

Surgical management of an open thumb fracture in a child

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ABSTRACT

Pediatric thumb fractures of the first metacarpal and/or proximal and/or distal phalanx are rare and most commonly treated conservatively. Surgery is preferred in patients with intraarticular fractures or when closed reduction cannot be achieved. In cases of comminuted open fractures, surgical treatment is also recommended. Dorsolateral, volar, or midlateral approach may be conducted, respecting the tendons, sheaths, and neurovascular structures. In this study, we describe an unusual case of a boy with a comminuted open fracture of the proximal phalanx of his left thumb. Due to extended soft tissue injury and severe swelling, surgery was performed in a late fashion, through the extensor mechanism of the thumb.

KEY WORDS: open thumb fracture; surgical approach; extensor mechanism

Introduction

The hand is a multifunctional and extremely important part of the human body. During its interaction with the environment it is exposed to injuries that may result in serious functional impairment [1]. Thumb opposition to the other four fingers is considered to be the most important milestone of the evolution of human species. In general, conservative treatment is preferred in finger fractures, but when surgery is necessary the least invasive procedure should be chosen [2].

Fractures and fracture-dislocations of the pediatric thumb ray should be treated *lege artis*, as the integrity of the thumb, as well as the first carpometacarpal joint, are far more important as compared to the other fingers or joints, in terms of hand function [3]. Comminuted open fractures or intraarticular fractures of the proximal phalanx of the thumb, if not be treated ap-

propriately, may result in severe complications as stiffness, limitation of range of motion, pain, pinch and grip impairment. Surgery is recommended when conservative treatment with closed reduction and splinting fails. Nonunion is uncommon, however, atrophic nonunion in a fracture of the proximal phalanx of the thumb has been published [4], and it was attributed to late treatment that was applied one and a half years after the initial injury!

In this report we present the unusual case of a comminuted open fracture of the proximal phalanx of the left thumb in a 10-year-old boy. Four days after injury, he was treated with open reduction and fixation with Kirschner wires, through a dorsal thumb approach *via* the extensor mechanism.

Case report

A 10-year-old boy was referred to our department from

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Fig. 1a



Fig. 1b



Fig. 1c

Fig. 1. The radiograph (a) shows a comminuted open fracture of the proximal phalanx of the left thumb in a 10-year-old boy. The pictures (b and c) show severe swelling and extended soft tissue damage, 4 days after the injury

a county hospital, where he had been admitted for a severe injury of his left thumb, 4 days ago. The injury had been caused after the fall of a heavy stone on his left thumb at the school playground. During clinical examination, severe swelling, pain and limitation of thumb motion were documented (**Fig. 1b and 1c**), however there were no signs of any tendon rupture or neurological deficit. The soft tissue of the volar surface of the thumb was injured in different sites that were closed with nylon sutures. The hand radiographs showed a comminuted fracture of the diaphysis of the proximal phalanx (**Fig. 1a**).

Because of the severe swelling and multiple soft tissue injuries, the standard surgical approaches (dorsolateral, volar, or midlateral) to the fracture site were deemed unsafe, considering protection of tendons, sheaths and neurovascular structures and infection avoidance. An approach through the extensor mechanism (**Fig. 2**) via an incision on the dorsum of thumb was conducted. To expose the fracture site, the periosteum along the proximal phalanx was partially stripped, and subsequently, reduction was carried out with slight tension and appropriate maneuvers. Fixation was achieved using two antegrade crossed, 0.9mm Kirschner wires starting at the radial and ulnar base of the proximal phalanx. After repair of extensor mechanism with interrupted sutures and surgical wound closure, a forearm cast was applied, immobilizing the wrist in slight ex-

tension and the thumb in abduction. A postoperative hand radiograph confirmed the good reduction (**Fig. 3**). After surgery the patient was administered intravenous prophylactic antimicrobial agents for 5 days. The cast and Kirschner wires were removed after 4 weeks and the patient at this point was suggested to begin active motion and thumb exercises. Favorable functional outcome of the thumb was documented at the 3-month follow-up (**Fig. 4**).

Discussion

There is a disagreement in the literature concerning the most common fracture type of the proximal phalanx of the thumb in young ages before adolescence. The most common type seems to be the Salter-Harris type II fracture (72%) [5]. Rotational deformities after Salter-Harris fractures are rare. In some cases though, 5 degrees of angulation may cause rotational deformity, which may be evident at clinical examination and confirmed at radiographic evaluation [6]. In the presented case, surgical treatment was performed attempting to achieve optimal reduction of the fracture fragments in order to avoid such complication.

The fractures of sesamoid bones at the metacarpophalangeal (MCP) joint of the thumb are fortunately rare and sometimes are associated with tears of the volar plate ligament of the MCP joint. A failure to recognize the ligament injury may lead to a long-term hy-

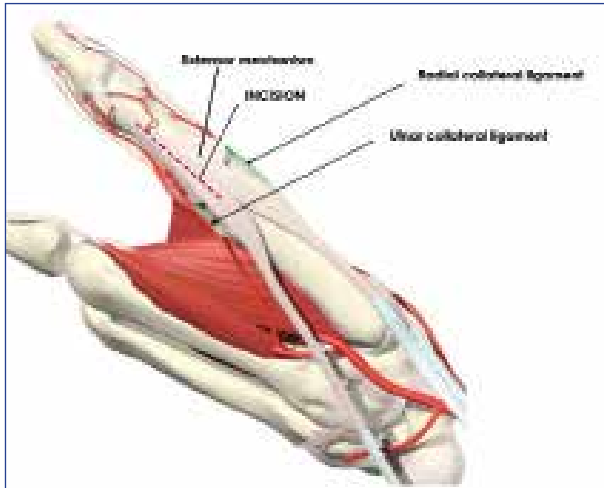


Fig. 2



Fig. 3a



Fig. 3b



Fig. 3c



Fig. 4

Fig. 2. The anatomy of thumb extensor mechanism and the incision through it (dotted line) for the dorsal approach of proximal phalanx

Fig. 3. Intraoperative picture (a) shows the incision to the dorsum of the thumb and the approach to the fracture site through the extensor mechanism. Fixation (b) was achieved with two Kirschner wires. Postoperative radiograph of the hand (c) confirmed the good reduction

Fig. 4. The picture shows the favorable clinical result three months after surgery. Extension of thumb and fingers

perextension instability on pinching [7, 8]. Our patient didn't report a hyperextension trauma to the MCP joint of his left thumb. We know that young children inadvertently place their thumbs in vulnerable positions, such as doors, drawers, or under heavy objects. The knowledge that the developing bones are more fragile than the ligaments explains why fractures and fracture-dislocations are more common than true dislocations in children [1-3].

Fractures of the proximal phalanx of the thumb often lead to range of motion impairment (mainly extension lag) of the MCP joint, mainly because of adhesions between the extensor tendon and the fracture site. Hence, the fracture alone may generate some degree of motion loss. Additional motion impairment may be iatrogenic, caused by inappropri-

ate surgical treatment or rehabilitation strategy [9].

The decision for surgical treatment of a comminuted thumb fracture is based on patient age and on sagittal and coronal alignment, dorsal displacement and tilt of the distal fragment, and prominence of the volar "spike" which impedes flexion at the MCP joint [10]. However, there are no trials comparing one treatment method to another for phalangeal fractures in children, and the literature is largely limited to retrospective case reports (like ours) and series [11].

In the presented case, specific technical details were taken into account. An incision to the dorsum of the thumb and the approach to the fracture site through extensor mechanism was performed respecting the soft tissues and avoiding further damage of the already injured sites of the thumb. Gen-

tle maneuvers were performed to achieve fracture reduction, and Kirschner wires were used for fixation instead of other bulky implants (such as plate and screws) that could be prompt for infection. Finally, the extensor mechanism was carefully repaired,

while early mobilization contributed in a favorable functional outcome. 

Conflict of interest

The authors declared no conflicts of interest.

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ΠΕΡΙΛΗΨΗ

Τα κατάγματα του αντίχειρα στην παιδική ηλικία που αφορούν το 1ο μετακάρπιο ή/και τις φάλαγγες (κεντρική και ονυχοφόρος), είναι σπάνια και συνήθως αντιμετωπίζονται συντηρητικά. Σε ενδοαρθρικά κατάγματα, εφόσον η κλειστή ανάταξη αποδειχθεί ανεπιτυχής, προτιμάται η χειρουργική επέμβαση. Σε συντριπτικά ανοικτά κατάγματα επίσης ενδείκνυται η χειρουργική αντιμετώπιση. Η προσπέλαση πραγματοποιείται με ραχιαία, παλαμιαία ή πλάγια τομή για να διαφυλαχθούν έλυτρα, τένοντες και αγγειονευρώδη δεμάτια. Περιγράφεται σπάνια περίπτωση αγοριού με συντριπτικό επιπλεγμένο κάταγμα 1ης φάλαγγος αριστερού αντίχειρα, όπου επιλέχθηκε η καθυστερημένη αντιμετώπιση εξαιτίας φλεγμονής, με προσπέλαση δια μέσου του εκτατικού μηχανισμού.

ΛΕΞΕΙΣ ΚΛΕΙΔΙΑ: κάταγμα αντίχειρα, προσπέλαση, εκτατικός μηχανισμός