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A clinical study on role of surgical management of clavicle fractures in adults

Siva Sankar Murthy T[1], Syam Kumar R[2*]

[1]Assistant Professor, Department of Orthopedics, Government Medical College, Anantapuramu-515001, Andhra Pradesh, India

[2]Resident, Department of Orthopedics, Government Medical College and Hospital, Anantapuramu-515001, Andhra Pradesh, India

ABSTRACT

Clavicle, the horizontal bone of the body fractures is seen commonly in Road traffic accidents, fall from heights and also in simple falls. The clavicle fractures account for about 5-10% of all fractures. Traditionally it is believed that conservative management is best instead of surgery for clavicle bone. Internal fixation for middle third fractures of clavicle with interlocking will not be ideal choice as the implant cannot be precontoured. Fixation with plates would be a better choice for the said situation. Similarly, fixation of lateral third fractures is also better option suggested by many authorities. To analyze methods of surgical management for the fractures of middle and lateral third parts the current study was carried out at Department of Orthopedics, Government Medical College and Hospital, Anantapuramu. An attempt is also made to study the epidemiological factors associated with fracture of the clavicle. At the end of the study it can be concluded that the middle and lateral third fractures of clavicle are common in younger age group males who met with road traffic accidents. As for as surgical management is concerned, internal fixation with plates and screws for middle third fractures and tension band wiring for lateral third fractures of Clavicle would be ideal choice as they allow for early rehabilitation, less chances for infection and pose least number of complications.

Key words: Clavicular fractures, Complications, Internal fixation, tension band wiring.

Introduction

Clavicle is the bony link from thorax to shoulder girdle and contributes to movements at shoulder girdle. Clavicle fracture is a common traumatic injury around shoulder girdle due to their subcutaneous position. It is caused by either low- energy or high- energy impact. Fracture of the clavicle accounts for approximately 5 to 10% of all fractures and up to 44% of injuries to the shoulder girdle. About 70% to 80% of these fractures are in the middle third of the bone and less often in the lateral third (12% to 15%) and medial third (5% to 8%). Fractures of the clavicle have been traditionally treated non-operatively.

Although many methods of closed reduction have been described, it is recognized that reduction is practically impossible to maintain, and a certain amount of deformity and disability is expected in adults.

Many interventional methods like fiction with plate and screws, tension band wiring, usage of Steinman pins, Kirshner wire etc are used, however each method has got its own pros and cons. In this context the current study was under taken so as to gain experience with the surgical management of fresh displaced, comminuted middle third clavicle fractures with plate and screws and Kirschner wires with tension band construct for displaced lateral third clavicle fractures[1].

**Correspondence*
Syam Kumar R
Resident, Department of Orthopedics,
Government Medical College and Hospital,
Anantapuramu-515001, India

Materials and Methods

The current prospective study was carried out from May 2015 to May 2016 at Department of Orthopedics,

Government Medical College and General Hospital, Anantapuramu after taking clearance from Institutional Ethics Committee. Study included 40 subjects who underwent surgeries for clavicular fracture during the mentioned period. All Adult male and female patients above 18 years who require surgical intervention for displacement and comminution at middle third clavicle fracture and displaced lateral third clavicle fracture were included as subjects in the current study. Patients who are less than 18 years of age, those who are not willing for surgery, patients who are medically unfit for the surgery were excluded from the study group. Proper procedure was explained to all patients in their own language and consent was obtained prior to the study.

A detailed clinical history as to general, history related to injury and medical history was recorded followed by a detailed general clinical, radiological and local examination and routine investigations and pre-anesthetic checks ups were carried out in all patients. Standard surgical and anesthetic protocols were followed for the surgeries. Middle 1/3rd fractures were treated with plate and screw fixation, while lateral 1/3rd clavicular fractures are fixed with tension band wiring. All the cases were done under general anesthesia.

Postoperatively all cases were managed with antibiotics, oral fluids, immobilization with arm pouch and other supportive care. Sutures were removed on 10th postoperative day. rehabilitation was initiated at weeks and followed up at 4-6 weeks. The whole rehabilitation process was designed to arrange active range of motion by 6-8 weeks of postoperative period. Further Clinical and radiological follow up of cases were done at four weekly intervals till radiological union is achieved. The functional Out come was assessed by Constant and MarleyScore [2-3]. All the patients were graded up to a maximum 100 points as shown in the table below(Table-1).

Table 1: Patient grading as per Constant -Murley scale

Total score	Result
100-90	Excellent
80-89	Good
70-79	Fair
0-70	Poor

Observations and discussion

Site of clavicular fracture(Table-2): It is evident from Table-2 that 32 subjects of our study had fracture of middle 1/3rd of clavicle amounting to 80% of the cases followed by8 cases of lateral 1/3rd of the clavicle amounting to 20%. These findings are consistent with those conducted by Botsman et al [4] and Kao etal [5]

Table-2: Cases distribution according to site of fracture

Site of clavicle fracture	Number of cases	Percentage
Middle third	32	80
Lateral third	8	20
Medial third	0	0

Age incidence of Cases (Table-3):Majority of the patients with middle third clavicle fracture i.e.12 patients (30%) were in the age group of 19-29. The youngest patient was 19 years and oldest patient was 63 years. The average patient was 35.65 years. Most of the patients 3 cases (7.5%) with lateral third clavicle fracture was between |30-39 years. The youngest patient was 27 years and oldest patient was 57 years with average age of 37.5 years. Almost similar findings are presented in other studies [4-5]. The findings indicated that these fractures are common in persons of younger age group, probably because of their active life styles and mobility when compared to other age groups.

Mode of Injury(Table-4):Out of 30 subjects who suffered form middle 1/3rd shaft fractures, 25% of subjects sustained fractures due to fall on shoulder from a two-wheeler, 45% of people sustained injury due to some form of road traffic accident and 5% of people received injury from simple fall. In lateral third fracturs of clavicle 5% people suffered fracture due to fall on shoulder from a height and 16% of them sustained from a road traffic accident. Studies conducted by other authors [6-7] indicated almost the same result. The findings indicate the increasing frequency of the road traffic accidents especially those due to two wheelers.

Table 3: Age wise distribution of cases

Age in years	No. of. Middle third clavicle fractures	%	No. of. Lateral third Clavicle fractures	%
19-29	12	30	2	5
30-39	10	25	3	7.5
40-49	4	10	1	2.5
50-59	2	5	2	5
>60	4	10	-	-
Total	**32**	**80**	**8**	**20**

Table 4: Distribution of cases as for mode of injury

Mode of injury	Number of middle third clavicle fractures	%	Number of lateral third clavicle fractures	%
1.Fall on shoulder from Two wheelers	10	25	-	-
2.Rta	18	45	6	15
3.Fall from height	2	5	2	5
4.Fall on outstretched Hand (indirect)	1	2. 5	-	-
5.Hit by train	1	2.5		
Total	**32**	**80**	**8**	**20**

Sex wise division of Cases[Table-5]: It is inferred that most of the sufferers were males in both the categories amounting to 70% and 15% in middle 1/3rd and lateral 1/3rd respectively when compared to female subjects who are 10% and 2% respectively in each category. Similar observations were made in studies conducted by Botsman and Kao et al [4-5]. This shows males are quite active and mobile as they are main bread earners of the families.

Table 5: Incidence of cases as to sex distribution

Sex	No. of. Middle third Clavicle fracture	%	No. of lateral third Clavicle fractures	%
Male	28	70	6	15
Female	4	10	2	5
Total	**32**	**80**	**8**	**20**

Classification of Fractures as per Robinson Classification[8] (Table-7): There were no type-1 (medial third) fracture. In type-2 middle third fracture type-2 B1 (displaced with simple or single butterfly fragment) occurred in 12 patients (30%) and type-2 B2(displaced with comminuted or segmental) fracture

occurred in 20 patients (50%).In lateral third clavicle fracture there were type- 3 B1 (displaced with extra articular) occurred in 6 patients (15%) and type-3 B2 fracture (displaced with intra articular) occurred in 2 patients (5%). The classification is utilized for planning of surgeries. identical findings are observed by studies done by Botsman etal [4] and Kao etal [5].

Table 6: Classification of cases according to Robinson Classification

TYPE		NO OF CASES
Type -1 Medial third		0
Type – 2 Middle third	B1	12
	B2	20
Type – 3 lateral third	B1	6
	B2	2

Time interval from Admission to surgery(Table-7): 75% of cases who had middle 1/3rd fractures of clavicle underwent surgeries within one week of admission while all cases of lateral end fractures were operated within one week. In a study conducted by Botsman etal all the cases are operated within 3 days. we feel that the cases should be operated as early as possible so as to achieve better healing, early rehabilitation and prevention of complications. The findings are reiterated in a study conducted by Coupe BD etal [9].

Table 7: Distribution of cases according to admission-surgery interval

Time of surgery	No. of Middle third clavicle fracture	%	No. of Lateral third clavicle fracture	%
<7 days	30	75	8	20
7-14 days	2	5	-	-

Types of Implant used(Table-8): All the fractures are middle 1/3rd shaft of clavicle were managed with plate and cortical screws. types of plates used are shown in table-9. For 50% of patients locking compression plates were used and 15% of patients received reconstruction plates and 15% patients received dynamic compression plates. The plates were intraoperatively adjusted to the contour of the clavicle. It is found out that there no significant difference in outcome of surgery by using different types of plates. This finding is similar to the observation made by Botsman etal [4]

Table 8: Type of Implant used

Type of plate	Number of patients	percentage
Reconstruction plate	6	15
Locking Compression Plate (LCP)	20	50
Dynamic Compression Plate (DCP)	6	15

Duration of Union(Table-9): It is shown in table-10 the time taken for healing of fractures from the date of surgery. For the current study the fracture was considered to be united when clinically there was no tenderness, radiologically the fracture wine is invisible and full unprotected function was possible. In middle 1/3rd clavicular fractures 70% of the fractures united by 12 weeks. 10% cases delayed union is observed because of large butterfly fragment at fracture site was present. In lateral third fractures 88% cases showed union, latest by 12 weeks. one case which was treated with a 4-holed dynamic compression plate healed at the end of 14 weeks. Similar findings are observed in a study conducted by Lazarus MD etal[10]

Table 9: Duration of Union of cases

Duration of union	No.of middle third clavicle fractures	%	No. of lateral third clavicle fractures	%
8-12weeks	28	70	7	87.5
>12 weeks	4	10	1	12.5

Complications(Tables-10&11): In the current study a complication was treated as major if the said complication resulted in an additional morbidity of two months.

In middle third clavicle fixation 4 patients (10%) had hypertrophic skin scar and in 6 patients (15%) plate prominence occurred. In 2patients restriction of shoulder movements occurred. In 4 patients (10%) delayed union occurred. In 1 patient (2.5%) plate loosening occurred which went for malunion and in 1 patient (2.5%) plate breakage occurred (Table-10). Findings are comparable to a study conducted by Collinge et al [11]

Table 10: Complications of Middle Third Clavicular fracture surgeries

	Types	No. of cases	%
Minor	Hypertrophic skin scar	4	10
	Plate prominence	6	15
	Delayed union	4	10
	Plate loosening	1	2.5
	Restriction of shoulder movements	2	5
Major	Plate breakage	1	2.5

As per lateral 1/3rd fracture surgeries are concerned1 patient (2.5%) superficial infection occurred which was treated with oral antibiotics for 5 days and in another 2 patients (5%) restriction of shoulder movements occurred due to associated glenoid fossa fracture. The patient was not able to follow the shoulder exercises because of pain.In 1 patient (2.5%) delayed union occurred (Table-11). Observations are comparable to findings of a study conducted by Der Tavitian etal [12]

Table 11: Complications of lateral Third Clavicular fracture surgeries

	Type of complication	No.of cases	%
Minor	Superficial infection	1	2.5
	Delayed union	1	2.5
Major	Restriction of shoulder movements	2	5

Functional Outcome (Table-12): From Table-12 it can be inferred based on Constant& Murley score[2] that of the 32 patients (80%) with middle third clavicle fracture treated with plate and screws, 24 patients (60%) had excellent functional outcome, good functional outcome is seen in 6 patients (15%) and fair functional outcome was observed in in 2 patients. while in 8 patients of lateral third clavicle fracture fixed with Kirschner wire and tension band wire 4 patients (10%) had excellent functional outcome results and 2patients (5%) had good functional outcome 1 patient had fair functional outcome and with 1 patient fixed with 4-hole dynamic compression plate had fair functional outcome due to associated scapula body fracture. This observation demonstrates the efficacy of the procedures in question and indicate that the mentioned procedures are quite ample to practice.

Table 12: Functional Outcome of clavicular fracture cases

Functional outcome	No .of middle third clavicle fractures	%	No .of lateral third clavicle fractures	%
Excellent	24	60	4	10
Good	6	15	2	5
Fair	2	5	2	5
Poor	-	-	-	-
Total	**32**	**80**	**8**	**20**

Conclusion

The following are the conclusions drawn from the current study

1. Clavicle fractures are usually treated conservatively but there are specific indications for which operative treatment is needed like comminuted, displaced middle third clavicle fractures and displaced lateral third clavicle fracture.
2. Among the internal fixation methods intramedullary fixation do not control rotation so they require longer period of immobilization till union.
3. In this study primary open reduction and internal fixation with plate and screws of fresh middle third clavicle fractures provides a more rigid fixation and does not require immobilization for longer periods.
4. In this study locking compression plates were used as it is providing strong fixation due to locking between the screw and plate, and blood supply preservation due to minimal contact between plate and cortical bone and precontoured to the shape of the clavicle, side specific and provide stablefixation. It is necessary to place the plate superiorly andat least three screws to be applied medially and three screws laterally.
5. Semi tubular plates were not used because it was difficult to contour them to the shape of the bone.
6. Dynamic compression plate is strong, gives excessive prominence through the skin and it is difficult to contour.
7. All the fractures united and there was no nonunion.
8. Only 6 implant removals were done till the end of this study.
9. For displaced, comminuted middle third clavicle fracture plate and screws fixation and early mobilization gave excellent results in 24 patients.
10. For displaced lateral third clavicle fractures in a small study of 8patients, 7 fixed with Kirschner wire with tension band wiring and 1 with 4-hole dynamic compression plate early mobilization gave excellent results in6 patients.

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