

Irreducible Dislocations of the Proximal Interphalangeal Joint: Algorithm for Open Reduction and Soft-tissue Repair

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Summary: The “jammed finger” is among the most common hand injuries and may include simple sprains, dislocations, fractures, and fracture-dislocations. In contrast, irreducible dislocations of the proximal interphalangeal joint are rare injuries. However, they must not be overlooked in the primary assessment, because persistent subluxation may lead to joint contracture, severely compromising hand function. Irreducible dislocations are challenging injuries with interposed soft tissues, preventing closed reduction. Thorough preoperative diagnosis and soft-tissue imaging guide the approach to open reduction and repair of injured peri-articular structures. We introduce a systematic algorithm with considerations on classification and management of irreducible proximal interphalangeal joint dislocations. The algorithm is useful for the primary assessment and for hand surgeons responsible for open reduction and rehabilitation. (*Plast Reconstr Surg Glob Open* 2018;6:e1729; doi: 10.1097/GOX.0000000000001729; Published online 18 May 2018.)

INTRODUCTION

The proximal interphalangeal joint represents the most frequently injured joint in the hand.^{1,2} Accordingly, dislocations of this joint are very common hand injuries. They have been classified as dorsal, lateral, volar, or rotatory.^{3,4} A dislocation occurs if 2 or more stabilizing peri-articular structures are compromised.⁵ The majority of dislocations are of dorsal and lateral type. These are typically amenable to closed reduction.⁶ If joint reduction by means of closed manipulation is not feasible due to interposition of periarticular soft tissues, an irreducible dislocation is diagnosed. Volar dislocations and those mainly caused by rotatory forces are less frequent than dorsal or lateral dislocations but exhibit a high potential for complications, because they are prone to soft-tissue interposition.

Therefore, these injuries more frequently require open reduction.^{4,7}

Irreducible dislocations of the proximal interphalangeal joint are rare injuries.⁸ However, every physician should recognize these injuries and timely refer them to a hand surgeon. Due to the different biomechanical etiology of irreducible dislocations, treatment may even be challenging for hand surgeons. Moreover, the pertinent literature on this topic is controversial, particularly considering the management of injured soft tissues.⁹ The aim of the present article was to introduce a systematic algorithm to irreducible dislocations of the proximal interphalangeal joint with considerations on classification and pre- and postoperative management. The algorithm is suitable for the primary assessment of proximal interphalangeal joint dislocations and for hand surgeons responsible for open reduction and rehabilitation.

TREATMENT ALGORITHM

Primary Assessment

The primary assessment of proximal interphalangeal joint dislocations is crucial (Fig. 1). It should contain a concise history and unravel the trauma mechanism. If relevant torque forces are involved, irreducible dislocations

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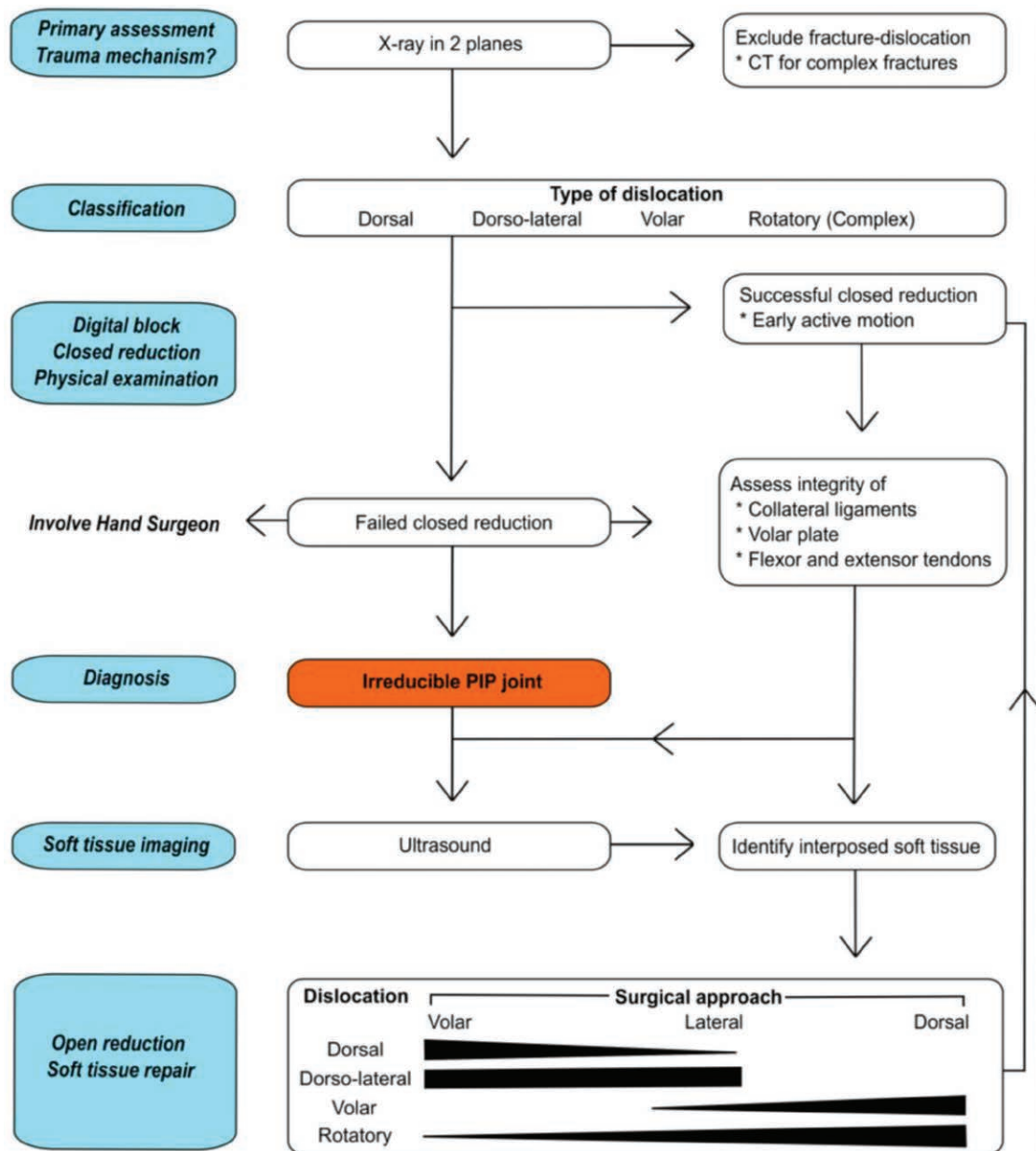


Fig. 1. Treatment algorithm for irreducible dislocations of the proximal interphalangeal joint. CT, computed tomography; PIP, proximal interphalangeal.

may be more frequent. A high index of suspicion is required for patients who report sudden rotatory traction injury, for example during exercising animals (ie, dogs or horses) or when catching fingers in spinning machines. The clinical examination may reveal puckering of the skin. This finding indicates soft-tissue interposition in the joint and is a helpful “red flag.”⁴ Finally, conventional x-ray images in true posteroanterior and lateral planes are evaluated to exclude fracture-dislocation. Especially for injuries with a rotatory component, true lateral images are difficult to obtain, and fluoroscopy is helpful in this regard. Complex fracture-dislocations may require further evaluation with computed tomography and frequently undergo surgical treatment.¹

Understand the Dislocation

An important step to successfully treat dislocations of the proximal interphalangeal joint is to understand the trauma mechanism. **Supplemental Digital Content 1** provides examples of dorsal, lateral, volar, and rotatory dislocations. (see **Supplemental Digital Content 1**, which displays classification of proximal interphalangeal joint dislocations, <http://links.lww.com/PRSGO/A757>). Lateral dislocations commonly involve a dorsal component. Accordingly, the term “dorso-lateral dislocation” is more accurate. Furthermore, these injuries should be classified according to the dislocation of the middle phalanx, that is, dorso-radial or dorso-ulnar type. Dislocations with a rotatory component should be recognized as potentially

complex dislocations.¹⁰ Even though complex injuries are mainly associated with volar dislocations,⁴ all dislocations may involve rotatory forces and result in a locked joint, requiring open reduction.

Failed Closed Reduction

Under local anesthesia, closed reduction is achieved for most dislocations of the proximal interphalangeal joint. Dorsal and dorso-lateral dislocations are reduced with gentle longitudinal traction and pressure on the dislocated base of the middle phalanx to prevent entrapment of the collateral ligament or the volar plate. In contrast, closed reduction of volar dislocations should be attempted with flexed metacarpophalangeal and proximal interphalangeal joints.⁴ This maneuver relaxes the entrapped extensor apparatus and facilitates closed reduction.⁹ Rotatory dislocations are reduced in a similar way with additional rotatory motion. After reduction, the integrity of periarticular structures (ie, collateral ligaments, volar plate, and tendons) should be assessed. Patients should be referred to a hand surgeon if (1) the joint cannot be reduced; (2) clinical findings indicate central slip avulsion (ie, loss of active extension in the proximal interphalangeal joint);

or (3) an unstable collateral ligament injury is observed. Importantly, after inappropriate attempts of closed reduction, such as pure longitudinal traction, even supposedly simple dislocations can require open reduction (Fig. 2).

Soft-tissue Imaging

Locked proximal interphalangeal joint dislocations commonly exhibit a combined soft-tissue problem. Consequently, even if the clinical assessment and the trauma mechanism seem obvious, more information on the interposed tissue is helpful. Sonographic assessment is a straightforward technique and allows imaging of the volar plate, the collateral ligaments and the flexor and extensor tendons (Fig. 2).¹¹ Moreover, ultrasound facilitates dynamic examination of injured finger joints.^{12,13} Alternatively, magnetic resonance imaging provides detailed information on the soft tissues. This technique, however, is more expensive when compared with ultrasound and does not allow dynamic examination of periarticular structures.

Open Reduction and Soft-tissue Repair

Irreducible dislocations of the proximal interphalangeal joint should undergo open reduction as quickly as

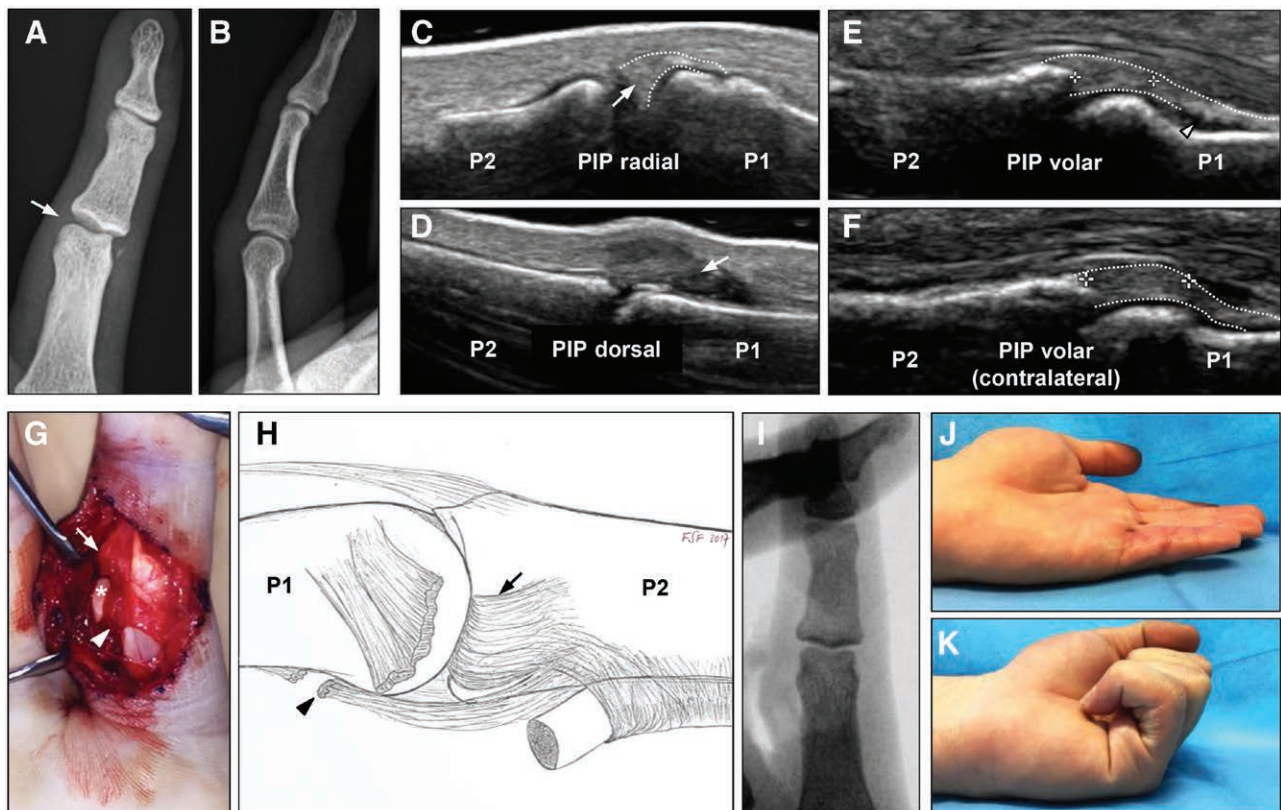


Fig. 2. Failed closed reduction of a dorso-ulnar dislocation. Persistent subluxation of the 5th proximal interphalangeal joint after failed closed reduction. (A and B) Preoperative x-ray with joint incongruity (A, arrow). (C-F) Sonographic evaluation illustrating an interposed radial collateral ligament (C, arrow) and a dorsal hematoma (D, arrow). The volar plate (E and F, blurred lines) was intact at the base of the middle phalanx. However, a hematoma (E, arrowhead) was detectable close to the radial check-rein ligament, indicating partial proximal avulsion. (G and H) Open reduction over a Bruner incision. Intra-ligamentous rupture of the collateral ligament (arrow), which was interposed in the joint. The collateral ligament was repaired with an absorbable mattress suture. Asterisk = radial P1 condyle, arrowhead = radial check-rein ligament. (I) Congruent joint after open reduction. (J and K) Four-week follow-up after early active motion with 85° range of motion of the proximal interphalangeal joint. P1 = proximal phalanx, P2 = middle phalanx.

possible to reduce the risk of long-term sequelae. If overlooked, shortening, adhesion, and fibrosis of periarticular structures may lead to joint contracture, severely compromising hand function.^{14,15} The synthesis of preoperative clinical and radiographic findings directs the surgical approach (Fig. 1).

Even though dorsal dislocations are the most frequent type, they are rarely complex. If irreducible, the volar plate is interposed in the joint.⁸ In more severe dislocations, the collateral ligaments and the joint capsule are injured and the head of the proximal phalanx may penetrate the volar soft tissues or even the superficial flexor tendon, resulting in a buttonhole mechanism.^{16–18} Irreducible dorso-lateral dislocations always exhibit complete rupture of a collateral ligament.^{5,19} Dorsal and dorso-lateral dislocations can be reduced over a volar approach. For this purpose, the flexor sheath is exposed over a Bruner incision. Then, the A3 pulley is opened, the flexor tendons are retracted, and the volar plate and/or the collateral ligament are lifted over the head of the proximal phalanx with a small hook (Fig. 2G). Alternatively, a lateral approach is suitable for open reduction of dorsal and dorso-lateral dislocations. After a midlateral skin incision, the transverse retinacular ligament is incised longitudinally to expose the proximal interphalangeal joint and to access the collateral ligament and the volar plate.²⁰

Irreducible volar dislocations of the proximal interphalangeal joint are serious injuries and always affect the extensor apparatus, 1 collateral ligament and the volar plate.^{21,22} Paradoxically, the central slip often remains intact in these injuries and the head of the proximal phalanx gets entrapped between the lateral band and the central slip.^{2,21,23} Finally, interposed collateral ligaments have been found during open reduction of irreducible volar dislocations.²⁴ Irreducible volar dislocations are reduced by dorsal or lateral approaches. For a dorsal approach, the skin incision is midline longitudinal or slightly curved, and care should be given to preserve the dorsal veins.²⁰ After skin flap elevation, the extensor apparatus and the lateral and volar periarticular structures are visualized. Preoperative assessment with sonography markedly facilitates the decision between a dorsal or lateral surgical approach. In the absence of extensor tendon disruption, a lateral approach may be more suitable.²⁴ These recommendations are overlapping with the algorithm for irreducible rotatory dislocations. Because the clinical and radiographic assessment may be inconclusive for these dislocations, preoperative soft-tissue imaging is particularly helpful for a successful treatment. Finally, precise identification of interposed soft tissues helps avoiding unnecessary incisions and shortens the time of surgery.

Soft-tissue repair has been discussed controversially except for repair of the radial collateral ligament in the index finger and for central slip avulsions.^{3–5} We are convinced that repair of completely ruptured collateral ligaments is beneficial for immediate active motion. In contrast, volar plate avulsions are commonly treated with extension block splinting or buddy taping.^{9,25} If collateral ligament or volar plate repair is pursued, small bone anchors or absorbable sutures represent suitable means (Fig. 2).

Rehabilitation

Early active motion is the key to a good result after open reduction of irreducible dislocations. We do not recommend strict immobilization in the early postoperative period. Buddy taping or extension block splinting is sufficient for most injuries. A major prerequisite for successful rehabilitation is an intimate cooperation with hand therapists. Under their supervision, loading exercises are initiated after 4 weeks. The patients should be instructed that the joint will often remain permanently thicker after reduction, and tenderness and soreness with use may persist for up to 12 months.¹⁰

CONCLUSIONS

Irreducible dislocations of the proximal interphalangeal joint are rare and therefore difficult injuries. It is crucial to recognize potentially complex dislocations (ie, dislocations with a rotatory component) at the time of injury. When treating these injuries, attempts of closed reduction without understanding the dislocation are to be avoided and involvement of a hand surgeon is recommended. Accurately planned open reduction and soft-tissue repair with subsequent early active motion yields good functional results.

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