International Journal of Case Reports in Orthopaedics

E-ISSN: 2707-8353
P-ISSN: 2707-8345
IJCRO 2021; 3(2): 92-95
Received: 16-06-2021
Accepted: 18-07-2021

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Case report: Open reduction and extension block pinning with volar plate reconstruction for 1 month PIP joint dislocation

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DOI: https://doi.org/10.22271/27078345.2021.v3.i2b.73

Abstract
Proximal interphalangeal (PIP) fracture-dislocation is a common injury that results from "jamming" a finger. It can be classified according to displacement of proximal phalanx over middle phalanx. For simple dislocation treatment can be closed reduction and splinting. For old cases open reduction is usually required. Following open reduction stability of the joint is checked and accordingly augmentation of stability is done. For unstable injuries, a variety of surgical interventions have been described including extension block pinning, open reduction internal fixation, volar plate arthroplasty, static or dynamic external fixation, and hemi-hamate reconstruction. For fracture dislocation treatment varies with the degree of articular surface involvement, which determines stability of the joint.
We present the case of an unstable, subacute middle finger PIP dorsal fracture dislocation in a young female for which attempts of closed reduction were given elsewhere but it could not be reduced. With volar approach we reduced the joint and for augmentation of the stability we did volar plate reconstruction using z-plasty of A3 pully. For additional stability we did extension block pinning.

Keywords: PIP fracture dislocation, proximal interphalangeal joint, extension block pinning, volar plate reconstruction

Introduction
Proximal interphalangeal joint (PIP) fracture dislocation is a common injury. It can be classified into; Dorsal, Volar and Lateral dislocations. Dorsal dislocations results from PIPJ hyperextension with longitudinal compression (i.e. ball striking fingertip) which leads to tearing of the collateral ligaments and shearing of the volar plate off of the base of middle phalanx [Figure 1]. It is commonly seen with small avulsion fracture of the base of the middle phalanx.

Fig 1: Dorsal dislocation of PIP joint.

For unstable injuries, a number of well recognized surgical treatments have been studied, but with no clear consensus as to the most effective [2]. Surgical techniques include extension block pinning, closed reduction and pinning, open reduction internal fixation, volar plate arthroplasty, static and dynamic external fixation, and hemi-hamate reconstruction. The common goals of treatment are: 1) maintain a concentric PIP joint, and 2) provide stability for early range of motion exercises to mitigate against joint stiffness.

Outcome studies, in general, show some degree of permanent finger stiffness and progressive joint degeneration [1, 3, 6].

We present the case of a 35-year-old female with a sub-acute (1 month old) presentation of an unstable PIP dorsal dislocation with attempted closed reduction twice elsewhere. The patient is an independent working lady and her priority was to regain maximum finger movements with correction of deformity. Given the potential to salvage the joint and patients wish to continue working, we opted for open reduction of the joint followed by augmentation of the stability using volar plate reconstruction and extension block pinning.

Case presentation

A 35-year-old working female injured her dominant middle finger falling backwards down a flight of stairs 4 weeks prior to presentation. She had persistent PIP pain and swelling and deformity, but continued to work full time. Radiographs demonstrated dorsal dislocation of PIP joint without any visible fracture of base of middle phalanx [Figure 2, 3].

Fig 2: Dorsal dislocation of PIP joint in a 35 year old female.

Fig 3: Clinical pictures of unreduced PIP joint with visible swelling and deformity.

Active PIP motion was 30-40 degrees with painful crepitus. Distal interphalangeal joint (DIP) motion demonstrated 20 degrees hyperextension to 30 degrees of flexion.

Considering her injury pattern, time to injury, age and functional demand open reduction with augmentation of stability with volar plate reconstruction and extension block splinting was opted.

In the operating room, under a regional block, a closed reduction was attempted. The middle phalanx would not come fully out to length, indicating contracture of the ligaments and joint capsule, as expected so open reduction was planned. A volar zig-zag (Bruner's) incision was made over the PIP joint. Flexor tendon sheath was exposed and A3 pully was raised from its base over proximal phalanx. Tendons of FDS and FDP was retracted to expose volar plate of PIP joint. Volar plate was found to be incarcerated into the joint hindering closed reduction. Through a window between the collateral ligament and volar plate PIP joint was exposed and incarcerated volar plate was brought out of the joint. "Shot - gun" [Figure 4] type of exposure was done by doing hyper-extension of the joint. Using a freer elevator joint was reduced and flexed. Reduction was confirmed under C-arm and was found to be congruent. To prevent re-dislocation an extension blocking Kirschner wire of 1.8mm was inserted from the head of proximal phalanx keeping the joint in 30 degrees of flexion. Concentric position of joint was confirmed under C-Arm in AP and Lateral views [Figure 5].

Fig 4: Shot gun" type of exposure.

Fig 5: Reduction and extension block pinning.

As volar plate was found to be completely frayed, for additional stability to the joint, reconstruction of volar plate was done using A3 pully flap [Figure 6] which was raised in the beginning so that early mobilization of the finger can be

done after removal of extension blocking K-wire. Skin closure was done. Joint was protected using a finger splint.
At 10 days stitches were removed and check X-rays were taken to confirm concentric reduction and position of the joint [Figure 7].

Fig 6: Reconstructed volar plate using A3 pully.

Fig 7: 10 days post op. x-rays. Protected with a splint.

Discussion

Unstable PIP fracture dislocations continue to be a vexing problem for the hand surgeon with no clear "gold standard" treatment and mixed outcomes, with many studies showing some residual joint contracture and progressive degenerative changes despite adequate treatment [1-8]. Treatment principles however, are clear—obtain a concentric joint with enough stability to permit a normal gliding arc of motion. Conversely, subluxed PIP joints move by hinging at the fracture edge and lead to progressive joint degeneration and poor functional outcomes [9-11]. Various treatments have been advocated, but due to lack of comparative studies, treatment is largely based on the experience and personal preference of the treating surgeon.
For sub-acute/chronic dislocations single stage/two stage open reduction needs to be done. For young active patients the conventional method of initial distraction the joint with an external fixator followed by closed/open reduction becomes cumbersome and time taking. For such individuals open reduction with palmer approach and "shot gun" type of exposure is surgeon as well as patient friendly. More over traction device outcomes have been reported in multiple studies with an average final PIP arc of motion from 66-80% and good grip strength, though superficial pin tract infections were common and up to 61% showed progressive degenerative changes [12, 6, 13].
Considering patients age, goal to gain as much movement as possible with correction of deformity and intra-operative congruity of joint as well as no signs of arthritic changes primary formal fusion of the joint with bridge plating was not planned but preparation was done in case of need. Radiological and intra-operative clinical findings did not suggest any arthritic changes hence, trial to keep the joint mobile was given. Patient was informed about delayed complications such as stiffness, delayed re-dislocation as well as secondary arthritis and explained about future need of joint fusion.
Open reduction was planned to be followed by the repair of the volar plate with collateral ligaments but since it was not in position to be repaired another option to give innate stability to the joint has to be planned. Z-plasty of the initially raised A3 pully flap was done from which one limb was used to reconstruct volar plate suturing it with collateral ligament remnants. Another limb of the flap was used to cover the from above to prevent even the slightest chance of "bow-stringing".

Conflict of Interest: The authors declare that they have no conflict of interest.

Statement of Human and Animal Rights: This article does not contain any studies with human or animal subjects.

Informed consent: Informed consent was obtained from all individual participants included in the study.

Statement of Funding: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

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