

Displaced Fracture of Head of 4th Proximal Phalanx with Posterior Subluxation of PIP Joint and Disruption of Volar Plate: Eaton Grade 3: A Rare Case Report

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Abstract

Volar plate avulsion fracture of the proximal interphalangeal (PIP) joint is one of the most common hand injuries. Unstable intra-articular proximal interphalangeal (PIP) joint fracture dislocations present a difficult problem that requires congruous joint reduction and stable internal fixation or distraction. Though fractures with limited articular involvement may be treated successfully with less invasive procedures, fracture dislocations with a volar shear component may benefit from joint reduction with subchondral support for maintenance of stability. The purpose of this article is to describe a volar screw technique and report the short term post-operative results. This treatment allows early active range of motion and provides good objective and subjective outcomes.

Keywords: Fracture dislocation of PIP joint; Shotgun therapy; Hemi hamate arthroplasty.

INTRODUCTION

Volar plate injuries are an example of the 'unseen' forces which underly many hand injuries.

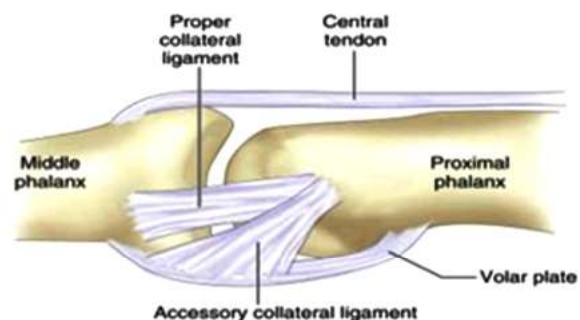
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An understanding of the soft tissue anatomy is important as these injuries do not look spectacular on radiographs. The volar plate avulsion fracture injury is usually caused by a hyper extension force, although a crush injury occasionally causes it. A volar or dorsal dislocation of the joint can also cause volar plate fractures.¹



CASE REPORT

42 year female patient sustained injury while throwing stone. Hyper extension injury occurred. No comorbidities. She was having pain and swelling and flexion deformities. On examination,

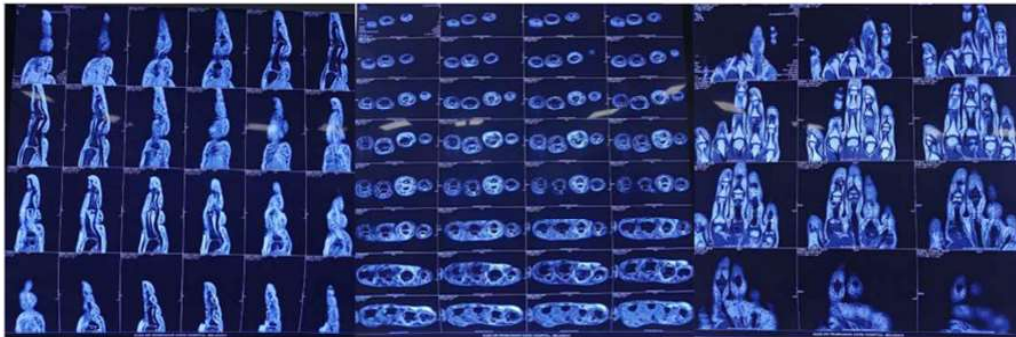
a swelling present in the proximal phalanx of the right 4th finger was noted, which was tender, firm in consistency, and had normal overlying skin without any scar or adherence to the underlying tissue. X-ray done showing head of 4th proximal phalanx with posterior subluxation of PIP joint.



Pre-operative X-ray, suggestive of proximal interphalangeal fracture dislocation of right ring finger.

MRI done suggestive of volar plate avulsion injury with breach in dorsal capsule of the

phalanx. The chest radiograph was normal and the blood investigations were within normal limits.



After giving a written informed consent, the patient underwent open reduction internal fixation using lag screw and volar plate repair.

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PROCEDURE

Open Reduction and Internal Fixation with Lag screw Fixation:

Palmar approach to the PIP Joint:

- Make a carefully planned palmar, angled skin incision (Bruner zig-zag), using the flexor skin creases as a guide.

The apex of the angle should be at the end of the intermediate flexor crease, level with the PIP joint.

- Retract the flexor tendons.
- Extension of the PIP joint to exposes the distal edge of the volar plate, which often bears a fracture fragment. The fracture fragment can be elevated together with the volar plate and retracted proximally.
- The distal and palmar attachments of the collateral ligaments detached bilaterally, and retracted dorsally.
- After detachment of the collateral ligaments, the finger can be fully hyper extended (as in

breaking open a shotgun).

- Volar plate

Reattached the volar plate and any small attached fracture fragment, using a pullout suture.

- **Pulleys**

A3 Pulley repaired.

- **Direct reduction** - Gently used a dental pick

to reduce the fracture accurately. Checked reduction using image intensification.

- **Screw Diameter** - 1.5 mm screw is used.
- **Pulley Repair** - The flap of the C1, A3, and C2 pulleys is passed beneath the flexor tendons, and sutured to the opposite side, using 5.0 monofilament non resorbable sutures, in order to reinforce the volar plate.



Intra-operative fluoroscopy images.



Post-operative image on day 4.

POST OP PROTOCOL

Post-operatively digit was protected with buddy strapping and kept in full extension. Active range of motion started after 3 weeks. Passive range of motion started after 4 weeks.

DISCUSSION

To achieve early range of motion and start daily routine activity without developing post traumatic arthritis. There are several treatment options

for volar plate avulsion injuries like ORIF and plating, lag screw, suture fixation and volar plate arthroplasty.

ORIF with Plating

Angularly stable plates are the preferred implants to use for protection. This kind of plate protects the reduced articular fragments and improves the stability of the fixation. Thereby they enable immediate post-operative mobilization. Apply the plate to the bone and insert the screws according to the fracture pattern. Test the stability of the fixation intra-operatively.²

Suture Fixation

Using 4.0 multifilament non absorbable sutures with double mounted straight needles, Interweave a suture through the detached distal end of the tendon and insert the two ends of the suture into the drill hole. Both needles exit dorsally through the nail. Gently approximate the tendon to the fracture surface by pulling the sutures in a dorsal direction. Confirm the position under direct vision.³

Volar plate Arthroplasty

In order for volar plate arthroplasty to be used, at least 60% of the dorsal articular surface needs to be intact. Loss of more than 40% of the articular cartilage is a contra-indication for this procedure,

and bone graft reconstruction becomes necessary.⁴

- Amongst them Lag screw fixation is the preferred one.

Possible Complications

Stiffness, Malunion, Non union, Loss of function and Infection.

To avoid such complications early open reduction internal fixation has to be done.

- There is no such complication found post operatively except mild stiffness which subsides gradually.

CONCLUSION

Avulsion fractures of the volar plate at the PIP joint have a good treatment outcome especially when picked up early. Treatment should aim to prevent complications, while maximizing functional outcome. Lag screw fixation has been

accepted mode of treatment for such injuries. This mode of treatment provides pain free and stable mobile joint. In this patient we achieved early range of motion, pain free joint without any deformity by using Lag screw fixation.

REFERENCES

1. Merrel G, Slade JF. Dislocations and ligament injuries in the digits. In: Wolfe S, editor. *Green's Operative Hand Surgery*. 6th ed. Philadelphia: Elsevier; 2011. pp. 291-7.
2. Rettig AC. Athletic injuries of the hand, Part II: overuse injuries of the wrist and traumatic injuries to the hand. *Am J Sports Med*. 2004;32(1):262-73.
3. Eaton RG, Malerich MM. Volar plate arthroplasty of the proximal interphalangeal joint: a review of ten years' experience. *J Hand Surg Am*. 1980; 5(3):260-8.
4. Kiefhaber TR, Stern PJ. Fracture dislocations of the proximal interphalangeal joint. *J Hand Surg Am*. 1998;23(3):368-80.

