ORIGINAL RESEARCH PAPER

Orthopaedics

FUNCTIONAL OUTCOMES OF OPEN REDUCTION AND INTERNAL FIXATION OF DISPLACED CLAVICLE FRACTURES IN ADOLESCENTS

KEY WORDS: displaced, closed, mid-shaft clavicle fractures, adolescents, ORIF

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ABSTRACT

INTRODUCTION: Clavicle fractures are common, surgical treatment of displaced clavicle fractures is controversial. The purpose of this study was to analyze the potential of open reduction and internal fixation for displaced mid-shaft clavicle fractures in adolescent patients.

MATERIALS AND METHODOLOGY: We reviewed our series of surgical cases performed in 24 adolescents (mean age: 14.6 years) with displaced unilateral clavicle fractures. Baseline data acquisition included demographic and radiographic variables. A Locking clavicular plate was utilized for fixation in all cases.

OBSERVATIONS: Postoperative monthly visits till three months followed by regular visits every three months. Clinically we used Constant shoulder score system for evaluation of all patients. The Grading of scores as follow: >90 Excellent 80-90 Good 70-80 Fair, <70 poor Excellent / good indicates satisfactory results, where as fair / poor indicates unsatisfactory results. Radiographic bony union was obtained in 22 patients, and other two patients were non-union. The mean time to union was 10.73 weeks.

At the end of follow up, the mean constant shoulder score was 91.86, which 12 cases were > 90 Excellent score, 9 cases was between 80-90 which Good score, one case from 70 to 80 which fair score and two cases less than 70 which poor outcome and those patients were non-union outcomes

CONCLUSION: Anatomical reduction with internal fixation and early mobilization of adolescent displaced clavicle fractures remains a viable treatment option with predictable results and no major complications in reliable hands.

INTRODUCTION

The treatment of displaced mid-shaft fractures of the clavicle continues to be a topic of controversy. Traditional treatment of clavicular fractures has been via non-operative methods both in children and adults.[1-6] Scientific literature has increasingly questioned the patient oriented outcomes in recent years. Many reports point out higher rates of complications such as shortening, nonunion, deformity and unsatisfactory patient-derived outcomes in cases of adult displaced mid-shaft clavicle fractures.[7-14] Two recent randomized controlled studies have demonstrated superior results in favor of the operative treatment in cases of completely displaced clavicle fractures in the adult population.[15,16]

Skeletally immature patients with clavicle fractures represent a special cohort of patients that are known to have a high rate of fracture healing and good remodeling potential.[17-20] However, as they transition into adolescence, their activity level and functional expectations rise rapidly and in fact may outweigh the activity expectations of most adults. Thus, they may have relatively greater functional impairment from residual disability at their age as compared to young or older adults. Although, clavicle fractures in adolescents have been traditionally treated non-operatively, the positive outcomes achieved from fixation of displaced clavicle fractures in young adults could challenge this classical treatment philosophy. Sports and trauma sub-specialty orthopedists are increasingly being obligated to fix these fractures by patients and parents of highly functional and active adolescents.

The purpose of this retrospective study was to analyze the potential of open reduction and internal fixation for displaced mid-shaft clavicle fractures in cases of adolescent patients

MATERIALS AND METHODOLOGY

we reviewed our series of surgical cases performed from January 2016 to July 2019 that included 24 adolescents with displaced unilateral clavicle fractures. Inclusion criteria for surgery were: clavicle fracture that was completely displaced and shortened by more than 15 mm, dominant arm in a high-end athlete, comminuted fracture including a z-shaped configuration with central segmental fragment / butterfly irrespective of the amount of shortening (Fig 1), and tenting of the skin associated with fracture (impending open fracture).

There were 13 males and six female patients. In 16 out of 19 cases, the dominant side was affected. Baseline data acquisition included demographic as well as radiographic variables. Plain radiographic evaluation involved a standard anteroposterior and a 45° cephalic tilt view[21] in order to assess fracture pattern and displacement including angulation

In all cases, surgical treatment was performed using a standard positioning on a Jackson radiolucent flat table for optimal intra-operative radiographic assessment with the patient in the supine position and a bump between the scapulae for optimal positioning and intra-operative fracture reduction. A Locking clavicular plate (side appropriate) was utilized for fixation in all cases.

Post-operatively, all patients underwent standardized protocol until full recovery. In the immediate post-operative period they were placed in a shoulder immobilizer with a bulky dressing and discharged home on post-op day (POD) 1 (n=14) or POD 2 (n=5). All patients came back for an initial post-operative check at 7–10 days. Following wound check they were allowed to start gentle oscillatory movements and pendulum exercises while placing the arm back in the shoulder immobiliser.

Second follow-up in all cases was at 3–4 weeks from initial surgery and included repeat radiographs. The shoulder immobilizer was discontinued and a sling was provided for support (for a week more). Range of motion (ROM) exercises (active and active-assisted) were now started. Overhead activities and weight lifting (>1 kg) were specifically avoided. Patients were brought back at the 6–7 week interval and repeat radiographs were performed. At this time overhead activities were permitted (with continuation of ROM increase) and strengthening exercises were started. At 12 weeks post-surgery, the patients were allowed to return to full sports including contact sports if radiographs did not reveal any abnormalities and clinical exam remained normal with full recovery of strength.

Fig 1 preoperative xray

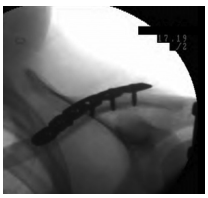


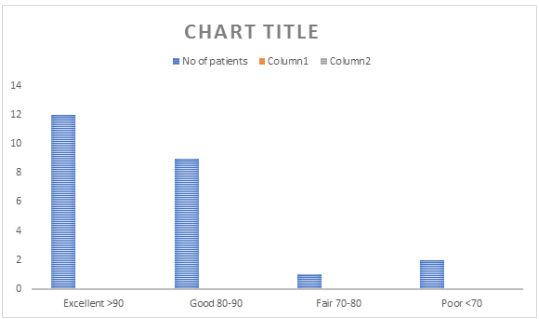
fig 2 postoperative xray

RESULTS

Postoperative monthly visits till three months followed by regular visits every three months. Clinically we used Constant shoulder score system for evaluation of all patients. The Grading of scores as follow: >90 Excellent 80-90 Good 70-80 Fair, <70 poor

Excellent / good indicates satisfactory results, where as fair / poor indicates unsatisfactory results. Radiographic bony union was obtained in 22 patients, and other two patients were non-union. The mean time to union was 10.73 weeks.

At the end of follow up, the mean constant shoulder score was 91.86, which 12 cases were > 90 Excellent score, 9 cases was between 80-90 which Good score, one case from 70 to 80 which fair score and two cases less than 70 which poor outcome and those patients were non-union outcomes As seen in column graph.



Graph no 1 showing distribution of patiets as per Constant shoulder score

Table no 1 showing clinical results in 24 pateints

Union rate	91(n 22)
Mean Shoulder score	91.86
Mean union time(weeks)	10.73
Return to work in 3 months	83.3(n=20)
Symptomatic hardware	8.3(n=2)

DISCUSSION

The clavicle fractures are common, because of their subcutaneous position, accounting for 2.6% of all fractures, more than 75% located in the mid shaft, after that coming lateral fractures, then rarely medial clavicle fractures [21]. Many conservative treatment ways have been described, but the most common are simple arm sling or figures of eight bandage have been widely used [22].

The arm sling use in the clavicle fractures, demonstrated better patient satisfaction. Moreover, figure of eight bandage which associated with higher complications, the some of these complications was axillary pressure sore, and neurovascular compression [23].

However; the many of recent studies have demonstrated higher rate of complications after non operative treatment, such as non-union, and poor functional outcome, while the results of operative treatment such as open reduction and internal fixation by plate as primary decision, have improved considerably [24-27]. The numerous of muscular and ligamentous forces, act on the clavicle, such as deforming force of sternocledomastoid after fracture, is very strong and cannot be overcome by external supports such as sling arm or figure eight bandage.[28]

Overall, the results of this study suggest, the open reduction and internal fixation of clavicle fracture, was satisfied, which the union rate in our study, was 91 %, which is comparable to that in Naveen et al (2017) [29], which here union rate was 100%, in study of management of mid shaft clavicle, its comparative study between operative and non-operative, consisting 60 patients, used the plate (DCP 3.5mm). While another study taking about management of distal clavicle fracture, Sylvia A Stegemanet al (2013) [29], its union rat was (98%), hook plate or medullary nail fixation used in this study. We followed up the patients by using constant shoulder score. The mean score was (91.86) after 6 months. However in other study, Chang-Hong Chen et al (2014) [30], its results were 78 ± 6 points at 8 to 12 months. In these study 33 patients, stabilized by hook plate, in another study B. M. Naveen (2017) [31], whereas the mean score after 6 months follow up was (94).

The average duration required for union in our study was 10.73 weeks, as compared to B. M. Naveen (2017)[31], where the result in surgical group was 9.27 weeks. In another study of Zeiad A. Alshameeri et al (2012)(32), under title of the outcome of surgical fixation of mid shaft clavicle fractures, the union was achieved in all patients after an average of 13 weeks.

CONCLUSION

In conclusion, the conservative treatment remains the treatment of choice for simple clavicle fractures, but for displaced and comminuted fractures surgical intervention is appropriate, especially when considering the overall outcome results. Our study included a small cohort of patients and suggests that the Plate fixation of displaced mid shaft or distal clavicle fracture reliably restores length and alignment. It resulted in shorter time to union with low complication rates.

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