National Journal of Clinical Orthopaedics

ISSN (P): 2521-3466
ISSN (E): 2521-3474

www.orthoresearchjournal.com
2019; 3(1): 57-61
Received: 04-11-2018
Accepted: 08-12-2018

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Evaluation of functional outcomes in clavicle fracture treated with anatomical locking compression plate

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DOI: https://doi.org/10.33545/orthor.2019.v3.i1b.12

Abstract
Background: The aim of this study to assess the functional outcome in clavicle fracture treated with anatomical locking compression clavicle plate conducted at Dhiraj Hospital, Vadodara Gujarat. The patient history and examination findings were recorded and then radiological investigation were ordered to confirm the diagnosis.
The findings and plan of management were discussed with operating consultant and recorded in 2 separate profoma. Any change in opinion between the consultant were noted in the profoma.
Result: The result evaluated by DASH SCORE in our study. Out of 34 patients 20(58.9%) patients had good result, 12(35.3%) had excellent result and 2(5.8%) had poor result
Conclusion: We conclude that Anatomical Locking Clavicle Plate is preferred for the treatment of displaced or non-united clavicle fractures with better functional outcome and faster recovery compared to other modes of treatment.

Keywords: Clavicle fracture, Anatomical Locking Clavicle plate, Dash Score.

Introduction
Clavicle fractures are common injuries in young individuals and they account for 2.6% of all fractures with an annual incidence of 29 per 100,000 population per year [1-6]. The incidence in females is constant with peaks seen in teenagers due to sports, motor vehicle accidents and the elderly with osteoporotic fractures from simple falls [1]. The majority of clavicle fractures (80-85%) occur in the midshaft of the bone where the typical compressive forces are applied to the shoulder and the narrow cross section of the bone combine and result in bony failure. Distal third clavicle fractures are the second common type (20%) which tend to occur in more elderly individuals as a result of simple fall. Medial third fractures are rarest (5%), mostly because of difficulty in accurately imaging and identifying them. Motor vehicle accident is the usual mechanism of injury with a relatively high (20%) associated mortality rate from concomitant head and chest injuries [1-2].

Materials and Methods
The prospective study was carried out in the selected group of patients treated in the Department of Orthopaedics, Dhiraj Hospital, S.B.K.S. Medical Institute & Research Centre, Sumandeep Vidyapeeth University, Piparia, Vadodara.
Study was conducted on consecutive 34 patients diagnosed with clavicle fractures presented to the Casualty and orthopaedic department from April 2015 to October 2017, after taking written and informed consent patients were selected according to the inclusion criteria of the study.
After getting fitness from anesthetist, patient was taken for fracture fixation with locking anatomical compression plate. An incision centered over the fracture medially from the sternal notch laterally up to the anterior edge of acromion was kept. The lateral platysma was released, clavipectoral fascia was incised and fracture was exposed. The fracture was reduced and fixed with bone clamps or K wire. Fixation was done with the help of lateral end anatomical or S shaped anatomical plate. If the fracture was oblique then lag screw was placed to hold both the fragments. Both the muscle and the subcutaneous layers are closed with

interrupted absorbable sutures. The skin layer is closed with subcuticular stitches followed by skin suturing. The limb was placed in shoulder immobilizer in the post op period. Regular dressing was done on 2, 5, 8 days and suture removal was done in between 12-14 days. The pendulum exercises were taught to patients. Regular follow up was taken on 3,6,12 and 24 weeks. At the time of follow-up patients were assessed clinically and radiologically on the basis of DASH scoring system. Once early callus formation was present on x-ray patients were advised progressive weight lifting, till patients were mobilized with full weight lifting.

Observations & Results

34 cases of fracture clavicle treated with open reduction and internal fixation using anatomical locking clavicle plate have been presented. The follow up results are analyzed and discussed.

Age Distribution

Age Group (In Years)	Number of Patients
10-20	2(5.8%)
21-30	15(44.2%)
31-40	10(29.5%)
41-50	4(11.7%)
>50	3(8.8%)
Total	34(100%)

- The patients were in the age group of 18 to 56 years with mean average age of 32 years.

Sex Distribution

Sex	Number of Patients
Female	4(11.7%)
Male	30(88.3%)
Total	34(100%)

- There was male predominance. Male: Female ratio was 7.5:1.

Mode of Injury

Mode of injury	Number of patients
Fall From Height	15(44.2%)
Vehicular Accident	19(55.8%)
Total	34(100%)

- Commonest mode of injury was vehicular accident (55.8%) and fall from height (44.2%).

Interval between injury and operation

Interval (Weeks)	Number of Patients
<7 days	30(88.4%)
7-10 days	2(5.8%)
>10 days	2(5.8%)
Total	34(100%)

- Majority of patients were operated within 7 days from injury.

Side Affected

Side Affected	Number Of Patients
Left	20(58.8%)
Right	14(41.2%)
Total	34(100%)

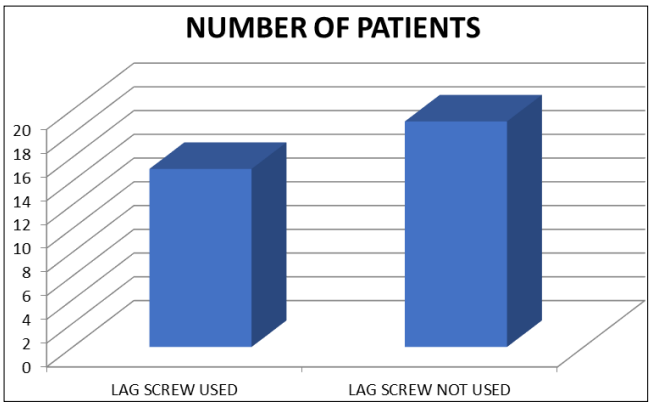
- Left side was affected in majority of patients (58.8%).

According to allman's classification

Grade	Number of Patients	Percentage (%)
Middle third(M/3)	28	82.4%
Lateral third(L/3)	6	17.6%
Medial third(Med/3)	0	0
Total	34	100%

- Majority of our patients were having Middle third fracture (82.4%) according to Allman's classification.

Inter-fragmentary lag screw was used in 15(44.2%) patients



Fracture Union

Number of weeks	Number of patients
<6	0(0%)
6 to 8	5(14.7%)
9 to 10	18(52.9%)
11 to 12	9(26.5%)
>12	2(5.9%)
Total	34 (100%)

- In majority of the patients, fractures were united within 9 to 10 weeks.
- Mean union time was 10.6 weeks.

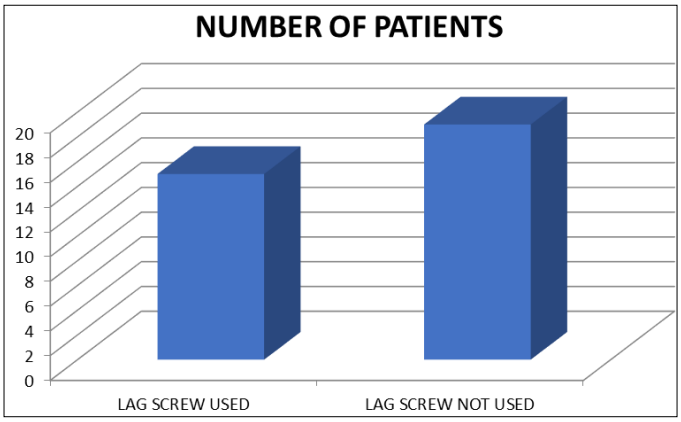
Final Dash Score

Dash Score	Number of Patients
<30	3(8.8%)
30-34	12(35.3%)
35-39	11(32.4%)
40-44	6(17.7%)
45 Or More	2(5.8%)
Total	34(100%)

Majority had final dash score around 34.

Final Result

Final Result	Number of Patients
Excellent	12(35.3%)
Good	20(58.9%)
Poor	2(5.8%)
Total	34(100%)



- Out of all 34 patients, majority 20(58.9%) had a Good result and 12(35.3%) had excellent result, 2(5.8%) had poor result.

Discussion

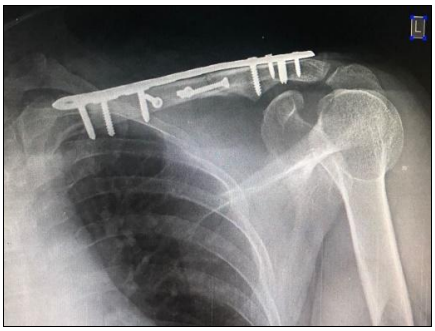
In our study the patients mean age group of presentation was 32 years compared to the study of Chul Hyun Cho *et al.* where the mean age was 46 years and a study in Kathmandu Medical Journal had mean age of 31years. There was male predominance in our study which is the same in Chul Hyun Cho *et al.* study, the Male to Female ratio in our study was 7.5:1, compared to 17:5 respectively in Chul Hyun Cho *et al.* and study in Kathmandu University Medical Journal which had a ratio of 4:1. Commonest mode of injury was vehicular accident (55.8%) and fall from height (44.2%) which was similar to Chul Hyun Cho *et al.* and the study in Kathmandu University Medical Journal. Majority of our patients were laborers and farmers by occupation. In our study majority of our patients were operated within 7 days from injury. Left side was most affected in majority of our patients (58.8%) compared to a study in Kathmandu University Medical Journal where both sides were equally affected. Majority of our patients were having Middle third fracture(82.4%) according to Allman's classification which is the same compared to Chul Hyun Cho *et al.* and a study in Kathmandu University Medical Journal. 6 patients had associated medical illness and 4 had associated bony injury in our study. In the line of management for fracture with anatomical locking compression plating we used bone substitutes in 2(5.8%) patients and Inter fragmentary screw was used in 15(44.2%) patients. Intra-Operatively, no complications were encountered in any patients. In postoperative period, one patient had broken implant and one patient had deep infection compared to Chul Hyun Cho *et al.* where he had documented 1 patient with hypertrophic scar, 1 mild pain and 1 limitation in movement whereas a study in Kathmandu University Medical Journal had 1 deep infection and 1 frozen shoulder which emphazises the nedd for physiotherapy and aseptic precaution in post operative management. In majority of the patients, fractures were united within 9 to 10 weeks. Mean union time in our study is 10.6 weeks compared to 11 weeks, 13.2 weeks from a study in Kathmandu University Medical Journal and Chul Hyun Cho *et al.* respectively. Majority had FINAL DASH SCORE around 34 compared to the outcomes of a study in Kathmandu University Medical journal and Chul Hyun Cho *et al.* which was 41 and 34.81. All 34 patients had full range of motion at final follow up without any limitation compared to that of both studies of Kathmandu Medical Journal and Chul Hyun Cho *et al.* were they had 1 patoent each with limitation of movements. Out of all 34 patients, majority 20(58.9%) had a GOOD result and 12(35.3%) had excellent result, 2(5.8%) had poor result according DASH SCORE.

Table 10

Parameter	Present study of 34 cases	Operative fixation of displaced clavicle fracture with superior reconstruction plate osteosynthesis (Kathmandu university medical journal) Study of 20 cases	Operative Treatment of Clavicle Midshaft Fractures: Comparison between Reconstruction Plate and Reconstruction Locking Compression Plate (study of 22 cases)
Mean Age	32YR	31YR	46 YR
Sex			
Male	88.3%	80%	77.27%
Female	11.7%	20%	23.73%
Side			
Right	41.2%	50%	-
Left	58.8%	50%	
Type			
Middle Third	82.4%	100%	-
Lateral Third	17.6%		
Intra Op Complication	NIL	NIL	NIL
Post Op Complication	One patient had broken implant & one patient had deep infection	1 deep infection 1 frozen shoulder	1 hypertrophic scar 1 mild pain 1 limitation in movement
Mean Union Time (Wks)	10.6	11	13.2
Mean Final Dash Score	34	41	34.81
Final Range of Motion	Full	Full	Full
Final Result			
Excellent	35.3%	2%	
Good	58.9%	94%	-
Poor	5.8%	4%	

Case 1

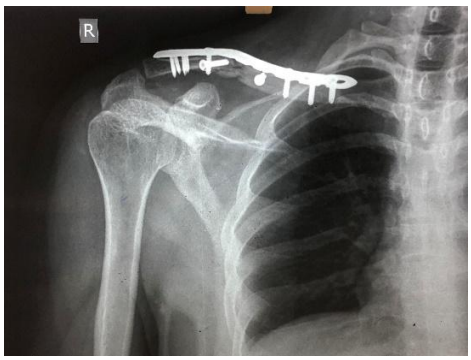
Pre-op X-Ray showing mid third clavicle fracture with a fragment



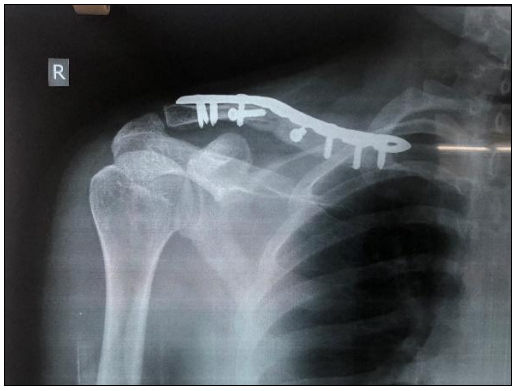
Post-op X-Ray after fixing it with clavicle plate and inter fragmentary screws

Case 2

Pre-op X-ray of mid third fracture



Immediate post-op X-ray after fixation

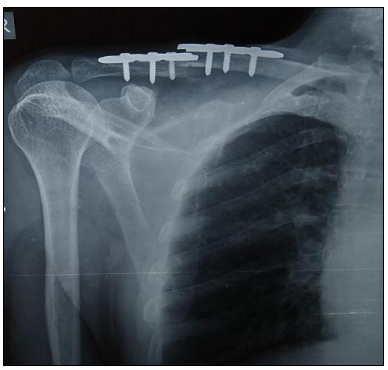


Final follow up X-ray

Abduction at final follow up

Overhead abduction at final Follow up

Case 3



Pre- op X-Ray of broken implant in clavicle fracture with no signs of union

Post-op X-Ray after Re-surgery

Final Follow up movements

Conclusion & Summary

- The patients were in the age group of 18 to 56 years with mean average age of 32 years.
- There was male predominance. Male: Female ratio was 7.5:1.
- Commonest mode of injury was vehicular accident (55.8%) and fall from height (44.2%).
- Majority of our patients were laborers and farmers by occupation.
- Majority of patients were operated within 7 days from injury.
- Left side was affected in majority of patients (58.8%).
- Majority of our patients were having Middle third fracture (82.4%) according to Allman's classification.
- 6 patients had associated medical illness.
- 4 patients had associated injury.
- Bone substitutes were used in 2(5.8%) patients.
- Inter fragmentary screw was used in 15(44.2%) patients.
- Intra-Operatively, no complications were encountered in any patients.
- In postoperative period, one patient had broken implant and one patient had deep infection.
- In majority of the patients, fractures were united within 9 to 10 weeks.
- Mean union time was 10.6 weeks.
- Majority had Final Dash Score around 34.
- All 34 patients had full range of motion at final follow up without any limitation.
- Out of all 34 patients, majority 20(58.9%) had a Good result and 12(35.3%) had excellent result, 2(5.8%) had poor result.

It is concluded that Anatomical Locking Clavicle Plate is preferred for the treatment of displaced or non-united clavicle fractures with better functional outcome and faster recovery compared to other modes of treatment.

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