Functional Outcome of Closed Displaced Clavicle Fracture Managed Operatively with Pre- contoured Anatomical Locking: A Retrospective Chart Review

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ABSTRACT

INTRODUCTION: Clavicle fracture is a common fracture occurring in adults and children. Most commonly, this fracture occurs within the middle third of the clavicle and may be associated with some degree of displacement. Traditional treatment modalities practised for nondisplaced fractures have many controversies. For largely displaced fractures, recent evidences favour operative management as it significantly decreases the rate of nonunion and malunion compared to nonoperative management. The present study was undertaken to study the role of surgical management in closed and displaced clavicle fractures in terms of functional outcome, duration of fracture healing and postoperative complications.

METHOD: This hospital-based retrospective study was done over a one-year period from 12 January 2015 to 11 January 2016 with study sample of 30 adult patients with displaced closed clavicle fractures managed with locking compression plate and screw under general anaesthesia. Passive range of motion was started from the fifth postoperative day. Data was collected by convenience sampling technique.

RESULT: Patients were operated on within 3 days of hospital admission .The average period of hospital stay was 10 days. The most common mechanism of injury was road traffic accident (RTA) accounting for 88.3% followed by fall on shoulder accounting for 3.3%.

The average time of fracture union was 8 to 12 weeks (mean 9.9 weeks). Good radiographic bony union was achieved in all patients. Constant and Murley score was excellent in 21 (mean 70%) and good in 9 (mean 30%) patients. Postoperatively, 3 patients had superficial surgical site skin infection and 5 patients had hypertrophic scar.

CONCLUSION: The use of the pre-contoured locking compression plate and screws in displaced clavicle fracture provides a rigid, secure and reliable fixation with early mobilisation. It also prevents development of shoulder stiffness and nonunion.

KEY WORDS: Clavicle, Fracture, Non-displaced, Pre-contoured plate and screws.

INTRODUCTION

Clavicle fracture is one of the most common fractures around the shoulder girdle. The clavicle fracture accounts for 2%-4% of all fractures and 35%-45% of all injuries to the shoulder.[1,2] Traditionally fractures have been treated conservatively, even when there were displaced fractures.[3,4] Studies have shown suboptimal outcomes and nonunion when displaced fracture were managed conservatively[5,6] and non-operative treatment brought out impairment function of shoulder and non- cosmetic bump at the base of the neck due to the shortening of the clavicle and exuberant callus formation.[5] when similar type of displaced clavicle fractures were treated operatively with various treatment modalities, there were significant reduction of the complications.[2] Good functional outcomes with high union rates, rigid fixations with low rate of complications have been reported with various surgical modalities of Kirschner wire (K-wire), Rush nails, Intramedullary K-wire, and other devices.[7,8]

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However some disadvantages have been reported including nonunion, hardware breakage, wound infection, hardware prominence, hypertrophic scar, repeat surgery for implant removal. The primary aim of this study was to evaluate the functional outcome of displaced clavicle fractures and secondary aim was to assess the complications managed by open reduction internal fixation (ORIF) with pre-contoured clavicle plate and screws.

METHOD

This hospital-based retrospective study was done over a period of one year from 12 January 2015 to 11 January 2016 among 30 patients with closed displaced clavicle fracture who underwent ORIF with clavicle plate and screws. The inclusion criteria included the displaced clavicle fractures of all types: transverse, oblique, and comminuted. The exclusion criteria included those cases that reported to the department with re-fracture. There was one case of re-fracture after four weeks of surgery which went for operative management again and was not included in the study. The research was done following the ethical approval from Institutional Review Board of National Academy of Medical Sciences (NAMS). Demographic variables, mode of injuries, side of the injury, interval between injury to surgery period, duration for union, nonunion, infection of surgical site, and time of mobilisation were recorded. After preanaesthetic check-up patients were operated. The operations were performed under general anaesthesia in supine patient position. Infraclavicular approach was achieved by proximally retracting the skin in the supraclavicular fossa and allowing an incision to be marked onto the clavicle centered over the fracture (Figure 1). When the skin retraction was released, the incision mark came to lie below the inferior border of the clavicle. Skin incision was then made along the mark up to the pectoralis fascia. This thick flap was elevated up to the superior surface of the clavicle which helped in preserving pectoralis attachments. After the reduction, the fracture fixation was carried out with the pre-countered clavicle plate and screws. Skin was closed in two layers. Postoperative findings of surgical site infection, scar were noted. Data collected were entered in Microsoft Excel and results were presented as frequencies and percentages. Functional outcome of shoulder was evaluated by Constant and Murley Score (CMS).[9] The CMS is a 100-points scale with different parameters that define level of pain and ability to carry out normal daily activities. The test is divided into four subscales: pain, activities of daily living, strength, and range of motion and rating can be done as poor, fair, good, and very good (Table 1).

Table 1: Constant and Murley Score (CMS)

Parameters		**Maximum score**
Criteria	**Pain**	**15**
	Activities of daily living	20
	Strength	25
	Range of motion	40
Total		100
		CMS (maximum 100 points)
Rating	Poor	<56
	Fair	56-70
	Good	71-85
	Very good	86-100

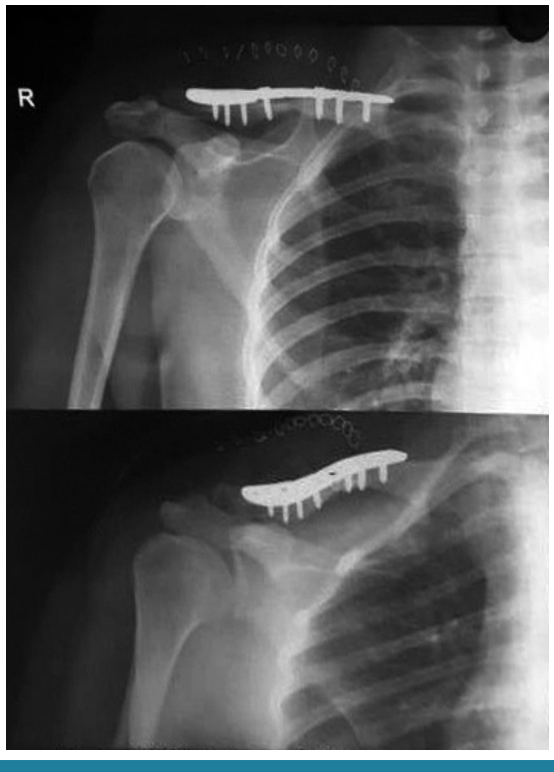

Figure 1: Post operative X-rays

RESULT

Most of the patients were operated within three days of reporting. The majority of patients were male. The most common mechanism of injury was road traffic accident (RTA) accounting for 88.3% followed by fall on shoulder accounting for 3.3%. The age of the patients

ranged from 15 years to 55 years with mean age of 31±9.021 years. Twenty patients (66.67%) belonged to the age group of 15-35 years and 10 (33.33%) patients to age group of 36-55 years. All 30 patients were treated with pre- contoured locking plate under general anaesthesia. Postoperatively, 3 patients had superficial surgical site skin infection and 5 patients had hypertrophic scar. The average time of radiological fracture union was ranging from 8 to 12 weeks (Table 2). The union was achieved in the time period of eight to 10 weeks in 20 patients and between 10 to 12 weeks in 10 patients (Table 2). The average period of hospital stay was 10 days. Passive range of motion was started on the 5th postoperative day. According to CMS for functional outcome, 21 patients (70%) had very good score and 9 (30%) had good score. The significant improvement in CMS reflected good functional outcome. There were no cases reported of nonunion. Complications of screw loosening and plate failure were not found. Good radiographic bony union was achieved in all cases.

Table 2: Radiological fracture union achieved (weeks)

Patients N (%)	Mean	Minimum	Maximum
20 (66.6)	9.9	8	10
10 (33.33)		10	12
Total 30 (100)	9.9	8	12

DISCUSSION

Numerous studies, biomechanical and clinical have been done in an effort to provide optimal treatment of displaced clavicle fractures.[10-13] The overall goal is to maintain sufficiently rigid fixation for bony union and allowing the early mobilisation to prevent stiffness and maximum shoulder function without any complications.[14-17] Several studies have assessed the relative strength of various types of fixation methods in the management of displaced clavicle fractures, including K-wire fixation, intramedullary nail fixation, tension band wiring. Conservative treatment of fractures with shortening is associated with high risk of non-union and unsatisfactory shoulder function.[3,5] Malunion of the clavicle may also alter the position of the glenoid fossa which may affect glenohumeral mobility and scapular rotation, leading to unsatisfactory results especially in young and active patients. Kwak-Lee in comparative study of contoured anatomical plate fixation versus intramedullary rod fixation found that it took a significantly longer operative time who underwent plate fixation 131.8 min (30-246 min), compared to pin fixation at 99.5 min (43-169 min).[18] There was also significantly longer time to fracture union in plate fixation with an average of 14.6 weeks (6-33.5 weeks) compared to pin fixation at 9.5 weeks (6-24 weeks). The study concluded that the both intramedullary pins and contoured clavicle plates were reasonable choices for fixation of midshaft clavicle fractures. The less invasive technique of intramedullary pin fixation might have improved early results with shorter operative times and faster overall fracture healing, but in the long term there was no significant difference in overall rate of union and full shoulder motion between the two groups.

Study conducted by Reddy found that bony union could be achieved with pre-contoured locking plate and the clinical outcomes were satisfactory without delayed and nonunion.[19] The study concluded that locking compression plate can be effective in the treatment of clavicle midshaft fracture which was comparable to our studies. In a similar study, Huang found that the operative treatment in displaced clavicular fractures, with precontoured plates to be safe with better functional outcomes without any complication.[20]

The current study on ORIF by locking plate is comparable with Bostman study done in 103 patients.[21] This study is also comparable with Hundekar which gave conclusion that when there was displacement of more than 2 cm, precontoured locking plate fixation gave excellent results with good functional outcomes with anatomical reduction without removing the implants.[22] It is also comparable with Mohammed, where 34 patients of mid- clavicular fractures were managed by open reduction and internal fixation with superior reconstruction plating and the average time of union was 14 weeks.[23] The removal of implants was carried out for protrusion of implant. Gheorghiu also observed that the congruent plate appeared to be an effective and reliable mass of fixing midshaft clavicle fracture.[24]

In the study done in Nepal by Dhoju in 20 patients 16 male and 4 female, result showed that all the fracture united in 16 weeks with complication of wound infection.[25] The average CMS was 97.45 in one year follow up. Similarly, Pandya showed that displaced

midshaft clavicle fracture can be treated with the pre-contoured anatomical plate.[26]

In current study pre-contoured locking plates were used which had the advantages of strong rigid fixation due to locking mechanism between the screw and plates and preservation of blood supply due to minimal contact between plate and cortical bone. Hence, complications such as screw loosening and plate failure were not found.

CONCLUSION

The use of pre-contoured anatomical locking plates in displaced clavicle fracture provides a rigid secure and reliable fixation with early mobilisation of shoulder. The current study supports that the operative management using pre-contoured locking compression plate is effective means for a stable construct with predictable union.

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