

Short Communication

Percutaneous elevation of depressed lunate fossa: A surgical technique

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ABSTRACT

Die-punch fractures or impaction fractures of distal radius articular surface are difficult to treat and hard to achieve satisfactory reduction. We present a unique, percutaneous and minimally invasive technique to elevate the depressed lunate fossa and maintain the reduction of the elevated fragment with no need of grafting in such fractures. This technique is simple, reproducible and can be executed with simple instrumentations. We think it deserves a variety of implications in the treatment of distal radius fractures.

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Introduction

Fracture of the distal radius is among the most common fractures encountered by orthopaedic surgeons. It follows a tri-modal distribution with three peaks: first in children at 5–14 years of age, second in young males under 50 years old and third in females over 40 years.¹ In the elder population this injury is generally an insufficiency fracture due to fall and mostly extra-articular; but in the young population such fracture represents a high energy injury and is often intra-articular and complex pattern.²

The columnar concept proposed by Jakob et al.³ classifies distal radius into three columns, respectively, the radial column consisting of radial styloid and scaphoid fossa, the intermediate column consisting of lunate fossa and sigmoid notch and the medial ulnar column. Integrity of the intermediate column is most important for wrist functions and articular congruity. In young adults with good bone stock, scaphoid and lunate impaction on distal radius articular surface causes a variety of fracture configurations of distal end of radius. Scaphoid impaction on scaphoid fossa causes shear fracture of the radial styloid. As lunate impacts on the articular surface with good bone stock, it splits the lunate fossa into two characteristic dorsal and volar fragments with sometimes third central impaction fracture.⁴ If the depressed articular surface is not elevated and

articular congruity not restored, it may lead to poor functional outcome and future arthritis.

Various methods for treating distal radius fractures have been described in the literature including external fixation and internal fixation. A comparative study by Kreder et al.⁵ demonstrated superior outcomes with external fixation provided satisfactory radiographic parameters were achieved as compared to internal fixation. Compression fracture of the articular surface or die-punch fracture often poses serious challenges to the surgeons. Depression of the palmar articular surface is difficult to reduce as it is usually not responsive to ligamentotaxis and often requires open reduction and elevation with supplemental grafting for the void created and internal fixation. However here we demonstrate a technique of percutaneous elevation of the depressed lunate fossa with no need of grafting or internal fixation and restoration of acceptable radiographic parameters.

Surgical technique

This technique is useful for specially die-punch fractures where the intermediate column is a single piece depressed or split into volar and dorsal fragments. We usually take traction X-rays to see how much the fracture is responsive to ligamentotaxis.

First the fracture is distracted by application of wrist distractor. This restores the radial height. If satisfactory restoration of radial height is obtained than the volar tilt will be restored with some dorsal manipulation and two K-wires 1.8 mm in diameter are inserted from radial styloid directed medially. The depressed dia-

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punch fracture is now better seen. Next a hole is created with a 3.2 mm drill bit in the dorsal cortex of the radius after careful blunt dissection and a blunt 2.5 mm K-wire mounted on a T handle is inserted through this hole directed towards the depressed area which is usually volar lunate fossa fragment and its position is

checked under fluoroscopy (Fig. 1A–D). We can also insert this wire directly through the fracture site (Fig. 2) dorsally if depressed area is reachable through this site. Then the T handle is hammered slowly with frequent change in position so as to elevate the whole depressed articular surface (Fig. 3). When whole of the articular

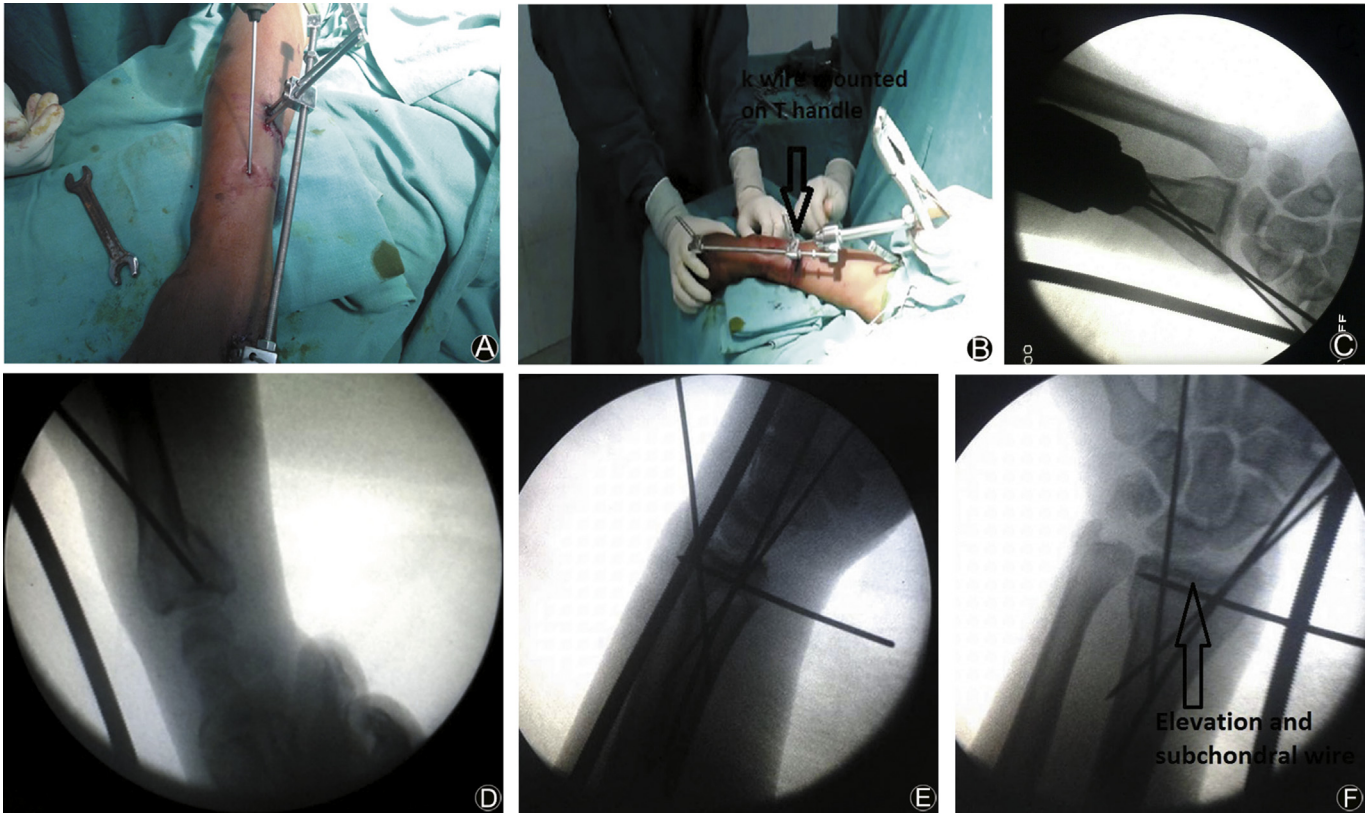


Fig. 1. Surgical technique showing sequential elevation of depressed fragment.

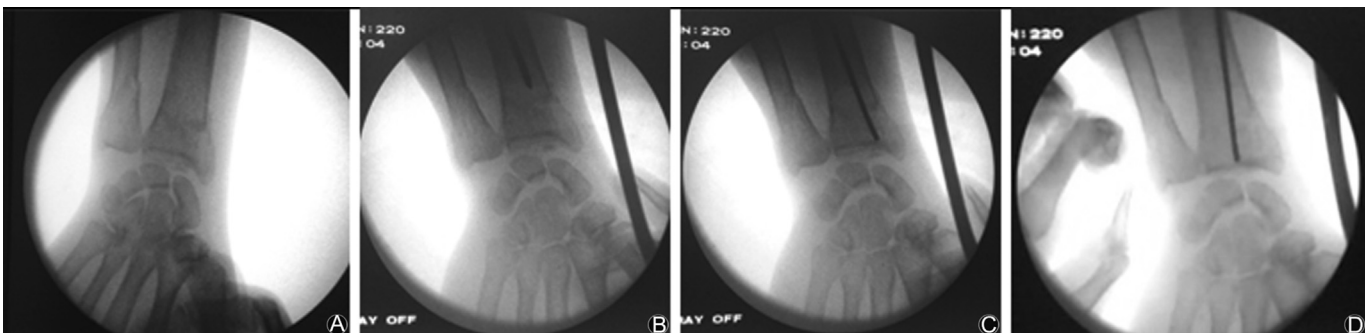


Fig. 2. Another case showing sequential elevation.



Fig. 3. Fluoroscopic views showing sequential elevation of the articular surface (Case of Fig. 1).

surface becomes congruent then a 2 mm transverse K-wire is passed in subchondral region parallel to articular surface from lateral to medial side to support the elevated fragment, get hold of volar intermediate column fragment and prevent it from falling back. Lastly the surgery is completed by passing an additional wire from dorso-ulnar aspect of distal radius to engage dorsal intermediate column fragment of radius (Fig. 1E–F). We had repeated this technique in few other cases and found it satisfactory and reproducible with some minor variations depending upon the fracture configuration.

Case example

A 30 years old male presented with lunate fossa die-punch distal radius fracture (Fig. 4A) with punctured wound over volar aspect of his left wrist. The patient had a history of fall on outstretched hand and had no distal neurovascular deficit. The wound over the volar aspect of wrist prompted us to avoid internal fixation in this case. Traction radiograph (Fig. 4B) suggested fracture responding to ligamentotaxis with depressed volar lunate fossa fragment. Patient was treated with the above-mentioned technique. Postoperative radiograph suggested acceptable and congruent articular surface (Fig. 4C). Three years follow-up radiographs (Fig. 4D) suggested maintenance of articular congruity and no evidence of osteoarthritis or depression of elevated surface along with acceptable radiological parameters and functional results (Fig. 5).

Discussion

It has been cited in the literature that more than 1 mm of articular incongruity results in radio carpal arthritis. A study by Zhang et al.⁶ demonstrated that patients with distal radius fractures involving the lunate facet would recover more slowly, especially for wrist flexion, supination, ulnar deviation and VAS in motion, and would be at a higher risk of loss of reduction and final articular step-off as compared to fractures not involving the lunate facet. Several methods have been cited in the literature to elevate distal radius following articular die-punch fractures, including open reduction and direct elevation of fragment through fracture site with tamp and balloon kyphoplasty followed by cementoplasty.⁷ Each has its own merits and demerits. But these procedures require sophisticated instrumentation or create a large void which needs either autogenous or synthetic void fillers.

Our technique has the advantage: (1) simple, inexpensive and reproducible; (2) does not require any sophisticated instrumentation and thus suitable for limited available resources; (3) the void created by this technique is very small obviating the need for grafting or cementing; (4) distraction and supportive K-wires prevent the subsidence of the elevated articular surface till union; and (5) can be used in compound fractures as well. We recommend this technique to be performed along with other modes of fixation such as plating with minimum dissection and minimum operative morbidity. This technique can be combined with arthroscopic



Fig. 4. Lunate fossa die-punch distal radius fracture on a 30 years old male patient. A: Preoperative radiographs; B: Traction radiographs showing die-punch fracture; C: Postoperative radiographs; D: Three years follow-up radiograph of wrist showing maintenance of reduction.



Fig. 5. Clinical photographs showing acceptable outcome.

visualisation of the joint direct from the articular surface. This technique can also be used for extra-articular fractures where radial length is not restored despite ligamentotaxis.

This technique has a few shortcomings: (1) it may not be suitable for very severe comminuted fractures which do not respond to ligamentotaxis because reduction of the elevated surface will be hard to maintain in such cases without suitable internal fixation; (2) this technique may be of limited usefulness in dorsal die-punch fractures as it is difficult to reach the depressed dorsal portion through dorsal cortical window. We recommend some bending of K-wire to increase the reachable area through this wire. Preoperative CT scan if available can accurately delineate the depressed area and may assist in better planning and outcome.

Conclusion

Percutaneous elevation of lunate fossa and distraction with supplemental K-wire fixation is a relatively simple, effective, inexpensive, minimally invasive and reproducible technique for die-punch distal radius fractures. During surgery, percutaneous elevation of the depressed lunate fossa can be combined with other modes of fixation which saves time and causes minimal injury to

the already damaged soft tissues in high velocity fractures. Despite the limitation of small sample size in this study, We think this technique may be an extension of the role of external fixation in dia-punch fractures of distal end radius.

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