K-WIRE AND SCREW FIXATION OF LATERAL END CLAVICLE FRACTURES

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ABSTRACT

BACKGROUND

As a known fact, lateral end clavicle fractures are difficult to treat conservatively. Till date various methods of stabilisation of the displaced lateral end factures are in use. Method, which is less invasive and has minimal complication was used to fix these fractures in our study.

MATERIALS AND METHODS

Study was conducted in Ortho Department, G. M. C., Kannauj; 20 lateral end clavicle type 2 fractures were included. All type 2 lateral end clavicle displaced fractures were included. Fractures were reduced with a small anterosuperior incision. Fractures were fixed by K-wires followed by coracoclavicular screw. Arm was supported in an arm pouch for six weeks. The routine removal of K-wire was performed in six weeks at O. P. D. Clinicoradiological results were studied after six weeks and monthly interval and thereafter until union.

RESULTS

All 20 fractures were united. There was no loss of reduction even after removal of Kirschner wires at six weeks. The mean average time of union was 9.5 weeks with an SD of 3.5. Patients regained near normal range of motion and the mean average constant score at the end of one year was 98.37 with an SD of 2.87. The range of motion remained the same in those who were followed up. Infection and Kirschner wire breakage were not noted in our series.

CONCLUSION

The clinicoradiological outcome were encouraging and comparable with earlier studies.

KEYWORDS

K-Wire - Kirschner Wire, Cancellous Screw.

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BACKGROUND

Even in today's scenario clavicle end fractures are approached and dispensed with conservative treatment, but lateral end clavicle fracture with displaced nature are complicated and need surgical intervention with special attention. Distal clavicle fractures account for 15% of all clavicle fractures. NEER classified this fracture into two types based on the condition of Coracoclavicular (CC) ligament.[1,2]

Type 1 - Minimally displaced fractures that occur lateral to the CC ligament. Type 2 - Displaced fractures that the proximal fragment is detached from the CC ligament.

The type 1 fracture is a stable kind of injury with an intact CC ligament, which prevents the fragments from substantial displacement. In type 2 fractures, the distal clavicle fragment suffers the distal pull by the weight of the arm and medial pull by the pectorii muscles and also the latissimus dorsi muscle, while the proximal fragment is pulled posteriorly by the trapezius. Due to these forces, fracture is highly displaced and unstable in nature.

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The type 2 fracture is further divided into type 2-A in which fracture occurs medial to CC ligament and type 2-B in which fracture occurs more lateral with CC ligament, disrupted from proximal fragment. With addition of more sub types, the NEER classification of distal clavicle fracture was later compiled to include up to five types.

Type 3 - Fracture extends into Acromioclavicular Joint (ACJ).

Type 4 - Fracture with periosteal disruption occurring in children.

Type 5 - Avulsion fracture of distal clavicle with the smaller cortical fragment remains attached to the CC ligament.

As per finding, the displaced type 2 fracture treated conservatively resulted in 30% of non-union and remaining in either bony union or fibrous union. Such a high percentage of non-union advocates for operative fixation.[3]

Though the best and ideal method for internal fixation is a matter of non-yielding debate, but a few series of coracoclavicular screws, tension band, K-wire hook plates, special anatomical locking and non-locking plates have been published with encouraging results in all the series.

Radiological Evaluation

In significant fracture displacement, the skin may suffer too much tension by bone spike of proximal fragment that requires urgent focus. In case of high energy trauma such as road side accidents, a meticulous examination is required to exclude other associated injuries. Neck and head injury are

noted in upto 10% cases, while ipsilateral rib fracture and associated chest injuries are also often noted.

A shoulder trauma series including AP view, scapulary view and axillary view of injured shoulder should be the standard radiographic investigation. Fracture could be classified on the basis of fracture displacement. An axillary view is useful in correspondence with AP view of the fracture. CT scan is sometimes needed in the case of complex and comminuted fracture patterns. Ultrasound and M.R.I. are seldom necessary except associated soft tissue injuries, such as a rotator cuff tear is suspected.

Conservative management tell us that there is no doubt that the initial treatment for type 1 and type 3 fractures will be non-operative. An arm sling is offered to support the weight of arm. Pendulum exercises can be started as soon as pain can be tolerated. The arm sling could be taken off when the pain has abated with active assisted and passive mobilisation exercises to start shortly. Strengthening exercises can be started when a pain free full shoulder range of motion achieved.[3,4]

Despite the excellent prognosis of type 1 and type 3 fractures, patients should be informed regarding the decimated chances of late residual shoulder symptoms, viz. ACJ arthrosis. For those patients who have substantial residual symptoms, operative treatment with distal clavicle resection may be needed to alleviate the symptoms.

Surgical Management available for Distal End Clavicle Fracture

Management of type 2 fractures is always the center of debate. With high risk of non-union, some surgeons will advise operative treatment for all type of type 2 fractures, while the advocates of non-operative treatment argue that most of these non-unions are asymptomatic but the patients having substantial fracture displacement, open wound and overlying skin compromises are clear indication of surgery; others may go for conservative treatment.[5,6]

When a non-operative treatment is selected, patients should be carefully consulted and informed about the following.

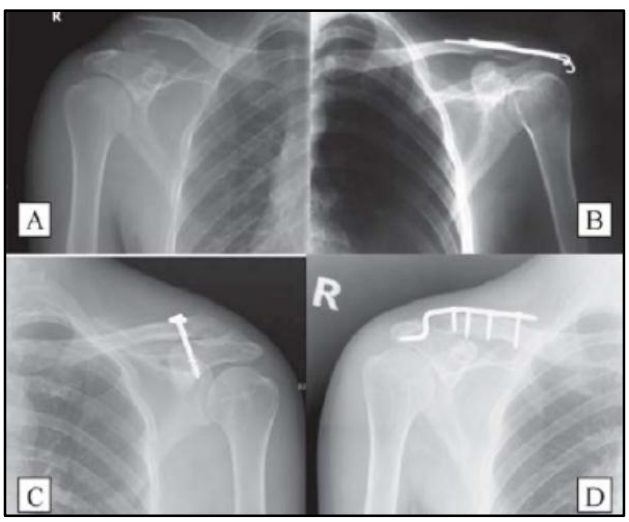
- The average risk of non-union is 30%.
- Most distal clavicle fracture non-unions will end up with mild symptoms and functional loss is usually low.
- The patients who develop symptomatic non-unions, late reconstructive surgery becomes inevitable.

Hence, making a judgment from the above each and every patient having type 2 fracture should be considered individually. For a low age, young and active patients who cannot take a risk of late reconstruction surgery shall have operative treatment early. On the opposite, the patients who have multiple medical co-morbidities with high perioperative risk or are immunocompromised shall go for initial conservative treatment.

Though there are numerous operative techniques reported in the past, but on a whole methods of surgical treatment can be summarised as below.

- Transacromial or intramedullary fixation in terms of K-wires and different pins such as the Steinmann pin, Knowles pin, etc. This fixation could be strengthened further by concomitant tension band wires.
- Coracoclavicular indirect fixation with use of screw, suture anchor, Dacron graft or Mersilene tape.
- Open reduction and clavicular plate fixation with the use of different plate systems such as Basler plate, AO hook plate, Wolter hook plate, etc.

Different surgical techniques have their own advantages and disadvantages (Picture: 1). With more than 20 techniques described so far, no single fixation is ideal and perfect. There is no such method of fixation that could be said unanimously the best surgical method to fix these fractures. Whichever method is chosen, careful planning and familiarity with the features of that operative technique are basic requirement for the best clinical outcome.[7,8]



Picture 1. Showing Different Methods of Fixation

Patients and Methods

This prospective study was conducted at Government Medical College, Kannauj, 2016.

Inclusion Criteria

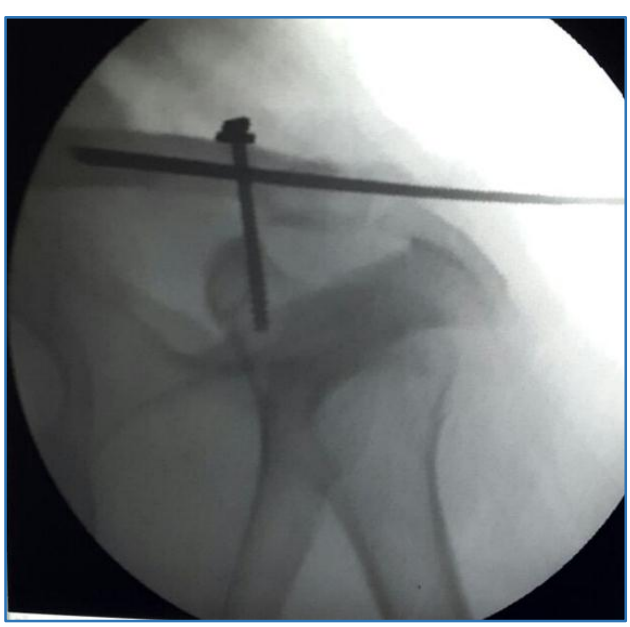
1. NEER Type - II displaced fractures of lateral end clavicle.
2. Medically fit patients.

A brief incision of 5 – 8 cm with center over fracture site is made antero-superiorly. Fracture site is reached by cautery dissection. Special care is taken to make sure that acromioclavicular ligaments are not disturbed. The fracture is reduced with the help of a clamp and fixed with two 1.8 mm transacromial K-wire and reduction is monitored on an image intensifier. After the desired reduction is achieved, a hole of 3.2 mm is drilled centrally through clavicle into the coracoids and a 4 mm cancellous screw is fixed. From the third post-op day, the pendulum exercises are started. From 7th post-op day, the passive flexion and extension is started. On 14th post-op day, the sutures are removed and gradual abduction is started. K-wire removal is done on 6th post-op week in outpatient department under local anaesthesia; an active shoulder movement is allowed. The clinicoradiological followup to confirm union is done on 6th post-op week and at monthly interval and a 6th monthly evaluation is done after the union was confirmed. The union is confirmed with 2 radiographs, viz. anteroposterior and axillary view of shoulder. The cortical continuity, static fracture line gap, re-constitution of medullary cavity, in consecutive radiographs and hard fracture site were clinical evidences of union at fracture site.[9,10,11,12]

RESULTS

Only in single case, the K-wire got loosened and migrated from its place prior six weeks, but reduction remained unaltered. Infection and non-healing wounds were not reported in our series. Skin impingement was noted in 2 of our cases due to bent K-wire. As the clinicoradiological union was confirmed, the patients were allowed to return to sporting activities.[13,14]

Picture 2. Showing Type 2 Lateral End Clavicle Fracture



Picture 3. Showing K-Wire and Screw Fixation in Lateral End Clavicle Fracture

Picture 4. Showing Pin and Screw Fixation in Lateral End Clavicle Fracture

DISCUSSION

Fracture of distal clavicle is less frequent than the more common middle-third fracture. Type 2 displaced fracture of distal end clavicle have extremely high rate of delayed union and non-union. The reason for the same is the rotational movement that occurs at the acromioclavicular joint, gets transferred to the fracture site which provides mobility to the lateral end resulting in the non-union. On the other hand rigid internal fixation between clavicle and acromion will fail, as it interferes with the routine rotational movement of the clavicle with respect to coracoid and acromion. Furthermore, if fracture unites with this kind of fixation, the first compulsion is removal of implant before full mobilisation is started. Such implant retrieval operation requires comprehensive exposure and substantial soft tissue damage is involved along with the risk of neurovascular injury.[15,16]

Our method is minimally invasive. The routine removal of K-wires before active mobilisation of shoulder decimates the complication of partially rigid kind of fixation and fracture reduction is maintained. The fracture becomes sticky at the 7th week; the ossification is of intramembranous nature; the union shall occur if conducive environment is provided. A single plain radiographic evaluation may give sign of delayed union, but we recommend two plain radiographic evaluations to confirm union, viz. anterosuperior and axillary view, since in some cases fracture line is visible in anterosuperior view but cortical continuity in axillary view confirms union. Furthermore, reformed medullary cavity, static fracture line gap and substantially hard fracture site suggests for fracture union. We recommend CT scan in cases where evaluation of union is doubtful, but routine use of CT scan to confirm union is not suggested.

Transacromial K-wires are passed under C-arm guidance to hold the fracture in anatomical position and 4.0 mm cancellous screw is fixed through clavicle into the coracoids. K-wires and screw are removed in O.P.D. under local anaesthesia. The limb is kept supported in an arm pouch for six weeks to make patient conscious that their shoulder needs protection and secondly the stress exerted by hanging limb is guarded fact minimises undue stress on the healing bone. The results of our technique of fixation are highly inspiring and encouraging with this small group of 20 patients and comparable with other studies.

Neer reported 100% union with Kirschner wire fixation and suggested displaced fracture should be stabilised for better results. Kona et al reported 52.6 success rate with Kirschner wires. Eskola et al reported 95.6 success rate with two Kirschner wires. Loosening of Kirschner wires, migration, undue stress during active mobilisation, back out and breakage are known complications with Kirschner wires fixation. We addressed a few of such complications by removing Kirschner wires before active mobilisation. Even after removal of Kirschner wires, reduction is maintained by figure-eight suture.

Edward et al, Yamaguchi et al and Ballmer et al reported 100% success rate in their series with Bosworth coracoclavicular fixation.

Coracoclavicular reconstruction using a Dacron graft has yielded 100% success rate in a series by Goldberg et al. However, the nature of surgical dissection is more traumatic than other minimally invasive techniques. Levy described single figure-eight suture fixation with PDS suture with a success rate of 100%.

CONCLUSION

Our method of fixation allows stable fixation with K-wires and cancellous screw. K-wire allows active mobilisation and decimates the number of implant related complications.

Although, the result of our studies over 20 patients are inspiring and encouraging, but we need to further extend the study on larger counts of patients to prove the superior role of our method on type 2 displaced clavicle end fracture.

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