

Functional Outcome of Surgically Treated Displaced Middle Third Clavicle Shaft Fracture

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Abstract

Introduction: About 70% of clavicle fractures are in middle third shaft. Traditionally these fractures are treated non-operatively. By closed method it is practically impossible to maintain anatomical reduction and hence certain amount of deformity and disability is expected in adults. We studied functional outcome of displaced middle third clavicle fracture. *Methodology:* Patients with displaced middle third clavicle fracture were included in study (Robinson's classification-type 2B). All patients underwent open reduction and fixation with plate and screws. Patients evaluated for Radiological union and functional outcome (Constant and Murley score). *Results:* 30 patients included in study (23 male and 7 female). In 26 patients fracture was united by three weeks. Four patients had delayed union. 23 patients (76.7%) had excellent functional outcome. *Conclusion:* Operative fixation of a displaced and comminuted fracture of the clavicle results in excellent functional outcome and a lower rate of malunion and nonunion with decreased immobilization time.

Keywords: Clavicle; Fracture; Plate Fixation; Non Union.

Introduction

Clavicle fracture accounts for 15% of all fractures [1]. Around 80% of these are midshaft clavicle fractures. Lack of soft tissue attachment and thin cortex at lateral and middle third make this junction more vulnerable for fracture [2]. Commonly middle third of clavicle fractures were managed conservatively. Nonunion chances are less and malunion at this region will not cause much functional impairment [3-6].

Recent studies prefer operative treatment for midshaft clavicle fracture as compared to conservative treatment. Surgical management is better in terms of functional outcome, reduced nonunion and malunion [7-9]. Various techniques like k wire fixation, plating, intramedullary nailing have been used for operative management of midshaft clavicle fracture [10]. Many studies consider fixation with plate is superior as it gives immediate rigid stability [9,11-15].

We studied functional outcome of midshaft clavicle fractures treated by open reduction and internal fixation with plate and screws.

Methodology

This prospective study was done in our institution from July 2014 to July 2016. All patients above 18 years with displaced clavicle middle third fracture were included in study. Patients with minimally displaced fracture were excluded from study.

Plain radiograph of clavicle with shoulder in anteroposterior view was taken to assess the site of fracture and the fracture type (displacement and comminution). Fractures were classified according to Robinson's classification.

Technique

Patient is placed in supine position with one

towel in between the scapula. Entire upper limb from base of neck to hand were prepared and draped. Skin incision (about 7-9cms) incision was made in the anterior aspect centering of clavicle over the fracture site. Skin, subcutaneous tissue and platysma were divided without undermining the edges. The overlying fascia and periosteum were next divided. The osseous ends were freed from surrounding tissue. Minimal soft tissue and periosteum dissection was done (Fig. 1). Fracture fragments were reduced and precontoured plate was applied over the plate was fixed to the medial and lateral fragment with 3.5mm cortical screw and at least three screws in medial and lateral fragment were applied (Fig. 2). The length of the plate to be used was determined according to the extent of comminution at the fracture. The aim was to place at least three screws in the medial and lateral main fragments through both cortices of the bone. Wound was closed in layers after ensuring meticulous hemostasis and sterile dressing was applied. After plate fixation, fluoroscopy is used to confirm the position and length of the fixation screws.

Fracture considered to be united when clinically there was no tenderness, radiologically the fracture line was not visible and full-unprotected function of the limb was possible.

The patient's extremity is immobilized for 2 weeks in a sling, followed by a gradual return to motion. Rehabilitation of the affected arm was started at the end of 2 weeks. Gentle pendulum exercises to the shoulder in the arm pouch were allowed. At 4 to 6 weeks gentle active range of motion of the shoulder was allowed but abduction in limited to 90 degrees. At 6 to 8 weeks active range of motion in all planes were allowed.

Patients were followed up every 4 weeks till radiological union. Constant and Murley score was used to assessed functional outcome [16].

Results

30 patients with middle third clavicle shaft fracture with 23 male and 7 female patients were included in study. All patients were treated surgically with plate and screw fixation. All the patients were available for follow-up. Average period of follow-up was one year six months. Road traffic accident was common mode of injury. 18 patients had right clavicle fracture. Only three patients had associated injury (one second metatarsal fracture and two patients had distal radius fracture). 27 patients

had type-2 B1 (displaced with simple or single butterfly fragment) and three patients had type-2 B2 (displaced with comminuted or segmental) fracture as per Robinson classification.

In 26 patients fracture is united by eight weeks to 12 weeks of duration. Four patients had delayed union (at 16 weeks), among them two patient had large butterfly fragment, one patient had comminution and one patient had plate loosening at six weeks postoperatively. One patient had superficial infection, which is healed by regular dressing. Three patients had hypertrophic scar.

Majority of patients (23 patients) had excellent functional score at the end of follow-up period. (Table 1)

Table 1: Functional outcome of patients at end of follow up period

Functional outcome	Middle third clavicle fracture patients
Excellent	23 (76.7%)
Good	5 (16.7%)
Fair	2 (6.6%)
Poor	0
Total	30



Fig. 1a and 1b: Intra-operative picture of clavicle fracture reduction and fixation with plate



Fig. 1a and 1b: Intra-operative picture of clavicle fracture reduction and fixation with plate



Fig. 2: Pre operative X-ray of clavicle displaced midshaft fracture



Fig. 3: Post-operative X-ray after plate fixation

Discussion

More than 70% of fracture clavicle is in middle third shaft. Traditionally majority of clavicle fractures have been treated nonoperatively. This is because less non union rates and good functional outcome. Also many studies have shown better patient satisfaction when treated nonoperatively [17,18,19]. The goal of clavicle fracture treatment is to minimize morbidity, dysfunction and cosmetic deformity. Fractures of middle third of the clavicle are greatly underrated with respect to pain and disability they produce especially during the first three weeks of treatment. It is also impossible to support and immobilize a fracture of middle third of clavicle in an adult by external means with figure-of-eight bandage.

For undisplaced middle third shaft fracture of clavicle, non-operative treatment remains treatment of choice. Meta-analysis of nonoperatively treated midshaft clavicle fracture by Zlowodzki M et al. showed nonunion rate of 5.9% in undisplaced fracture where as in displaced fracture it was 15.1% [20]. Most of undisplaced fracture of middle third shaft heals without much functional disability; where as certain amount of functional disability is expected in displaced fracture.

Indications for surgical treatment for clavicle shaft fracture are neurovascular compromise, multiple traumas, floating shoulder, skin tenting and displacement. Among this displacement as indication remains controversial. Recent studies show less nonunion rate and good functional outcome after internal fixation when compared to non-operative treatment for displaced midshaft fracture [6,21,22]. It is evident in literature that certain specific fracture types are a high risk for poor outcome [20]. Now a days many surgeons recommend plate fixation for displaced middle shaft clavicle fracture.

Hill JM et al. showed that more than 2cms shortening in displaced fracture has higher nonunion rate when treated nonoperatively [23]. Non union may be up to 20% in displaced comminuted fracture when treated nonoperatively [22,24]. Nonunion rate is less when displaced fractures are treated with open reduction and fixation by plating. Many authors consider young athletes with high functional demand for surgical fixations [25]. Also in patients with clavicle shortening more than 2cms, multiple trauma situations surgical fixation of clavicle shaft is considered for optimal outcomes [25].

Clavicle fracture can be fixed surgically by various options such as wire or plate fixation and interosseous sutures [26-28]. In general, Kirschner wire fixation has proven unsafe because of breakage and migration [11]. Intramedullary pin fixation is more cosmetically accepted as it requires small incision. However it provided less rotational and linear stability compared to plate fixation [29-32]. This technique requires routine removal of pin after fracture healing and carries complications like implant breakage, brachial plexus injury, and migration of pin [33-35].

Many surgeons prefer plate fixation as it provides immediate rigid fixation and early mobilization [23,36-38]. Fracture shortening and comminution predispose to malunion compromising functional outcome. Hence for these fractures plate fixation is recommended as by this method fracture unites early and restores anatomy [39]. Complications of plate fixation are infection, implant failure and hypertrophic scarring [40].

In our study all displaced fractures treated with plate fixation. Fracture healed in 26 patients (87%) within eight weeks to 12 weeks postoperatively. Four patients had delayed union. One patient had plate loosening because of noncompliance with postoperative rehabilitation. Patient went

for farming and was lifting heavy weight before fracture union. With further advise of not to lift heavy weights in the affected limb clavicle fracture went to unite in mal position at end of 16 weeks and no reoperation was performed for this patient. 23 patients (77%) had excellent functional outcome.

Primary open reduction and internal fixation with plate and screw for fresh middle third clavicle fractures provides a more rigid fixation and does not require immobilization for longer periods. Stable fixation needs at least three screws to be applied medially and three screws laterally. Near anatomical reduction and early rehabilitation give excellent functional outcome.

Conclusion

We recommend plate fixation for displaced and comminuted middle third shaft clavicle fracture. Operative fixation of a displaced and comminuted fracture of the clavicle results in excellent functional outcome and a lower rate of malunion and nonunion with decreased immobilization time.

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