

# Functional Outcome of Primary Kirschner Wire Fixation in two Part Mid Clavicular Fractures

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## ABSTRACT

**INTRODUCTION:** Middle third is the commonest site for clavicular fractures. Incidence of high energy clavicular fractures with comminution and displacement is increasing, for which reduction and maintenance with braces and bandages are not only uncomfortable with need for frequent monitoring of loosening and complications, but also insufficient resulting in unacceptable malunions and nonunions. Intramedullary Kirschner's wire fixation is a safe and simple procedure, with small incision and little soft tissue dissection. It has good result in terms of patient comfort, union rate, cosmesis, and ease of hardware removal following fracture union. The objective of the study was to evaluate the functional outcome, rate and time for union, possible complications with primary Kwire fixation of the two part middle third clavicular fractures.

**METHOD:** It was a prospective observational study, with in a period of one year, in three government hospitals in Kathmandu. 28 cases with displaced 2 part middle third clavicle fracture were included. Intramedullary K-wire fixation (2.5mm) was done and outcome was assessed in terms of time of fracture union, complication rate, DASH scores and compared with similar studies done elsewhere.

**RESULT:** 18-50 years old patients, 20 males and 8 females were involved in the study. Fall on the point of shoulder was commonest mechanism of fracture(56%).

Mean time of union was 7.6 weeks(6-11 weeks).

Superficial wound infection was seen in 4 cases, hematoma in 1. There was no nonunion, malunion, k-wire migration, hardware failure, and neurovascular injury. K-wire was removed after the radiological union of fracture was seen.

**CONCLUSION:** Primary intramedullary K wire fixation of middle third two part clavicle fracture is a safe and simple procedure with good functional outcome and recommended as a method of treatment.

**KEY WORDS:** Clavicle fracture, Open reduction, Internal fixation, K-wire fixation

## INTRODUCTION

Midshaft is the most common site for clavicle fracture accounting for 69-82% of all clavicular fractures, of which 48% are displaced and 19% comminuted. Conservative treatment with a simple sling, clavicular brace or figure of eight bandage are often cumbersome and uncomfortable for the patients. They can cause

pressure sore, neurovascular compromise and stiffness of the joints, yet resulting in unacceptable rates of malunion and nonunion. Cosmetic deformity and poor functional outcome are frequent. Mild discomfort can linger in adults for months. Surgical treatment allows clavicle to heal with minimal deformity, minimal loss of motion and pain. Although plating is becoming popular in fixation of clavicular fractures, literature shows higher rate of complications, with non union and surgical site wound infections.

Many variations of intramedullary implants have been described.<sup>2</sup> Primary intramedullary fixation of the mid third clavicular fracture with K-wire is a simple

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and straightforward procedure. It is ideal for fixation of fracture without comminution, where the two fragments are retained in anatomical alignment by the K-wire with the principle of three point fixation. Mid third fracture with a butterfly fragment can also be fixed with intramedullary k wire after the butterfly fragment is fixed to a main fragment by circlage with stainless steel wire or a strong suture material.

The benefits of intramedullary k-wire fixation are smaller skin incision, less soft tissue stripping at fracture site, less risks of injury to neurovascular structures and pleura, higher rates of union, easier hardware removal, less weakening of bone after hardware removal, better cosmetic results. However, pin migration, hardware irritation, implant breakdown and infection have been reported. It is also supposed to be biomechanically weaker than plate fixation. But bending the k-wire on the lateral aspect and avoiding over head activities for at least six weeks will prevent any possibility of k-wire migration.

## METHOD

It was a prospective observational study done at Bir hospital, Shree birendra hospital and Patan hospital over a period of 1 year.

All men and women of age group 18-60yrs, with displaced (>1.5cm) or shortened (>1.5 cm) two part middle third fractures, fracture with bony spike or threatened skin, within two weeks of injury were included in the study after taking informed consent.

Pathological, open, segmental, comminuted and those with neurovascular injuries were excluded. Similarly, fractures with associated ipsilateral upper limb injuries or, with other comorbidities and contraindications to anaesthesia were also excluded.

Patients who meet the criteria were enrolled in the study after Institutional Review Board (IRB) approval and informed consent. Surgeries were performed in the Operation Theaters. Position was supine or the beach chair position with head and neck tilted away from surgical site and a bump placed behind the scapula to aid in reduction. The arm prepped in the field to allow traction and manipulation to assist in the reduction. A small incision (3-5cm) was made over the site exposing the fractured ends. The K-wire (2.5mm) was inserted retrograde through the lateral fragment that comes out through a small stab wound over the

lateral end of the clavicle. Next the fracture is reduced, held in position and the pin is advanced anterograde across the fracture into the medullary canal of the medial segment until the wire just got engaged into the cortex. The lateral end is then cut, bent and buried under the skin. Incision was closed in layers. Skin was closed with subcuticular stitches of 3-0 absorbable material.

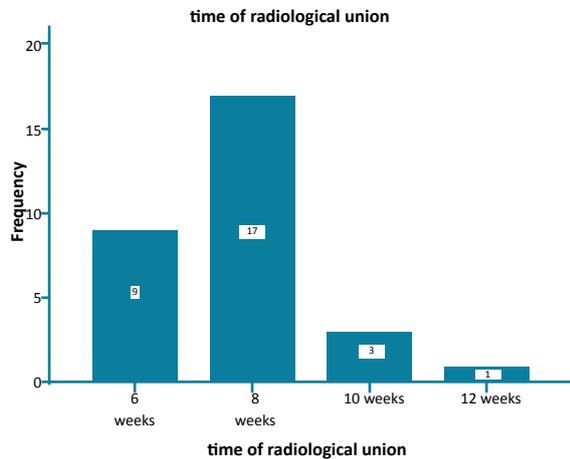
Arm sling was used for about a week after surgery and then light daily activities, such as writing and eating were allowed. Patients were discouraged from driving, heavy lifting, or raising the arm above the head until radiological bony union was apparent.

Follow up posterior-anterior chest radiographs were taken every 2 weeks until fracture united or upto 4 months of surgery. Radiological evidence of bony union were callus formation and trabecular bridging across the fracture site. Clinical assessment with DASH scores were done at 6 weeks and 3 months of surgery. After the radiological union of fracture, k – wire was removed. Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) version 11.5 software package.

## RESULT

Out of 30 patients, 22 (73.3%) patients were males and 8 (26.7%) were females. Patients were from 16years to 52 years of age, with a mean age of 29.03 years with a standard deviation of 10.562 years. Of the total cases, mechanism of injury could be reproduced by 27 patients. Commonest mechanism of injury was fall on shoulder, comprising 23 (76.7%) cases. Fall on outstretched hand accounted for 4 (13.3%) cases. There were 16 cases (53.3%) of left clavicle fracture and 14 cases (46.7%) of right clavicle fracture.

Most of the cases (16) were operated between 1 to 3 days of injury. 10 cases were operated between 3-7 days of injury. 2 cases were operated within 24 hours of injury and 2 were operated after a week. Mean duration of surgery was 49.20 minutes with a range of 38-75 minutes. Mean duration of hospital stay following surgery was 2.63 days, with a range from 1-5 days and standard deviation of 0.809 day. Most of the patients were discharged on second (13 cases) or third day (13 cases) of surgery. Mean duration for radiological union of fracture was 7.73 weeks, with a range of 6-12 weeks.



Overall complication rate was 20%. 2 cases (6.7%) developed pain related to hardware prominence, 2 cases (6.7%) developed superficial infection and 2 cases (6.7%) developed shoulder stiffness. There were no cases of deep infection, iatrogenic Nerve Injury, Nonunion, Hardware failure, symptomatic malunion or refracture.

**CASE ILLUSTRATION**

26 years man following fall on the point of shoulder (RTA). Open reduction and internal fixation with K-wire was done the next day, which took 60 minutes. He was discharged after 2 days. Post operative period was uneventful. Fracture union with bridging callus around the fracture was seen 12 weeks following the surgery, K-wire was removed. DASH score at 3 months was 6.

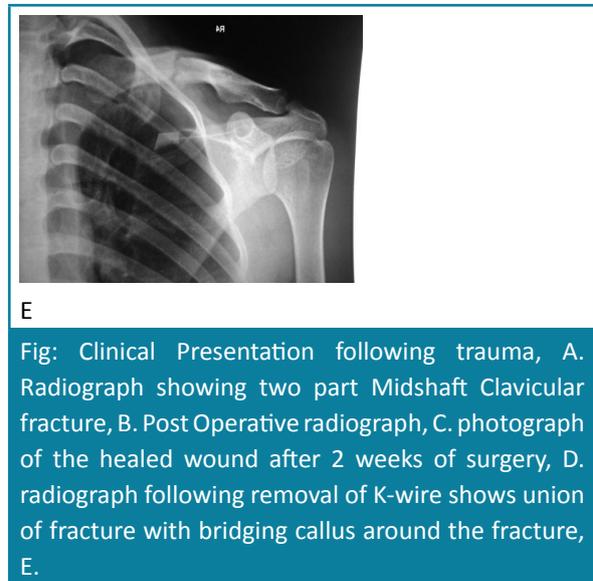
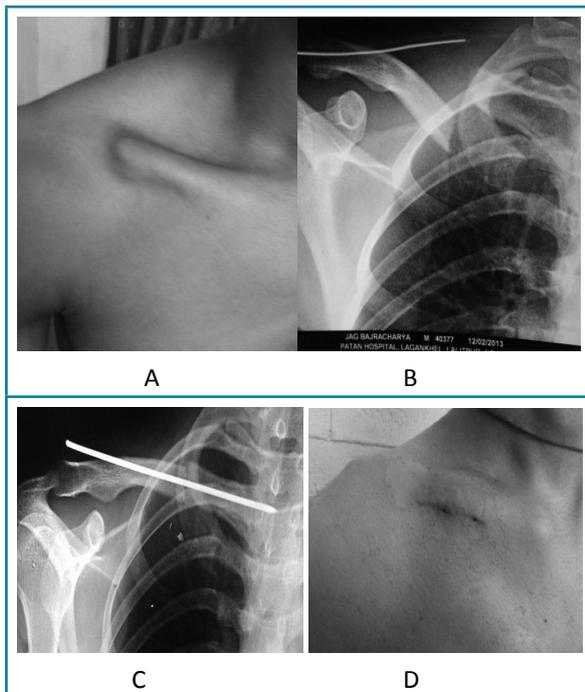


Fig: Clinical Presentation following trauma, A. Radiograph showing two part Midshaft Clavicular fracture, B. Post Operative radiograph, C. photograph of the healed wound after 2 weeks of surgery, D. radiograph following removal of K-wire shows union of fracture with bridging callus around the fracture, E.

**DISCUSSION**

Treatment of fractures of middle third of clavicle is aimed at restoring shoulder function to pre injury level. Neer<sup>1</sup> and Rowe<sup>2</sup> in 1960s reported very low risk of nonunion (0.1% and 0.8% respectively) and no functional deficit with nonoperative treatment of middle third clavicle fractures and hence concluded that these fractures should be managed nonoperatively. This became the basis of treatment of midthird clavicle fractures for many decades until recently when studies showed unacceptable rates of nonunion (15%) and symptomatic malunion (31%) after nonoperative treatment of displaced clavicular fractures in adults, along with reports of low nonunion rate (2.2% with plating and 2% with IM pinning) and better functional outcome following surgical treatment,<sup>3,4</sup> hence causing a paradigm shift towards operative treatment.

Although clavicular plating, preferably with contoured plates is popular these days, it is also not exempt from complications like deep infections, hardware breakage, refracture after plate removal and nonunion<sup>5</sup>. Intramedullary fixation is also an option for two part fractures of the middle third of the clavicle with advantages of smaller incision, less soft tissue stripping and less complication rates. Although most of recent literatures of intramedullary fixation are on the Titanium Elastic Intramedullary nailing,<sup>6,7,8</sup> K wire has also been studied with a very good results<sup>9</sup>. Complications of K-wire fixation like migration upto spine and breakage of hardware have led to less use of K-wires in clavicular fixation in the Europe.<sup>10,11</sup> But

we have virtually eliminated the risks of migration and breakage by bending the k-wire laterally, avoiding overhead abduction of the shoulder, and piercing the anterior cortex of clavicle by the medial end of the K-wire, use of larger k-wires (not less than 2.5 mm) and early removal of k-wire after union of fracture. Likewise, engaging the k-wire medially through the anterior cortex of clavicle provides some degree of rotational stability at the fracture site. Hence, k-wire wire proves to be at least as good as or even better than the commonly used titanium elastic intramedullary nail in terms of biomechanical stability. Our results with K-wire are encouraging and are comparable to studies done elsewhere.

Majority of cases were <30 years of age, representing the young and athletic individuals who require earlier functional return to their pre injury level of activity.

Mechanism of injury in our study was fall on to the point of shoulder, accounting for 85.18% of the known mechanisms (23 out of 27). This value was similar to that in study by Jeray KJ who reported 85-94% of clavicular fractures caused by a direct fall or blow onto the point of the shoulder.<sup>2</sup>

Left sided clavicle was more commonly fractured than the right side in our study population. There were 16 cases (53.3%) of left clavicle fracture and 14 cases (46.7%) of right clavicle fracture. This is also consistent with the epidemiological studies by several authors which show left clavicle to be more commonly involved.

Mean duration of hospital stay in our study was 2.63 days with a range of 1-5 days. It was comparable to the study by A Jubel et al.<sup>12</sup> who reported 2.9 days of hospital stay with a range of 1-6 days.

Time of radiological union in our study was 7.73 weeks. It is comparable to the study by Chaithavat Ngarmukos who reported union of all acute fractures of the middle third of the clavicle by 8 weeks.<sup>13</sup> We had an overall rate of complications of 20%. This result was less than the metaanalysis by McKee et al who reported 29% of overall complication rate in the operatively treated cases of middle third clavicle fractures.<sup>14</sup> Their meta-analysis showed nonunion rate of 1% and no case of symptomatic malunion. Our study had no case of nonunion or symptomatic malunion.

Non union rate in study by Judd et al, Smekal et al and Witzel et al, who studied on the intramedullary fixation of clavicular fractures, was one out of 57 cases, zero out of 60 cases and zero out of 68 cases respectively.<sup>15,16,17</sup> These results are similar to our study.

DASH score has been widely used as the outcome score after treatment of clavicle fractures.<sup>18,19,20</sup>. These studies have shown significant decrease in DASH score with operative treatment measures than the non operative treatment. Hence, DASH score was taken as a reliable patient oriented outcome measure in our study. Mean DASH score in our study was 4.96 at 3 months. This was comparable to study by Canadian orthopedic trauma society, who had DASH score of 5.2 at 1 year after plate fixation.

## CONCLUSION

Fracture of mid shaft of Clavicle is the commonest of the clavicular fractures. Traditional method of conservative treatment of displaced two part midclavicular fractures is associated with high rates of complications and poor functional outcome. Our study has shown that results of treatment of such fractures can be very good with primary K-wire fixation, which is a simple and safe procedure.

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