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Salter-Harris type IV fracture of the proximal phalanx of the thumb with rotation of the epiphysis: Outcome 10 years following open reduction and K-wire fixation



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ABSTRACT

INTRODUCTION: Salter-Harris type IV fracture of the proximal phalanx with 90° rotation of the epiphysis is very rare. We report on a case of Salter-Harris type IV fracture of the proximal phalanx of the thumb with rotation of the epiphysis and document the outcome 10 years after surgery.

PRESENTATION OF CASE: A 5-year old boy presented with Salter-Harris type IV fracture of the thumb with 90° rotation of the epiphysis. Open reduction and K-wire fixation was done. Ten years later, the injured thumb was smaller in width when compared to the contralateral thumb, although there was no length discrepancy. Clinically, there was full range of motion. Radiologically, the physis was still open but there were minor irregularities at the adjacent metaphyseal base and epiphysis. The diaphysis of the injured proximal phalanx had a constricted appearance when compared to the contralateral normal side.

DISCUSSION: After an extensive literature review, we found one reported case which was similar to our case and had long term assessment. At skeletal maturity, there was complete remodeling and full range of motion of the digit with no shortening. The X-ray showed a constricted diaphysis of the proximal phalanx with an identical appearance to our case.

CONCLUSION: We present a rare case of Salter-Harris type IV fracture of the proximal phalanx of the thumb with rotation of the epiphysis. Long term outcome was satisfactory but there was diaphyseal constriction leading to a narrower thumb.

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1. Introduction

Salter-Harris fractures with rotation of the epiphysis are rare and their long-term outcome is poorly documented. We report on a case of Salter-Harris type IV fracture of the proximal phalanx of the thumb which was associated with rotation of the epiphysis and document the outcome 10 years after surgery. The work has been reported in line with the SCARE criteria [1].

2. Presentation of case

A 5-year old boy caught his right thumb in a closing door. Clinically (Fig. 1a), the thumb appeared in volar dislocation at the metacarpophalangeal joint with no passive or active motion at that joint. Radiologically (Fig. 1b), there was a Salter-Harris type IV fracture with almost 90° rotation of the epiphysis. Under general anesthesia, closed reduction failed to de-rotate the epiphysis. A 1 cm mid-lateral incision was made and the epiphysis

was de-rotated and a percutaneous oblique K-wire was inserted to maintain the reduction. The K-wire was removed at 3 weeks. The patient was seen 8 weeks later at which time there was evidence of clinical union (not tenderness) but the fracture line was still visible radiologically (Fig. 1c). The patient was recalled to the clinic 10 years later. When asked about any subjective complaints, he stated that his injured (dominant) thumb is narrower in width when compared to the contralateral thumb, although these is no length discrepancy (Fig. 1d).

Clinically, there was full range of motion of the injured thumb and the key-pinch measured 110% of the contralateral non-dominant thumb. Radiologically (Fig. 1e), the physis was still open but there were minor irregularities at the adjacent metaphyseal base and epiphysis. A more interesting finding was the constricted appearance of the diaphysis of the injured proximal phalanx when compared to the contralateral normal side (Fig. 1f).

3. Discussion

Traumatic rotation of the epiphysis is rare and is not addressed in major reviews of paediatric hand fractures [2,3]. In contrast, dorsal displacement of the epiphysis (without rotation) is a well

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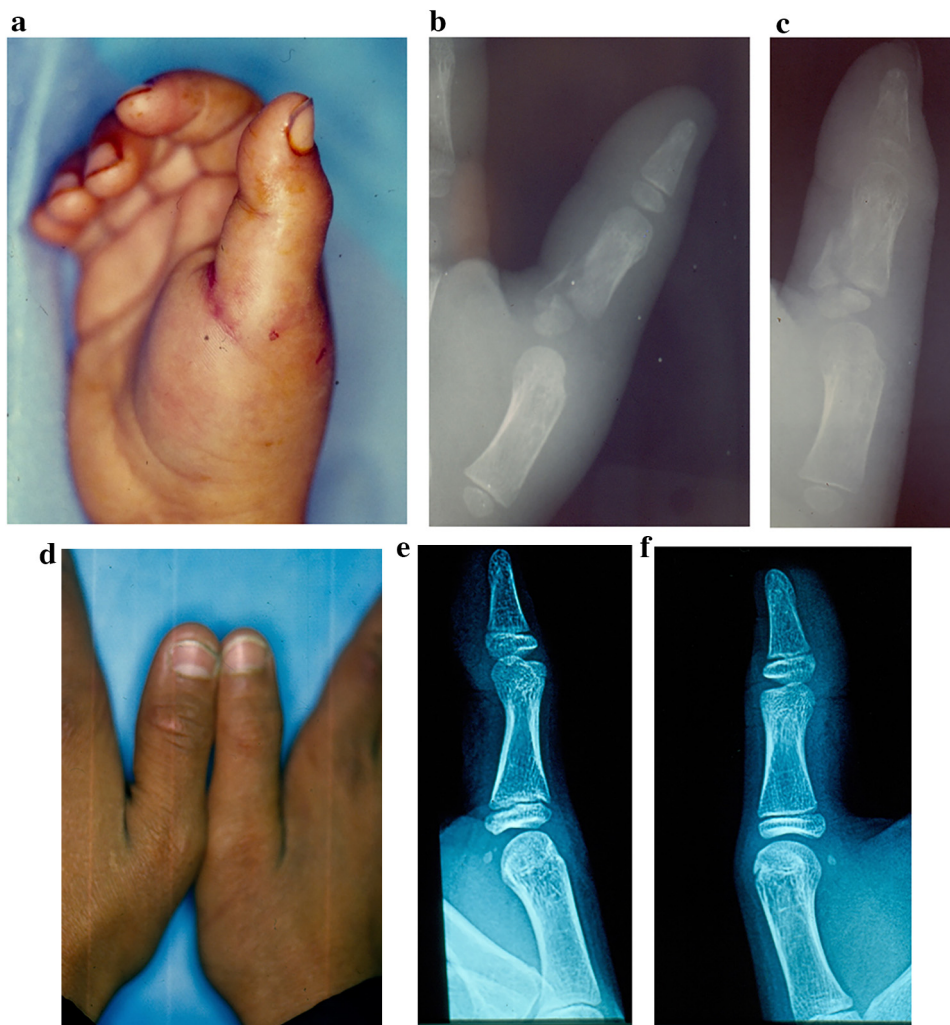


Fig 1. a: Clinical appearance at the time of injury. b: X- rays at the time of injury. c: X-ray at 8weeks (5weeks after removal of the K-Wire). d: Clinical appearance 10 years later. Note that there is no length discrepancy but the previously injured right thumb is narrower in width. e: X-ray of the injured thumb 10 years later. Note the patent physis and the constricted diaphysis. f: X-ray of the contralateral uninjured thumb for comparison with Fig. 1e.

described injury and is known to be associated with Salter-Harris I injury [4]. A major problem with paediatric hand fractures is the paucity of reports on long-term outcome. For example, Hashizume et al. [4] reviewed the literature on Salter-Harris I injuries associated with dorsal displacement of the epiphysis and stated that long term results were unknown, although shortening (due to premature epiphyseal fusion or epiphyseal necrosis) was expected.

After an extensive literature review, we found one reported case which was similar to our case and had long term assessment [5]. A 3 year-old boy had a Salter-Harris type IV of the proximal phalanx of the little finger with 90° rotation of the epiphysis. At skeletal maturity, there was complete remodeling and full range of motion of the digit with no shortening. The X-ray showed a constricted diaphysis of the proximal phalanx with an identical appearance to our case. In both cases, the excellent remodeling and patency of the physis prevented long term deformity and longitudinal growth arrest; respectively. However, the constricted phalanx resulted in narrowing of the digit. It is important note that the physis adds bone through endochondral ossification resulting in longitudinal growth, while periosteum-mediated membranous appositional bone formation (with concomitant endosteal remodeling) leads to enlargement of the diameter of the diaphysis which is highly vascular in young children. The injury site in our case and in the case reported by Graham and waters [5] was the base of the

phalanx and yet, the physis managed to escape ischaemic sequelae and remained patent.

The main message from our report is to bring the attention to the complication of constricted diaphysis (despite the presence of a patent physis) following Salter-Harris fractures.

4. Conclusion

We present a rare case of Salter-Harris type IV fracture of the proximal phalanx of the thumb with rotation of the epiphysis. Long term outcome was satisfactory but there was diaphyseal constriction leading to a narrower thumb.

Conflict of interest

None.

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Ethical approval

The study was approved by the Research Committee of National Hospital (Riyadh Care), Riyadh, Saudi Arabia.

Consent

Written informed consent was obtained from the parent of the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by Editor-In-Chief of this journal on request.

Authors' contribution

All authors contributed significantly and in agreement with the content of the manuscript. All authors participated in data collection and in writing of the manuscript.

Registration of research studies

Not relevant here.

Guarantor

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