

EVALUATION OF DISPLACED FRACTURES OF CLAVICLE MANAGED BY RECONSTRUCTION PLATE

*Dipesh Kumar., Jaspal Singh., Dharam Singh., Chandan Gupta and Radhe Sham Garg

Department of Orthopaedics, Govt. Medical College/ Guru Nanak Dev Hospital, Amritsar, 143001, India

ARTICLE INFO

Article History:

Received 20th April, 2017

Received in revised form 15th May, 2017

Accepted 12th June, 2017

Published online 28th July, 2017

Key words:

Clavicle, fracture, reconstruction, plating

ABSTRACT

INTRODUCTION: Most clavicular fractures heal uneventfully without serious consequences with nonoperative treatment.

There has been increasing evidence that the outcome of nonoperatively treated (especially displaced or shortened) midshaft fractures is not as optimal as was once thought.

Recent evidence from prospective and randomized clinical trials has suggested that there is a subset of individuals who benefit from primary operative care.

MATERIAL AND METHODS: The present study consisted of 25 cases in the age group of 16 years or above of either sex in this study patients aged 16 and above with displaced clavicular fracture will be selected. They will undergo open reduction and internal fixation with reconstruction plate. The patients will be evaluated clinically and radiologically and outcome assessed by constant score.

RESULTS: Road traffic accidents accounted for the majority of cases of diaphyseal fracture of clavicle. In present study 23 cases were having good to excellent results. 2 cases were having fair results and none was having poor result on functional evaluation. 22 had union in less than 12 weeks of time. 3 cases which had union after 12 weeks were labelled as delayed union.

Copyright©2017 Dipesh Kumar et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

The clavicle is one of the most frequently fractured bones in the body, the fracture most often resulting from a direct blow or a fall on an outstretched hand. With ever increasing number of automobile accidents fracture of clavicle in adult too has increased manifold. Fractures of the clavicle represent 2.6% of all fractures with an overall incidence of 64 per 100,000 per year. Mid shaft fractures account for approximately 69% to 81% of all clavicle fractures.¹ Distal third fractures are the next most common type (20%), and although they can result from the same mechanisms of injury as that seen with mid shaft fractures, they tend to occur in more elderly individuals as a result of simple falls.^{2,3,4,5} Medial third fractures are the rarest (5%), perhaps because of the difficulty in accurately imaging (and identifying) them.^{6,7} This is consistent with functional anatomy of the clavicle as distal and proximal ends of the clavicle are supported firmly by strong ligaments and muscles attached to them, where as central part is relatively bare. Recent evidence from prospective and randomized clinical trials has suggested that there is a subset of individuals who benefit from primary operative care.^{8,9,10}

Operative repair in this setting should be reserved for medically well, physically active patients who stand to benefit the most from a rapid restoration of normal anatomy and stable fixation. There are multiple potential indications for primary operative fixation.

Fracture-Specific

- Displacement > 2 cm
- Shortening > 2 cm
- Increasing comminution (>3 fragments)
- Segmental fractures
- Open fractures
- Impending open fractures with soft tissue compromise

MATERIALS AND METHODS

A prospective case series study of 25 cases of closed diaphyseal clavicle fractures fixed with open reduction and internal fixation by reconstruction plate was done. Patients of age above 16 years and both the sexes were included in the study. Fractures with displacement and shortening >2cm, with comminution were included in the study. Institutional ethical committee approval was taken. On admission, all patients were clinically assessed for general condition and skeletal and

*Corresponding author: Dipesh Kumar

Department of Orthopaedics, Govt. Medical College/
Guru Nanak Dev Hospital, Amritsar, 143001, India

Evaluation of displaced fractures of clavicle managed by reconstruction plate

soft tissue injuries. Hemodynamic instability was treated with appropriate fluids and blood replacement. Head injury, pelvic injury, abdominal injuries were given priority treatment. All fractures were fixed with an adequate size reconstruction plate by open reduction. All patients were followed monthly till radiological union. During follow up patients were assessed clinically, radiologically and functionally. The results were evaluated by Constant Score. The complications were evaluated in terms of infections, delayed union, nonunion, implant failure, secondary loss of reduction, implant breakage and re-fracture after plate removal.

RESULTS

A total of 25 cases of fracture clavicle were seen in the study. Most common age group was between 21 to 40 years with mean age of 37.16 years. Males (68%) had higher frequency compared with females (32%). Right sided fractures (64%) were more than left sided fractures (36%). Road sided accidents (56%) were the most common cause followed by falls from height (40%).

Age group in years	No. Of cases			%
	Total	Males	Females	
0-20	02	02	00	8
21-40	14	9	5	56
41-60	8	5	3	32
>60	1	0	1	4

Most common pattern of fracture was diaphyseal wedge (60%) and diaphyseal non comminuted fractures (36%). 14 patients (56%) had only clavicle fractures but 11 patients (44%) had associated fractures which were treated accordingly [table no. 4]. 16 patients (60%) were operated within 7 days of injury where as 8 patients were operated with in 1 month of injury. Average duration of surgery was 69.12 minutes ranging from 40 to 88 minutes. Duration of hospital stay averaged 12 days. Patients were followed till the time of their complete clinical and radiological union.

Type of fracture	No. of cases	Percentage
Type B1	9	36
Type B2	15	60
Type B3	1	4
Total	25	

19 patients (76%) had full range of movement in flexion and abduction at the shoulder and 6 patients (24%) had deficient movement at the shoulder.

Range of shoulder movement (flexion and abduction)	No. Of patients	Percentage
More than 165°	19	76%
150-165°	6	24%
Less than 150	NIL	0%

15 patients had consolidation within 9 weeks, 8 patients between 9-12 weeks, and 3 patients between 12-15 weeks. In the present study minimum time of radiological union was 6 weeks and maximum time of union was 15 weeks. The average radiological complete union time was 9.72 weeks.

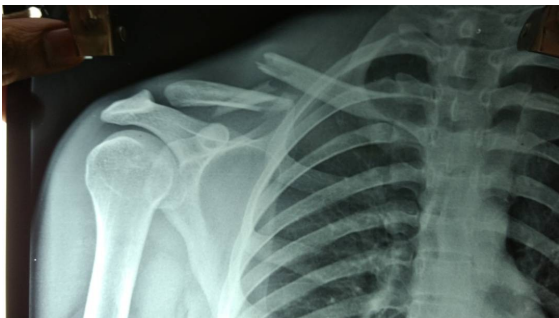
Period of union	No. of cases	Percentage
Within 9 weeks	15	60.0
9-12 weeks	8	32.0
Between 12-15 weeks	3	12.0

In our study, 10 cases had hardware prominence, 8 cases with incisional numbness, 3 patients had delayed union, 1 patient had superficial infection and 1 patient had implant breakage, 2 cases with periarthitis shoulder shown in table. The superficial infections responded to antibiotics alone while the broken implant was removed when complete consolidation of bone had occurred. In present study 23 cases were having good to excellent results. 2 cases were having fair results and none was having poor result on functional evaluation.

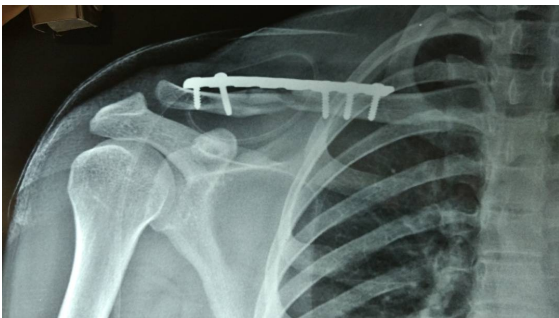




Photographs showing full range of movements at full union.



a).showing pre operative x-ray



b).showing post operative x-ray



c) showing complete union

DISCUSSION

Age

Majority of our patients were in the age group 21-50 years. The youngest being 20years and oldest being 65 years. The mean age of patients in our study was which is comparable to other studies showing mean age of 37 years¹¹, 34.3 years¹², 29.3 years¹³, 29.385. The higher incidence of these injuries in this age group can be owed to their engagement in activities relating to travel and outdoor works.

Lesser incidence of patients in the older age group in our study was mainly because of less active lifestyle in this age group of the patients.

Sex

In the present study displaced clavicle fracture seen predominantly in males comprised of 17 males(68%) and 8 females(32%). The sex distribution of earlier reported were 70% male and 30% females¹⁴ and 67.9% males and 32.1% females¹⁵. Hence the incidence in present study closely correlates with previous studies. This is probably due to type of society in which outdoor activities are predominantly preferred by males which predispose them to accidental injuries. One recent study of 57 such fractures reported that patients were typically men in their fifth decade and that the usual mechanism of injury was a motor vehicle accident.¹⁶ These authors also noted a relatively high (20%) associated mortality rate from concomitant head and chest injuries

Side Involved

In the present study right side was involved more commonly in 16 cases and left in 9 cases. Many studies also reported similar incidence of right side involvement with 57% right and 43% left¹⁷, 67% right and 33% left¹⁸, and 58.8% right and 41.2% left¹⁹ which commensurate with the studies done by above cited authors. Force of trauma having been borne by right side as being the dominant side.

Site Of Fracture

In this study it has been observed that fracture are more common in middle third of clavicle because this part is free of muscular attachments while medial and lateral ends are secured firmly by strong ligaments. A series of 9 cases of fracture clavicle demonstrated that most common site of fracture clavicle is middle third.²⁰

Another study showed 72.6% incidence of fractures of the middle 1/3rd.²¹

Mechanism of Injury

Mechanism of injuries classified mainly as roadside accident, fall and sports injuries. The present study showed mechanism of injuries were roadside in 14 cases, fall in 10 cases and assault in 1 case. Most common cause of fracture clavicle in males were roadside accidents seen in 12 out of 14 roadside accident cases. In females causes of this fracture were roadside accident in 2 cases, fall in 5 cases and 1 case of assault. It was also noted that fracture due to roadside accident mainly occurred in males and fracture due to fall in females. Reported mechanism of injuries were roadside accident in 62.5% and fall in 23.5% cases¹⁸. Roadside accident in 46%, fall in 20% and 34% sports injuries²², and roadside accident in 62%, fall in 15%, sports injuries in 15% and assault in 8% cases.²³ This incidence is seen as males are mostly predisposed to roadside accidents and females to fall during household works.

Associated Injury

As shown in present study main mechanism of injury was roadside accident thus chances of associated injuries increased. 3 cases were having associated rib fracture, 2 cases were having head injury, 1 case of associated femur fracture, 1 case of fracture both bone forearm. 1 case of fracture both bone leg, 1 case of fracture olecranon and 1 case each of

fracture supracondylar humerus and fracture neck humerus. The number of associated injuries shows the force of trauma due to high velocity vehicles now a days.

Fracture Classification

The incidence of fracture according to AO classification in the present study was as follows. Diaphysis noncomminuted type B1 were 9 cases(36%), diaphysis wedge type B2 were 15 cases(60%) and diaphysis segmental type B3 was 1 case(4%). So diaphyseal wedge was most common type. These findings were slightly different with earlier reported literature with type B1 23%, B2 73% and type B3 4%²³ probably due to difference of mechanism of fractures and racial difference of bony constitution between study groups.

Time Of Injury To Surgery

In the present study time of injury to surgery was less than 7 days in 16 cases. 1 case was operated on 15th day as he was not fit for general anaesthesia due to concomitant head injury. 1 case presented with non union 60days after injury. Non union was treated with bone graft from iliac crest along with plating. This shows that plating technique can be used in both fresh and old fractures.

Union

In the present study mean duration of radiological union was 9.72 weeks ranging from 5 weeks to maximum 15 weeks. 15 cases showed union within 9 weeks, 8 cases showed union between 9-12 weeks and 3 cases within 15 weeks. A study of 20 patients of fracture clavicle treated by AO plate fixation achieved union in 6 weeks.²⁴ Another study of 10 cases of fracture clavicle treated by plating achieved union in an average time of 19 weeks²⁵. In 1994 9 patients of fracture clavicle were treated with narrow LC-DC and at an average follow up of 17 months union was achieved in all cases.²⁰

Complications

Few complications were seen during follow up. There were 10 cases of hardware prominence due to placement of reconstruction plate. 8 cases were of incisional numbness due to injuries to supraclavicular branches. There was one case of superficial infection which was treated by iv antibiotics. Also there was one case of implant breakage after union of bone, which was later removed after the bone had united. In 3 cases bone united after 12 weeks and these cases were marked as delayed union. 2 cases suffered from peri arthritis shoulder of same side, but it was not clear that peri arthritis was sequel of fracture or faster progression of earlier disease. There was on complication of deep infection, non union, malunion, loosening of screws or stress fracture. Overall, it can be stated that in the present study there was no major complication regarding management and healing, leading to reoperation. Hardware prominence is linked to superior placement of the plate over the bone. Its advantages include a general familiarity with this approach in most surgeons' hands, the ability to extend it simply to both the medial and lateral ends of the clavicle, and clear radiographic views of the clavicle postoperatively. In a recent metaanalysis that examined operative series from 1975 to 2005, Zlodwodzi *et al.* reported a superficial infection rate of 4.4%, and a deep infection rate of only 2.2%; these figures are significantly improved compared with earlier studies.¹ If infection does occur and it is superficial, then it is usually possible to

temporize with local wound care and systemic antibiotics until fracture union has occurred. There was no case of malunion, angulation or shortening of fracture.

Constant Score

The self evaluated constant score calculated on scale 0-100 where 0 is worst and 100 best. The self evaluated constant score was minimum 74 and maximum 96. The mean constant self evaluated score was 88.84. Study in 2009 showed constant score of 93.7.²⁶ Another study in 2014 showed constant score of 89.3 with open reduction and clavicular plating.²⁷

RESULTS

In present study 23 cases were having good to excellent results. 2 cases were having fair results and none was having poor result on functional evaluation. injury. Diaphyseal wedge (60%) were most common followed by diaphyseal non comminuted(36%). There was no case of nonunion with 3 cases of delayed union. Average time of union was 9.72 weeks. 10 cases had hardware prominence, 8 cases with incisional numbness, 3 patients had delayed union, 1 patient had superficial infection and 1 patient had implant breakage, 2 cases with peri arthritis shoulder Excellent to good results were obtained in 92% of cases.

CONCLUSION

Operative intervention is reserved for young, healthy, physically active patients with good bone quality and completely displaced fractures who stand to benefit most from operative fixation with an intrinsically low complication rate. Operative plate fixation provides a more rapid return to a superior level of shoulder function with a consistently low complication rate compared with non operative care

References

1. Zlowodzki M, Zelle BA, Cole PA, Jeray K, McKee MD; Evidence-Based Orthopaedic Trauma Working Group. Treatment of acute midshaft clavicle fractures: systematic review of 2144 fractures: on behalf of the Evidence-Based Orthopaedic Trauma Working Group. *J Orthop Trauma*. 2005; 19(7): 504-7.
2. Goldberg JA, Bruce WJ, Sonnabend DH, *et al.* Type 2 fractures of the distal clavicle: a new surgical technique. *J Shoulder Elbow Surg* 1997; 6:380-382.
3. Robinson CM, Cairns DA. Primary nonoperative treatment of displaced lateral fractures of the clavicle. *J Bone Joint Surg Am* 2004; 86A:778-782.
4. Rockwood CA. Fractures of the outer clavicle in children and adults. *J Bone Joint Surg Br* 1982; 64B:642.
5. Rokito AS, Eisenberg DP, Gallagher MA, *et al.* A comparison of nonoperative and operative treatment of type II distal clavicle fractures. *Bull Hosp Joint Dis* 2003; 61: 32-39.
6. Seo GS, Aoki J, Karakida O, *et al.* Case report: nonunion of a medial clavicular fracture following radical neck dissection: MRI diagnosis. *Orthopedics* 1999; 22:985-986.
7. Throckmorton T, Kuhn JE. Fractures of the medial end of the clavicle. *J Shoulder Elbow Surg* 2007; 16:49-54.

8. Canadian Orthopaedic Trauma Society (MD McKee, principal investigator). Plate fixation versus nonoperative care for acute, displaced midshaft fractures of the clavicle. *J Bone Joint Surg* 2007; 89A:1-11.
9. Hill JM. Closed treatment of displaced middle-third fractures of the clavicle gives poor results [letter to the editor]. *J Bone Joint Surg Br* 1998; 80B:558.
10. Judd DB, Bottoni CR, Pallis MP, et al. Intramedullary fixation versus nonoperative treatment for midshaft clavicle fractures. In Proceedings of the 72nd Annual Meeting of the American Academy of Orthopaedic Surgeons. Washington DC, February 2005.
11. McKee MD, Pedersen EM, Jones C et al. Deficits following nonoperative treatment of displaced mid shaft clavicular fractures. *J Bone Joint Surg Am* 2006; 88A :35-40
12. S Venkatachalam, G Packer, C Sivaji, A Shipton. Plating Of Fresh Displaced Midshaft Clavicular Fractures. *The Internet Journal of Orthopedic Surgery*. 2006 Volume 5 Number 1p16
13. Nicholas AF, Hodgson P, Vannet N, Williams R, Evans RO. Locked intramedullary fixation vs plating for displaced and shortened mid shaft clavicle fractures: A randomized clinical trial. *J Shoulder Elbow Surg* (2010) 19,783-9
14. Nowak J, Mallmin H, Larson S. The aetiology and epidemiology of clavicular fractures. A prospective study during a two year period in Uppsala, Sweden. *Injury* 2000; 35(3):353-8.
15. Paladini P, Pellegrini A, Merolla G, Campi F, Porcellini G. Treatment of clavicle fractures. Unit of Shoulder and Elbow Surgery. *Traslational Medicine@UniSa*, -ISSN 2239-9747 2012, (6):47-58.
16. Throckmorton T, Kuhn JE. Fractures of the medial end of the clavicle. *J Shoulder Elbow Surg* 2007; 16:49-54.
17. Mullaji and Jupiter JB. Low contact dynamic compression plating of clavicle. *Injury* 1994; 25(1):41.
18. S Venkatachalam, G Packer, C Sivaji, A Shipton. Plating Of Fresh Displaced Midshaft Clavicular Fractures. *The Internet Journal of Orthopedic Surgery*. 2006 Volume 5 Number 1p16
19. Postacchini R, Gumina S, Farsetti P, Postacchini F. Long term results of conservative management of midshaft clavicle fracture. *Int Orthop*. 2010 June; 34(5):731-6
20. Mullaji and Jupiter JB. Low contact dynamic compression plating of clavicle. *Injury* 1994; 25(1):41.
21. Nordqvist A, Petersson CJ, Redlund-johnell I. mid clavicle fractures in adults: end result study after conservative treatment. *J Orthop Trauma* 1998; 12(8):572-576.
22. Hartmann F, Hessmann MH, Gercek E, Rommens PM. Elastic Intramedullary Nailing of Midclavicular Fractures. *Acta Chir Belg*. 2008;108:428-32.
23. Chen CE, Juhn RJ, Ko JY. Anterior inferior plating of middle third fractures of the clavicle. *Arch Orthop Trauma Surg* 2010 April; 130(4):507-11
24. Alikhan MA, Lucas HK. Plating of fractures of the middle third of the clavicle. *Injury* 1978; 9(4):263-267.
25. David JM and Robert MS, Sacramento California. The operative treatment of mid shaft clavicular non unions. *JBJS* 1985; 67-A: 1369.
26. Thyagarajan DS, Day M, Dent C, Williams R, Evans R. Treatment of mid-shaft clavicle fractures: a comparative study. *International journal of shoulder surgery*. 2009 Apr 1;3(2):23
27. P Choudhari C. Displaced Mid-Shaft Clavicle Fractures: A Subset for Surgical Treatment. *Malaysian orthopaedic journal*. 2014 Jul; 8(2):1.

How to cite this article:

Dipesh Kumar et al (2017) 'Evaluation of displaced fractures of clavicle managed by reconstruction plate', *International Journal of Current Advanced Research*, 06(07), pp. 4771-4775. DOI: <http://dx.doi.org/10.24327/ijcar.2017.4775.0580>
