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# Simultaneous Juxta-epiphyseal Proximal Phalanx Fracture with Flexor Tendon Entrapment in a Child. A Case Report and Review of Literature

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**Background**: Juxta-epiphyseal/Salter-Harris fractures are the most common hand fractures in children and the proximal phalanx the one in most cases involved. In the absence of soft tissue interposition, these growth plate injuries are simple to reduce and are stable. However; in some cases, flexor tendon entrapment could be present.

**Methods**: We report an 11 year-old girl who sustained a fall onto her outstretched hand with subsequent injuries in her long, ring and small fingers.

**Results**: Plain x-rays revealed a severely displaced juxta-epiphyseal proximal phalanx fracture in her ring finger associated with mildly displaced juxta-epiphyseal proximal phalanx fractures of the long and small fingers. Fractures reduction couldn´t be achieved after closed reduction attempt. An open reduction and stabilization by kirshner wires was performed in the fourth and fifth fingers, due to entrapment of the FDP tendon. Excellent functional as well as radiological outcomes were achieved.

**Conclusions**: These types of injuries are very uncommon and a high index of suspicion based on clinical as well as radiological findings is needed to make an early diagnosis and perform an adequate treatment. Multiple proximal phalangeal fractures could be associated with simultaneous entrapment of flexor tendons in different fingers such as in our case; this fact is important to bear in mind since is useful when planning the definitive surgical treatment and doing so, will have a positive impact into the last functional as well as radiological outcomes.

**Key words:** Flexor tendon, juxta-epiphyseal fracture, kirshner wires, open reduction, proximal phalanx fracture.

## Introduction

The proximal phalanx is the most commonly fractured hand bone in children [1,2,3]; these fractures appear to be about twice as common as fractures in the other phalanges [4,5] and the base due to a high incidence of juxta-epiphyseal as well as Salter-Harris type II fractures is the most common site for these fractures [1,6].

Usually these fractures, present no problem with regard to reduction and post-reduction stability [4]; however, in some cases soft tissue entrapment could be presented and an irreducible fracture its consequence [1,4,5,7]. This fact it´s important to be taken into account since repeated attempts at closed reduction may result in increasing swelling, damage to the growth plate or the entrapped tissues [4,7].

There are few reports of displaced irreducible phalangeal growth plate fractures in children due to different anatomic structure such as: extensor hood-periosteal [4,8], fibrous tissue infolding [9], lumbrical and interosseous tendons [5] and flexor tendons [1,7,10,11].To the best of our knowledge, we report the first case of a simultaneous irreducible proximal juxta-epiphyseal fracture of the ring/little fingers due to interposition of the Flexor Digitorum Profundus (FDP) tendon.

## CASE REPORT

An 11 year-old girl fell down while playing soccer onto her outstretched left hand. She presented to the emergency department (ED) with deformity at the base of the fourth and fifth fingers, swelling and painful restricted motion.

Rotational deformity of the fourth and fifth fingers associated to radial deviation and hyperextension were found during physical examination, neurovascular structures were intact. Plain radiographs of the affected hand revealed a severely displaced juxta-epiphyseal fracture of the fourth proximal phalanx and mildly displaced juxta-epiphyseal fracture of the third and fifth proximal phalanges (with rotational deformity). (Fig.1).

Closed reduction under sedation was performed applying traction and ulnar deviation, followed by immobilization using a forearm cast with extension to the fingers in a functional position; however, repeat plain x-rays were obtained and didn´t reveal any changes (Fig.2).

Under general anesthesia, before an open reduction was performed, passive extension of the involved fingers were blocked, that finding, made us suspicious of a possible flexor tendon entrapment. Based on this fact, a dorsal approach over the metacarpo-phalangeal joint lateral to the extensor tendon in both fingers was done. The FDP tendon was found to be interposed (Fig.3) and was retracted from the fracture site in both phalanges. Afterwards, reduction was performed and stabilized by using retrograde Kirschner wires due to fracture instability (Fig.4). The kirschner wires were removed after four weeks.

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**Figure 1:** X-ray postero-anterior view of the left hand showing a severely displaced juxta-epiphyseal fracture of the proximal phalanx in the ring finger (Type II according to Campbell´s line) with radial deviation associated with two mildly displaced juxta-epiphyseal fracture of the proximal phalanx in the long and small fingers (Type I according to Campbell´s line).

At one year follow up, the patient had complete range of motion of both, the metacarpo-phalangeal joint as well as the proximal interphalangeal joint. Growth of both digits was normal and without any residual deformity. Plain radiographs showed fracture healing as well as a correct alignment (Fig.5A,B).

## Discussion

Juxta-epiphyseal/Salter-Harris fractures are the most common hand fractures in children and the proximal phalanx the one in most cases involved. In the absence of soft tissue interposition, these growth plate injuries are simple to reduce and are stable [4,7]. Tendon entrapment can occur in these type of fractures and in most instances, it involve´s the flexor tendons. The FDP tendon is the most commonly involved tendon in such entrapment due to its proximity to the bone; in these patients the tendon becomes trapped between the fractured epiphyseal fragments [12].

**Figure 3:** Clinical picture taken during dorsal surgical approach, in which entrapment of the Flexor Digitorum Profundus (FDP) tendon is appreciated. It was in the fracture site.

The reported mean age of the patients in which this entrapment occurred was 8.5 year-old (range, 4-12) and in the majority of cases a girl was affected (table 1). Among the mechanism of injury described, sport related injuries and hyperflexion were commonly present such as in our case.

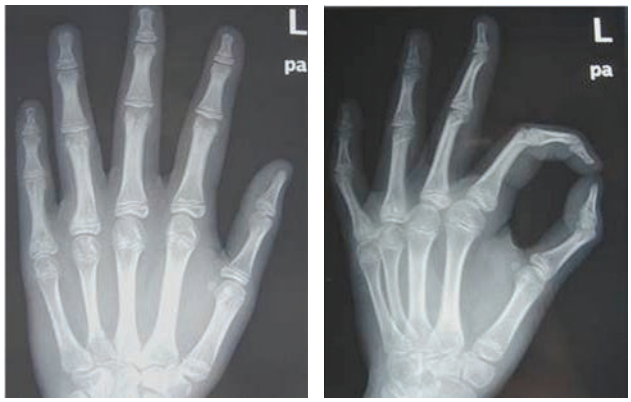
In all cases a severely displaced juxta-epiphyseal/Salter Harris fractures were presented, according to Campbell´s lines all were type II [10]. Al-Qattan didn't find any case of flexor tendon entrapment in type I fractures (mildly displaced). This fact, should be taken into account during the assessment of patients with these type of fractures.

Clinically we have to suspect the presence of a flexor tendon entrapment when dorsal angulation of the digit after a severe hyperextension injury, attempts at closed reduction are unsuccessful, a rubbery resistance to manipulation and severe swelling are found [1,7]. In our case, all these characteristics were presented in both fingers.

Repetitive closed manipulative reduction is useless, if not injurious, to the growth plate and tissues [7]; this may result in

**Figure 2:** After performing a closed reduction attempt, plain x-ray showed juxta-epiphyseal fractures of the proximal phalanges still displaced.

**Figure 4:** Clinical picture in which a dorsal approach used during open reduction could be appreciated. Also, stabilization of fractures using kirschner wires are showed.




A B

**Figure 5.** At one year follow up, the patient has excellent functional outcome and correct alignment. **A.** Postero-anterior view of left hand showing healing of fractures with open physis and correct alignment. **B.** Oblique view of left hand showing healing of fractures with open physis and correct alignment.

increasing swelling and could damage the growth plate or the entrapped tissues [1]. In some cases, tendon entrapment may remain unnoticed and present late as tendon dysfunction [12]. This is why a high suspicious based on clinical as well as radiological findings is needed, so further damage could be avoided.

It has been reported that within the proximal phalangeal fractures, the small finger is the one involved in most cases, followed by the ring and middle ones [10]. In three cases of flexor tendon entrapment, the small finger was the most commonly involved, followed by the ring and long one (Table 1); this distribution is similar to the one of the juxta-epiphyseal/ physeal fractures. In three cases [1,10,11] only one finger was involved and in two, multiples phalanges were involved (7, our case). Harryman et al [7], reported multiple phalangeal fractures but only one with flexor tendon entrapment; however, in our case there was entrapment in both fingers. It´s important to highlight the fact that in Harryman et al case, the phalanges without entrapment were minimally displaced, in contrast to our case in which the entrapment was present in the one with severely displacement as well as in the one with mild displacement and rotational deformity; so having a mildly displaced fracture doesn't rule out a tendon entrapment. Bearing this fact in mind, will help us in the pre-operative planning with regards to the number of fingers in which a surgical approach should be considered.

When closed reduction and splinting are performed in severely displaced fractures, long-term complications may occurred as reported by Al-Qattan et al [10]. Entrapment of flexor tendons are associated in most cases with severely displaced fractures which are irreducible, if treated by closed reduction will result in poor outcome. This is why, an open reduction and pinning is the prefer method of treatment in these cases. An anatomic and stable reduction of the phalanx involved is very important because this will allow a proper gliding of the tendon [1]. Instability of these fractures might be related to disruption of the periosteal sleeve on the side of angulation and Kirschner-wire fixation is needed [10]. Several surgical approaches have been reported (table 1) and in our case we used a dorsal approach in both fingers, identifying easily both flexor tendons. This approach also makes easy the retraction of the tendons and reduction of the fractures with further stabilization. If an anatomic and stable reduction is achieved, there will be a good functional as well as radiologic outcomes; as seen in all cases reported.

We report a patient with a simultaneous irreducible proximal juxta-epiphyseal fracture of the ring/little fingers due to interposition of the FDP tendon. This type of injury is uncommon, but when present, it demands an early diagnosis and accurate treatment. Flexor tendon entrapment has been associated with severely displaced juxta-epiphyseal fractures and involvement of one finger, even in multiple fracture phalanges. We want to highlight the idea that even in mildly displaced juxta-epiphyseal fractures, a tendon entrapment as well as multiple phalanges involvement may be observed; we think that a high index of suspicion is of outmost importance based on radiological as well as clinical findings. All these facts, will help the surgeon to provide the best treatment and achieve excellent outcomes.

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