Jeopardized digital circulation from a closed phalangeal fracture

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Closed phalangeal fractures that accompany concomitant vascular injuries are not common. The mechanism of such vessel injuries vary, from direct vascular trauma by fractured bone segment, increased compartmental pressure or unintentional vascular traction during reduction procedures. Acute digital ischemia requires appropriate surgical intervention(s) to minimize complications. The authors present a case of a closed phalangeal fracture with concomitant digital artery injury, and a brief review of the related literature.

**Key Words:** Closed; Digital injury; Finger injuries; Vascular

CASE PRESENTATION

A five-year old girl presented to the emergency room with painful swelling in her left fifth finger. No external wound was noted on physical examination, except for slight swelling of the proximal interphalangeal joint. Radiography revealed a transverse middle phalangeal base fracture, with notable displacement of the bony fragment and a concomitant fracture of the neck of the proximal phalanx (Figure 1). The patient was discharged after conservative management with manual reduction and finger splinting. However, on her follow-up visit two days later, the injured digit exhibited severe swelling coupled with distal skin necrosis, indicating vascular compromise (Figure 2). The patient underwent urgent explorative surgery under general anesthesia, and subsequent intraoperative inspection confirmed total transection of the radial digital artery and nerve. Internal fixation of the fractured bone segment using a Kirschner wire, along with arterorrhaphy and neurorrhaphy using 10-0 Ethilon sutures (Ethicon, USA), were performed (Figure 3). Despite such revascularization attempts, no clinical improvement was observed, which led to the loss of the nail appendage six months after the surgery (Figure 4). The proximal interphalangeal joint currently exhibits normal range of motion, but the distal interphalangeal joint remains rigidly fixed.

**DISCUSSION**

Closed phalangeal fractures are often regarded as relatively nonemergent, simple injuries compared with open fractures (1). However, even in the absence of an open wound, closed fractures can inflict serious damage to surrounding vital structures, as described in the case presented and other literature (2,3).
Intervention at an appropriate time may have yielded a better result; however, the patient did not present any cyanosis nor pallor, and such lack of ischemic signs ultimately led to delayed detection long past the 'golden' time window critical for limb salvage.

Given the slow development of clinical manifestations of vascular ischemia in this case, vessel traction coupled with direct vascular injury from fractured bone segment during the initial reduction procedure are suggested as the primary cause of vascular compromise. However, direct injury from bone segment displacement, as well as increased compartment pressure following soft tissue swelling, may also have aggravated the event (4).

We focused mainly on the radial digital artery because it is the dominant vessel of the little finger, as reported by Haerle et al (5). Intraoperative Doppler ultrasound confirmed intact revascularization and postoperative prostaglandin was also given. Unfortunately, such measures did not succeed in complete recovery of the entire finger. Nevertheless, they prevented further shortening of the limb because skin necrosis may have progressed to the middle phalanx level had the surgery not been performed. Also, soft tissue swelling, as well as reperfusion injury from delayed vascular anastomosis, may all have contributed to distal finger necrosis.

A thorough examination of an injured finger is an essential step, especially when managing a closed phalangeal fracture in children. In pediatric finger crush injuries, possible neurovascular damage should be suspected and evaluated even if no abnormal signs are present. Surgical intervention must be promptly executed when vascular insufficiency is determined, which may result in excellent functional outcomes.

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REFERENCES

Figure 3) Intraoperative photograph of transected artery and nerve anastomosis
Figure 4) Six-month postoperative photograph reveals healed distal phalanx without nail structure