for Plating

- Locking Recon Plate/locking anatomical plate
- Non locking Recon plates
- Sleeves
- Drill bit 2.7 mm, 2.5 mm, 3.5 mm
- Tap
- Depth gauge
- Locking screw 3.5 mm
- Cortical screw 3.5 mm
- Screw driver

Procedure

After General Anesthesia, patients will be positioned in a “beach chair semi sitting” position. Or Patient placed supine on OT table, place a sand bag between the medial border of the scapula and the spine.

Supine position, a sand bag between the medial border of the scapula and the spine right side.

Incision was made transversely just under the fracture site. Supra clavicular nerves will be identified and spared wherever possible.

After reduction of fractures, an appropriate size of locking plate was fixed on the antero-superior surface of the bone by appropriate size screw.

After reduction recon locking plate was fixed. In oblique or complex fractures, inter fragmentary lag screws were used to achieve compression. The fascia and skin were closed in layers.

Results

Table 1: Shows types of operative intervention done

Procedure done	No. of cases	Percentage
Plate and screw (group II)	31	50%
Tens (group I)	31	50%
Total	62	100%

Table 2: Table shows open/closed reduction internal fixation (CRIF/ORIF)

Procedure	Group I	%	Group II	%
CRIF	27	87.09	-----	-----
ORIF	4	12.90	31	100
Total	31	100	31	100

In group I, 27 patients reduction could be achieved by closed method and fixation could be achieved by percutaneous fixation, rest 4 cases required limited exposure, open reduction and internal fixation. All the patients of group II were treated by open reduction and internal fixation.

Table 3: Shows Fracture Union

Status of Union	Time of Union (In Weeks)	Group I		Group II	
		no OF Cases	%	no of Cases	%
United	Within 6 weeks	1	3.22%	----	----
	6-12 weeks	5	16.12%	0	6.45%
	12-18 weeks	10	32.26%	6	12.90%
	18-24 weeks	12	38.71%	10	32.25%
	24-36 weeks	1	25.80%	13	41.94%
Non united	Up to 48weeks (1 year)	2	6.45%	2	6.45%
Total		31	100%	31	100%

Union time was less in TENS group as compared to plate group.

Fracture union

Clinicians use various criteria to define a nonunion. Nonunion usually describes a fracture that has not adequately healed between stipulated 6 and 9 months after injury; delayed union, a

fracture that has not healed after 3 to 6 months. However, some clinicians believe that a clavicular fracture is non-united if the fracture has not adequately healed within 4 months after injury.

Table 4: Shows final functional assessment

POOR				FAIR				GOOD				Excellent			
GPI	%	GPII	%	GPI	%	GPII	%	GPI	%	GPII	%	GPI	%	GPII	%
1	3.23	-	-	-	-	-	-	1	3.23	2	6.45	29	93.55	29	93.55

Final functional assessment

Grading the Constant score of Murley (Difference between normal and abnormal side) <11 excellent, 11-20 good, 21-30

fair, >30 Poor.

At the 12 months of study excellent cases in both the groups were same i.e. 93.55%.

Table 6: Final Functional Assessment

Assessment Period	(Mean+SD)		p value (NS)
	Group I (Tens)	Groupii (Plate)	
12 Months	94.19355±8.882265	95.45161±4.288269	0.25

The constant scores were not significantly different between the two groups in the follow-up period and there was not much alteration after 1 year postoperatively. At final evaluation, the overall results using the constant score were 29 excellent, 2 good in the plate group; while in the TENS group it was 29 excellent, 1 good and 1 poor results.

Discussion

Patients were randomly divided in to two groups' patients of group I were treated by closed /open reduction and internal fixation with TENS and group II were treated by open reduction and internal fixation plate and screws.

Results of closed /open reduction and internal fixation with TENS have been compared with results after open reduction and internal fixation with plate and screws

In group I (TENS group), one case had radiological evidence of callus formation and union, within six weeks, five cases within 6-12 weeks, 22 cases within 12-24 weeks and one case took more than 24 weeks to unite. In remaining, two cases there was no evidence of union even up to 9 months and were labeled as nonunion.

Patients of group II (Plate and screws group), Radiological evidence of union was seen earliest at 12 weeks and six patients showed union at 12 -18 weeks, 23 of these patients took 18-36 weeks to unite. In remaining two cases, there was no evidence of union even up to 9 months and were labeled as nonunion.

Early callus formation and faster healing of fracture was observed in group I which were treated by closed or limited exposure technique and fixation of fracture by percutaneous method as compare to group II where open reduction internal fixation was done.

Similar observation about faster healing and union in patients treated by intramedullary nail as compare to plate has also been

reported by others ^[5, 6]

Some other workers Thyagarajan *et al.* (2009), Shishir *et al.* (2014), Mishra *et al.* (2014), Gao *et al.* (2016), Kadakia (2016), Jain *et al.* (2016) independently reported similar observations of faster union ^[7].

In our study there was no difference in results, in comminuted fracture clavicle whether treated by TENS/plate and screws. However the workers reported better results by open reduction and internal fixation by plate and screws.

Fewer complication encountered were superficial infection, deep infection, ugly scar, implant protuberance, pin migration, nonunion. Superficial infection occurred in 5 cases of group I (TENS) at the entry point whereas 3 patients had superficial infection and two patients had deep infection at site of incision in plating group (group II). None of the cases treated by TENS had any evidence of deep infection at fracture site.

Clavicle is the percutaneous bone without muscle coverage hence two patients had protuberance of plate and 3 patients had ugly scar in patients treated with plate whereas 2 patients had pin migration in TENS group. Incidence of nonunion was same in each group.

Zeng *et al.* observed that plate fixation can provide more rigid stabilization than intramedullary pin fixation and may facilitate early mobilization and offer a superior construct for highly comminuted fractures where the bridge plating technique can be implemented. However, this technique may require large incisions and extensive exposure and soft tissue insult which could cause complications such as infection, scarring, and refracture after the removal of the plate. Intramedullary fixation provides an alternative and less invasive technique for the treatment of displaced midshaft clavicular fractures. It has the advantages of obtaining relatively stable fixation that allows axial compression, and preserving the soft tissue envelope, the

periosteum and the vascular integrity of the fracture site, which enhances healing [8].

Chen *et al.* observed that TENS fixation allows for earlier relief of shoulder pain and a more cosmetically satisfactory appearance than plate fixation. In addition, the infection rates may be decreased and fracture callus formation enhanced. However, the main complications of intramedullary fixation are superficial infection, hardware migration, skin irritation. In our study complications are more in plating group as compare to TENS group, which is in accordance of available literature [9].

Shorter operative time, shorter hospital stay and shorter time of union in patients treated by close reduction internal fixation by TENS as compared to patients treated with open reduction internal fixation by plate and screws has also been observed independently by others [10].

At final evaluation the overall result were evaluated using the constant scoring system of Murley. In group II (plate) 29 patients scored less than 11 point as per constant scoring system of Murley and were graded as excellent, 2 patients scored between 11-20 and were graded as good. Whereas 29 excellent, 1 good and 1 poor in TENS group.

Though there was early callus formation and faster healing in patients treated by intramedullary fixation but at 1 year post-operative treatment constant score in two group was not significantly different.

Finally in our study no significant difference was found in function and nonunion rate in both the groups but major complications and union time are more in plate fixation group than TENS group so, TENS fixation is the preferred treatment of choice for fracture middle 1/3rd clavicle.

Conclusion

- Anatomical alignment, compression at fracture site and rigidity of fixation was better with plates group than with TENS group.
- Callus formation was early in TENS group and healing was faster as compare to plate group.
- In our study there was no difference in results, in comminuted fracture clavicle whether treated by TENS/plate and screws. However the workers reported better results by open reduction and internal fixation by plate and screws.
- The range of motion calculated according to constant scoring system of Murley achieved after fracture union. According to our study, at the end of this study no significant differences was found in functional outcome between TENS and plates fixation ($p > 0.05$).

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