Emergency Open Reduction for an Irreducible Dislocation of the Metacarpophalangeal Joint of the Thumb in a Child

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Introduction

Dorsal dislocation of Metacarpophalangeal joint (MPJ) of the thumb in children is an unusual injury. Although the patho-anatomy of pediatric metacarpophalangeal joint (MPJ) dislocations shows similarities to adult MPJ dislocations, they may have differences regarding absence of sesamoid bone formation and cartilage fracture of the metacarpal head at the collateral ligament insertions. In this report, we present a child who had irreducible dislocation of the MPJ of the thumb that required surgical intervention.

Case Report

A 4-year-old right hand dominant female presented after a fall in dance class. A right thumb MPJ dislocation was diagnosed and a closed reduction was attempted under sedation (Fig. 1). Despite several attempts by three different emergency physicians, the joint could not be reduced. One more unsuccessful closed reduction was attempted immediately in the operating room and open reduction was required. Because a volar plate rupture was anticipated, a radiovolar oblique incision was performed and the joint was reached. Volar plate rupture, radial collateral ligament rupture with an entrapped chondral fragment and accessory ligament tear of the ulnar collateral ligament were encountered (Fig. 2). The joint was reduced and was temporarily pinned with a 0.035 in. K-wire. The

chondral fragment with collateral ligament was spontaneously reduced and the chondral fracture was secured with 6–0 polyglactin sutures. The volar plate was repaired with 6–0 polyglactin sutures. The K-wire was removed at 3 weeks. Occupational therapy was started with a removable thumb spica splint for three more weeks. The patient regained full range of motion of the right thumb in 2 months and was followed 8 months without any complication (Figs. 3 and 4).

Discussion

We present a 4 year-old patient who had dorsal MPJ dislocation of the right thumb that was successfully treated with open epiphyseal reduction, temporary joint fixation, radial collateral ligament and volar plate repair. The mechanism of injury was described as a fall on the outstretched hand with forcible hyperextension of the MPJ, which is a characteristic for this injury [1]. According to Ishizuki et al., Kobayashi et al. described the pathologic anatomy of an irreducible MPJ. The flexor pollicis longus tendon and volar plate create an ulnar deviation moment and the sesamoid bones migrate to the open joint and lock the MPJ into a dorsal dislocation [2]. Whereas, transverse metacarpal ligaments and natatory ligaments are implicated for entrapment of metacarpal heads in irreducible MPJ dislocations of the other fingers [3, 4]. Collateral ligament ruptures, volar plate interpositions and metacarpal head entrapments in thenar muscles were accused for this irreducible joint dislocation of MPJ of the thumb in children [4–7]. Children who are younger than mid-adolescent may not have an ossified sesamoid bone [8]. Therefore sesamoid interposition may not be an issue, or at least cannot be radiographically confirmed, for irreducible MPJ dislocations in children.

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Fig. 1 X-Ray images of complex dislocation of the MPJ of the right thumb

Fig. 2 Dorso-volar Illustration of intraoperative findings of the present case

Fig. 3 X-ray images of reduced MPJ of the right thumb at 8 weeks post-operatively

There is limited data on the surgical management of dislocations of MPJ of the thumb in skeletally immature children (Table 1). Takami et al. reports a child who required open reduction. Their 9-year old patient had a volar plate rupture and it was folded into the joint. They were able to reduce the joint after removal of the volar plate from the joint. After 2 weeks of immobilization, a good outcome was achieved. Their article also provides an adult cadaver study for MPJ dislocations. MPJ dislocation can be created with hyperextension injury and they discovered that the radial sesamoid bone was in the joint with the volar plate. Simple traction and flexion was not enough to reduce the joint; However, reduction of the MPJ was able to performed by hyperextending the MPJ and sliding or translating the base of the proximal phalanx over the metacarpal head [7]. Similarly, Maheshwari et al. [9], Sulko et al. [6], and Mayer et al. [4] reported volar plate, and tendon interpositions and collateral ligament ruptures as causes of irreducible MPJ dislocation of thumb in children. Distinct from other reported open reductions of dislocations of the MPJ of the thumb, our patient had a chondral fracture of the head of the first metacarpal. Light and Ogden reported an osteochondral fracture on the ulnar side of second metacarpal head in a 6 year-old girl. After open reduction, the fracture fragment reduced spontaneously. The

Fig. 4 Functional outcome of the right thumb at 8 weeks post-operatively with opposition to the Palmo-Digital Crease

chondral piece in our patient piece was almost 20 % of the metacarpal head, which was not detectable with conventional X-ray. There was no soft tissue support to keep the joint stable. Therefore, tension of the adductor pollicis tendon was keeping the first metacarpal head into the adducted position. After identifying all the injured structures, the MPJ was reduced and the reduction was secured with one 0.035 in. K-wire. The chondral fragment with the origin of the radial collateral ligament reduced spontaneously with joint reduction to its original location and simple 6–0 polyglactin sutures used to secure it. Subsequently, the volar plate was repaired.

Like our patient, complex injuries are seen in irreducible dislocations of MPJ of the thumb in children. Metacarpal head

defects, short metacarpal, infection and lytic destruction of the metacarpal epiphysis were reported in open reduction of MPJ dislocations in other fingers [3, 8]. Only one complication, which is a recurrent dislocation that was successfully treated with collateral ligament reconstruction was reported by Maheshwari et al. after an open reduction of the MPJ of the thumb in children [9]. Most cases that required an open reduction of the thumb MPJ in children uneventfully recover [1, 4–7].

In conclusion, the MPJ dislocation of the thumb should be carefully reduced under sedation. As McLaughlin mentioned, traction maneuvers may transform simple dislocations to complex ones [10]. Thus, reduction of the MPJ should be

Table 1 Cumulative data Thumb MPJ dislocations in skeletally immature children

Author	Age and gender	Mechanism of Injury	Side	Type	Surgical approach	Intraoperative findings	Complications
Green and Terry 1973 [1]	7 -male	Not given	Left	Closed dorsal	Volar	N/A	None
Mayer et al.1984 [4]	13- male	Gym	Left	Closed dorsal	Volar	Tendon interposition and collateral ligament rupture	None
Takami et al.1998 [7]	9 -female	Direct trauma	Right	Closed Dorsal	Volar	Volar plate interposition	None
Sulko et al.2004 [6] ^a	Not given	Not given	Not given	Closed dorsal	Not given	Flexor tendon interposition	None
Rashdeen et al.2005 [5]	8 - female	Direct trauma	Right	Closed dorsal	Dorsal	Metacarpal head was trapped in thenar muscles	None
Maheshwari et al.2007 [9] ^a	Unknown age and gender of four patients	Not given	Not given	Closed dorsal	2 volar 1 dorsal 1dorsoulnar	-Volar plate, flexor tendon, capsule and collateral ligament interpositions. -Ulnar collateral ligament insufficiency	1 patient recurrent dislocations needed ulnar collateral ligament repair
Present study	4-female	Fall	Right	Closed dorsal	Volar	Volar plate interposition, radial collateral ligament rupture and chondral fracture	None

^a Ages of children were not provided however those patients are accepted as skeletally immature. (Ages: years old)

performed by hyperextending the MPJ and sliding or translating the base of the proximal phalanx over the metacarpal head [7]. The volar plate ruptures, interposed tendon, collateral ruptures and chondral fragments should be expected in surgery. Early concentric reduction, repair of injured structures, 3 weeks of immobilization, followed by hand rehabilitation should provide good outcomes in most cases.

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