

Original Research Article

Functional outcome of displaced mid shaft clavicular fractures treated by plate fixation: a prospective observational study

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ABSTRACT

Background: Clavicle fractures are one of the commonest injuries to the shoulder girdle. Traditionally these fractures are treated conservatively. This study was to assess the functional outcome of displaced mid shaft clavicular fractures treated with plate fixation.

Methods: This was a single center prospective observational study conducted at department of orthopaedics M.E.S medical college Perinthalmanna between the period January 2018 to December 2018 in patients with displaced mid shaft clavicle fractures treated by plate fixation. Out of 51 patients 35 patients were males and 16 were females with mean age of 37.7 years (range 19-59). All patients included in this study were included under Allman group 1. All Patients were treated with plate fixation. Post op follow done at 1 1/2 ,3 and 6 months. During follow up clinical and radiological union were checked. Final functional outcome was assessed at 6 months follow up by Constant-Murley Score.

Results: Out of 51 patients with displaced mid shaft clavicle fractures treated with plate fixation 43 patients (84.3%) showed excellent functional outcome 8 patients (15.7%) showed good functional outcome. None of the patients showed moderate or poor outcome. The radiological union was attained at 9.35 weeks. No complications in 83.4% of patients.

Conclusions: Mid shaft clavicle fractures are more common in young males sustaining high energy trauma, and those fractures treated with plate fixation has a better functional outcome in terms of pain relief, activities of daily living and range of motion.

Keywords: Mid shaft, Clavicle fractures, Allman group, Constant Murley score

INTRODUCTION

Clavicle fractures represent the 44-66% of all shoulder girdle fractures.¹ Most of the clavicle fractures occurs as a result of direct blow to the shoulder or a fall on an outstretched arm.² In adults, more than two-thirds of these injuries occur at the diaphysis, and the chance for displacement are great compared with medial and lateral third fractures (probably due to high energy trauma through sports and traffic accidents).³

Traditionally, clavicle fractures were treated non-operatively and the reported rates of non-union were less than 1% after conservative treatment.^{4,5} Recently, there is increasing evidence which shows that conservative treatment of displaced midshaft clavicle fractures has a higher rate of non-union and deficits in shoulder muscle strength and endurance. Good results with high union rates and low complication rates of displaced fractures of clavicle has been achieved with surgical fixation of mid shaft clavicle fractures. It has therefore been suggested that surgical intervention for these fractures should be considered as first line due to lower rates of non-union and

greater patient satisfaction. The concept of early surgical fixation and exact post-operative protocol all have convincingly improved the good functional outcome of the patient to a larger extent.⁶

METHODS

This prospective observational study was conducted among patients with displaced mid shaft clavicle fractures treated by plate fixation at Department of orthopaedics, MES medical college, Perinthalmanna during the period from January 2018 to December 2018. The study included all patients within the age group 18-60 years and displaced mid shaft clavicle fractures as per Allman group I: Substantial displacement (more than 100%), comminution ("Z-deformity") or shortening (>1 to 2 cm). Open fractures, pathological fractures, patients with associated head injury, neurovascular injury, acromioclavicular joint dislocation, established non-union from previous fracture, any medical contraindication to surgery or general anaesthesia (heart diseases, renal failure or active chemotherapy), patient not giving consent for surgery were excluded.

Sample size was calculated based on the formula $4pq/d^2$ with 95% confidence interval and 5 percentage alpha error. 'P' was taken as proportion of patients with good constant Murley score in study by Lokesh et al¹³, which was given as 15%. Absolute error (d) was taken as 10%, and the subsequent sample size calculated was 51.

Preoperative management

All patients were received in the emergency department. Then general information of the patient like name, age, sex, occupation and address noted. Then detailed history regarding the mode of injury like Road traffic accident, direct injury to the shoulder or fall on outstretched hand and site of pain or swelling is noted. History of any comorbidities or medications were noted. Initial general examination of the patient including airway, breathing and circulation is noted and further detailed examination of the affected extremity is done (Figure 2). This was followed by local examination and radiological evaluation.

The affected limb was immobilised with clavicle brace and arm sling and then subjected to pre-operative evaluation and plate fixation of the displaced clavicle. (Figure 2)

Surgical procedure (Figure 3)

Patient in supine or propped up position (45 degrees) with sand bag placed between the medial border of ipsilateral scapula and spine. Entire upper limb from the base of neck to the hand were prepared and draped. Anterior approach to the clavicle with 7-10 cm centring clavicle over fracture. The skin incision was deepened through the platysma to reach the subcutaneous border of clavicle. Fracture ends freshened and periosteum elevated. Fracture reduction obtained with bone clamps and pre contoured plate placed

on the superior aspect of the clavicle. Plate secured with locking cortical screws, with at least 3 screws in the medial and lateral fragments. Final reduction were confirmed under C-arm guidance. Haemostats achieved and wounds were closed in layers and sterile dressings was applied.

Postoperative management

Post-operative immobilisation was done using an arm pouch. Initial wound inspection on 3rd post-operative day. Gentle pendulum exercises were allowed in the initial period up to 2 weeks. From 4 to 6 weeks active range of motion of the affected shoulder advised, but overhead abduction was prevented. At 6 to 8 weeks active range of motion in all planes allowed.

Follow up

Regular follow up on 1 1/2 months, 3 months and 6 months were done. On each follow up clinical and radiological assessment of fracture were done to assess for union, implant and complications. Rehabilitation of the affected extremity were done according to the stage of fracture and time duration from surgery. The patients were assessed till 6 months. Final functional outcome score was calculated using constant Murley score. Implant removal were done after fracture has united well at 10 to 12 months.

For evaluating the functional outcome, we used the constant Murley score devised by C Constant and A Murley.⁷

All data obtained during the study was entered into Microsoft Excel (version 2007) after coding. Statistical analysis was done after exporting the coded data into Epi Info by CDC. Categorical variables were summarized in terms of frequencies and percentages, while continuous data are presented as means with their standard deviation.

RESULTS

A total of 51 subjects were included in the final analysis. The mean age was 37.37 ± 10.66 years ranging from 19 to 59 years. Among the study population, 35 (68.6%) were male and 16 (31.4%) were female. Majority of the study population had injury from RTA (Figure 2).

Table 1: Descriptive analysis of total score in the study population (n=51).

Total score	Frequency	Percentage
Good	8	15.7%
Excellent	43	84.3%

36 (70.6%) had right side and 15 (29.4%) had left side fracture. The mean time of surgery was 1.8 ± 0.85 days in the study population, minimum was 1 and maximum was 4 in the study population (95% CI 1.57 to 2.04). Among the study population, 46 (90.2%) had pre-contoured plate and 5 (9.8%) had recon plate.

Table 2: Comparison of mean of Overall score between the study groups (n=51).

Parameter	Age group (Mean±SD)		P value
	≤40 (N=30)	>40 (N=21)	
Overall score	98.23 ± 2.9	88.52 ± 5.43	<0.001

Table 3: Descriptive analysis of overall score in study population.

Parameter	Mean±SD	Median	Min	Max	95% CI	
					Lower	Upper
Overall score	94.24 ± 6.32	96.00	74	100	92.46	96.01



Figure 1: Examination of the study subject (in clockwise manner).



Figure 2: Clavicle fracture before and after plate fixation.

The mean mobilisation started in days was 2.78±0.7, minimum was 2 and maximum was 4 in the study population (95 % CI 2.59 to 2.98).



Figure 3: Surgical procedure in clockwise manner.



Figure 4: Hypertrophic scar presentation in a post-operative patient.

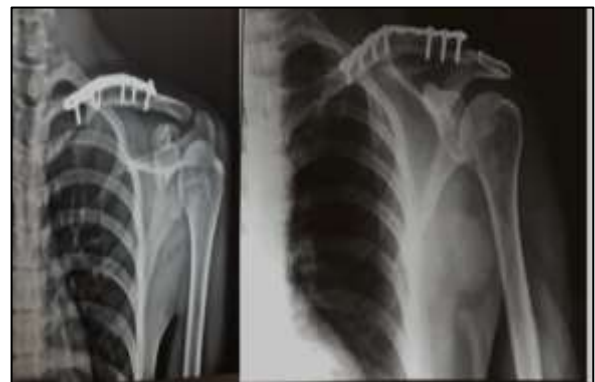


Figure 5: Plate bending and implant loosening in post-operative patient.

The mean clinical union was 7.24±1.01 weeks in the study population, minimum was 6 and maximum was 9 in the study population (95% CI 6.95 to 7.52). The mean

radiological union was 9.35 ± 1.57 weeks in the study population, minimum was 6 and maximum was 12 in the study population (95% CI 8.91 to 9.80). Among the study population, 4 (7.8%) had hypertrophic scar (Figure 4) and 3 (5.9%) were with plate bending and implant loosening (Figure 5).

The mean of Overall score was 94.24 ± 6.32 in the study population, minimum level was 74 and maximum level was 100 in the study population. Majority of the study population had excellent outcome (Table 1).

The mean Overall score of people aged ≤ 40 was significantly higher than those aged more than 40 among the study population (Table 2).

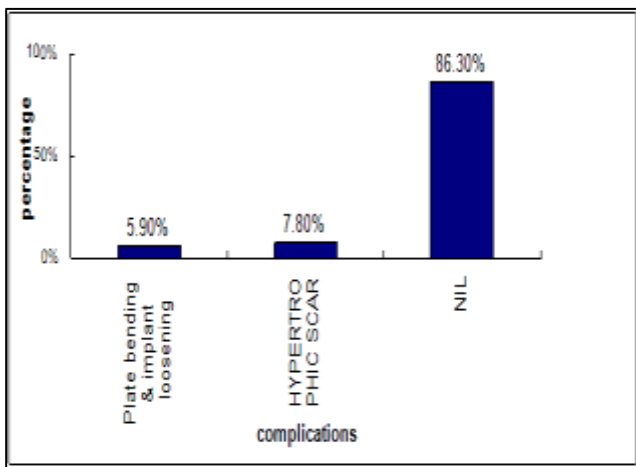


Figure 6: Complications in the study population (n=51).

DISCUSSION

Clavicle fractures, one of the common fractures of adult population are often treated by conservative method since the time of Hippocrates. In clavicle fractures, major determining factor for better functional outcome is the restoration of clavicular length. In 1790, Therselben described that the chief function of clavicle is to keep the shoulder blade away from the axial skeleton and that helps in proper functioning of the shoulder.⁸ For a long period of time conservative management was the mainstay of treatment for clavicle fractures. These fractures were conservatively treated with a simple sling or figure of 8 bandage. Based on review of various recent studies the effectiveness of non-operative management is found to be inferior in providing optimal outcome particularly in young population. Recent studies suggest that the operative management of mid shaft clavicle fractures resulted in lower non-union rates, improved functional outcome, early functional return, better cosmesis and increased patient satisfaction.

In this study the mean age was 37.37 ± 10.66 years in the study population, minimum age was 19 years and maximum age was 59 years (95% CI 34.37 to 40.37). In a

study by Bostman et al patients average age was 33.4 and the youngest patient was 19 years old and oldest patient was 62 years.⁸

In this study population, 35 (68.6%) were male and 16 (31.4%) were female. Compared with Bostman et al study including 76 male patients (73.79%) and 27 female patients (26.21%).⁸

The mean time of surgery was 1.8 ± 0.85 days in the study population, minimum was 1 and maximum was 4 in the study population (95% CI 1.57 to 2.04). In Bostman et al study all patients were operated within 3 days of injury.⁸ In Cho et al (84) study, the reconstruction plate group was operated by 4 days and locking compression plate by 9 days.⁹

The mean radiological union in our study was 9.35 ± 1.57 weeks in the study population, minimum was 6 and maximum was 12 in the study population (95% CI 8.91 to 9.80). Lazarus stated that radiological union occurred approximately between 6 and 12 weeks in his study.¹⁰ In Cho et al study, bony union for reconstruction plate was 14.6 weeks and that of locking compression plate was 13.2 weeks.⁹

In this study, 4 (7.8%) had hypertrophic scar and 3 (5.9%) were with plate bending and implant loosening (figure 6). In Bostman et al study 7 patients (6.80%) had implant loosening and skin complications in 23% patients.⁸ In Cho et al study the reconstruction group had plate loosening in 3 patients (15.8%).⁹

The mean of Overall score was 94.24 ± 6.32 in the study population. (Table 3). Among the study population, 30 (58.8%) people were aged ≤ 40 and 21 (41.2%) people Aged over 40. The mean overall score of people aged ≤ 40 was 98.23 ± 2.9 and it was 88.52 ± 5.43 for people aged over 40, the association between two groups was statistically significant ($p < 0.001$). In Olivier et al study, 23 patients (76.6%) had excellent functional outcome, good functional outcome in 5 patients (16.6%) and fair functional outcome in 2 patients (6.6%).¹¹ Robinson et al concluded that surgical fixation of mid shaft clavicular fractures has a better outcome compared to conservative management as evident by the constant score of 92.0 in the operative group compared to 87.8 in non-operative group.¹²

CONCLUSION

Mid shaft clavicle fractures are more common in young males sustaining high energy trauma, and those fractures treated with plate fixation has a better functional outcome in terms of pain relief, activities of daily living and range of motion.

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Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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