

Hang Fire – Acute Crush Injury of Fingers – Till Appropriate Intercede – A Case Report

S Karthick¹, Balasubramanian Nellaiyappan¹, Subashini Rajendiran¹

Learning Point of the Article:

X-rays of the blunt injury of the hand are must as the phalanges can get fractured easily. Differentiation between arterial ischemia and venous congestion is important. In threatened ischemia, the decision between surgery and conservative management has to be taken by serially monitoring the finger.

Abstract

Introduction: Pediatric crush injuries of the hand may present with fractures and threatened digital vascularity, requiring careful differentiation between venous congestion and arterial ischemia.

Case Report: A 6-year-old boy sustained a crush injury to the left hand with phalangeal fractures and threatened vascularity of the middle finger. The patient was managed conservatively with immobilization, limb elevation, hydration, anticoagulation, thermal support, and serial vascular monitoring. Progressive recovery of perfusion and viability was achieved without surgical intervention.

Conclusion: Conservative management with close observation may successfully salvage borderline ischemic digits in selected pediatric crush injuries and avoid unnecessary surgical exploration.

Keywords: Pediatric crush injury, digital ischemia, venous congestion, missed injuries, precarious viability, deformity, stiffness.

Introduction

Hand injuries are common in the pediatric population and may present with associated vascular compromise [1]. Crush injuries, in particular, can result in soft-tissue damage, fractures, and threatened digital viability [2]. While surgical intervention is often considered in cases of ischemia, selected cases have to be managed conservatively with close monitoring and intervened only when necessary because the surgical procedure per se can worsen the ischemia. We report a case of a 6-year-old male child with a crush injury to the left hand presenting with venous congestion and threatened viability of the middle finger, along with phalangeal fractures. (Fig. 1) The patient was managed with immobilization, limb elevation, anticoagulation, and serial

monitoring. Despite initial severe symptoms, gradual improvement in vascularity was observed, and the digit was successfully salvaged without surgical intervention. (Fig. 2 & 3).

This case highlights the importance of careful clinical assessment and emphasizes that conservative management can be a viable option in pediatric patients with borderline digital ischemia [3].

Phalangeal fractures account for a significant proportion of hand injuries, especially in children [1, 4]. Most stable fractures can be managed conservatively; however, crush injuries often present with associated soft-tissue damage and vascular compromise, making management more challenging [2, 5].

Digital ischemia is a critical concern, as delayed or inappropriate

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Author's Photo Gallery



Dr. S Karthick



Dr. Balasubramanian
Nellaiyappan



Dr. Subashini Rajendiran

¹Department of Orthopaedic Surgery, Sri Ramachandra Institute of Higher Education and Research, Chennai, Tamil Nadu, India.

Address of Correspondence:

Dr. Balasubramanian Nellaiyappan,
Department of Hand Surgery, Sri Ramachandra Institute of Higher Education and Research, Porur, Chennai - 600116, Tamil Nadu, India.
E-mail: drvenkatesh_11@hotmail.com

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Figure 1: Initial clinical image showing dusky middle finger with venous congestion.

management may result in tissue necrosis and permanent functional loss [6]. While surgical exploration is indicated in clear cases of arterial insufficiency, the management of borderline ischemia and venous congestion remains controversial [7,8].

Pediatric patients possess a rich collateral circulation, which may allow recovery even in cases of initially compromised vascularity [3, 9]. This case demonstrates successful conservative management of a child with threatened digital ischemia of the middle finger following crush injury.

Case Report

A 6-year-old male child presented with a history of an accidental fall of study desk while playing at school and sustained injury to left hand. The injury occurred due to direct compression of the hand.

He immediately received treatment at a peripheral health center and was managed conservatively, advised rest and ice pack application and sent home. However, X-rays of the finger were not taken. Patient attenders continued to notice there was a gradual increase in swelling and discoloration of the middle finger. Later, he was taken to another hospital where orthopedics surgeon ordered an X-ray, and X-ray showed comminuted phalangeal head fracture proximal phalanx middle finger. Due to the suspicious nature of the injury and darkish discoloration of skin, suspected vascular injury, patient had been referred to our tertiary care center to the hand surgery unit (Sri Ramachandra Institute of Higher Education and Research). The patient had intact arterial flow, venous congestion, and patient had been started on supportive measures such as hand warmer, hydration, limb elevation, and medical management such as analgesics and low molecular weight heparin. There was no significant past medical or surgical history. Developmental milestones and immunization status were appropriate for age.

Clinical examination

On local examination, the left middle finger showed diffuse swelling and tenderness over the phalanges. The fingertip was cold to the touch with discoloration extending from the tip up to the proximal interphalangeal joint. Sensations were altered over the middle finger. Active range of motion (ROM) could not be assessed due to pain. The findings were suggestive of venous congestion with threatened digital ischemia.

Imaging

Radiographs (antero-posterior and lateral views) of the left hand revealed:

- Fracture of the head of the proximal phalanx middle finger
- Fracture at the base of the middle phalanx middle finger.

Management and hospital course

The patient was admitted for close monitoring. Parents were counseled regarding the role of conservative management for venous congestion, the possibility of deterioration, and the potential need for surgical intervention, including amputation if the finger became non-viable.

The patient was managed conservatively with:

- Immobilization using plaster of Paris below elbow dorsal slab with wrist in neutral position and metacarpophalangeal joints in 90° flexion
- Hydration
- Low molecular weight heparin
- Limb elevation



Figure 2: Radiographs (Anteroposterior and lateral views) showing fractures of the middle finger.



Figure 3: Clinical progression showing improvement in vascularity.

Serial monitoring of vascular status
 Analgesics and supportive care
 Hand therapy exercises
 Hand warmer.

Hospital course

Day 1: Late presentation, delayed diagnosis, severe pain and agitation; finger appeared dusky with marked venous congestion on arrival

Day 2: Supportive measures augmented, and the finger continued to be precariously viable without any further worsening or improvement

Day 3: No further worsening of symptoms (ray of hope in the air)

Day 5: A significant level of recovery and marked improvement noticed

Day 7: Progressive improvement in color, warmth, and perfusion noted. Blister formation noted around the finger, and sterile evacuation done

Day 12: Finger ROM initiated and therapy taught to the patient

Day 14: Patient discharged from hospital with a further plan of operative skeletal stabilization after a week.

The patient showed steady recovery and was discharged after 14 days with a viable middle finger. (Fig. 4).

Results

At the time of discharge, the middle finger showed:

Restoration of vascularity

Improved skin color and temperature

Significant reduction in pain.

The digit was successfully salvaged without surgical intervention.

Patient was advised for review, but the patient did not come as advised no further treatment has been attempted for fracture management. Child continued to heal with flexed posture of proximal interphalangeal joint and started using his hand after 3 months from the date of injury. Patient attenders had been contacted over phone and advised to follow-up, and we requested clinical images through phone. Patient's attenders shared a clinical image through phone in WhatsApp, but conveyed they were not interested in further intervention for the finger. (Fig. 5).

Discussion

Crush injuries to the hand can result in both skeletal and vascular compromise. In pediatric patients, the presence of a robust collateral circulation increases the potential for recovery even in cases of threatened ischemia [10,11].

Pediatric patients possess excellent collateral circulation and tissue healing potential compared with adults. Even digits that initially appear poorly perfused may recover with careful observation, elevation, splintage, and serial neurovascular monitoring [10,12].

Crush injuries of the hand are unique because the extent of vascular and soft-tissue damage is often underestimated during the initial examination. Progressive edema and venous



Figure 4: Final outcome at discharge.

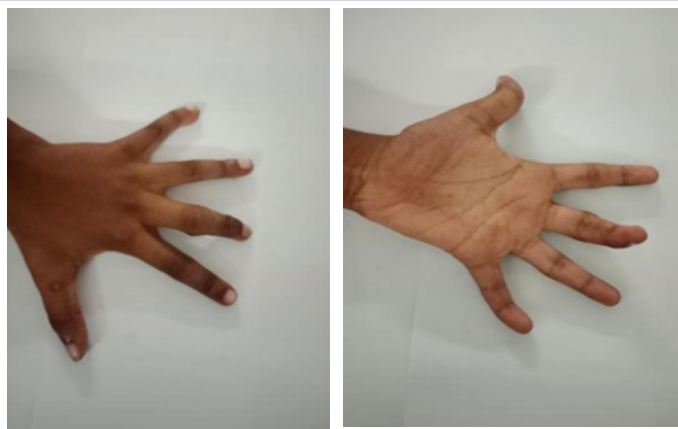


Figure 5: One-year follow-up shows with deformity of the finger, and assessment is limited due to non-availability of physical examination, as they were subjectively satisfied with the functional outcome.

During one year followup description

congestion may worsen tissue perfusion during the first 24–48 h, making repeated clinical assessment essential [11, 13].

Conservative management can be considered in selected cases of borderline digital ischemia where capillary refill gradually improves, and no definite arterial transection is identified. Avoiding unnecessary surgical exploration may prevent additional trauma to already compromised tissues [10, 13].

Early immobilization and elevation play a significant role in reducing edema and venous congestion in pediatric hand trauma. Reduction in swelling improves microvascular circulation and may aid spontaneous recovery of threatened digits [11, 14].

Serial documentation of color changes, temperature, capillary refill, oxygen saturation, and progression of swelling is essential in conservative management. Any deterioration in vascularity should prompt urgent reassessment for surgical intervention [13, 14].

Functional recovery in children is generally superior because of rapid bone healing and adaptability of the growing hand. However, delayed stiffness, nail deformity, growth disturbances, and joint contracture may occur, highlighting the need for long-term follow-up and physiotherapy [14, 15].

The present case supports the principle that not all congested or poorly perfused digits require immediate operative exploration. Careful patient selection and close monitoring may result in successful salvage with preservation of function and avoidance of unnecessary surgery [10, 13].

Venous congestion may present with discoloration and swelling, often mimicking arterial insufficiency. However, it does not always indicate irreversible ischemia. Differentiating between these conditions is essential to avoid unnecessary surgical intervention [13, 16].

Conservative management, including limb elevation,

anticoagulation, thermal support, and physiotherapy, can promote vascular recovery in selected cases [11, 14].

Previous studies have demonstrated that while surgical fixation is necessary in unstable fractures, conservative management remains effective in carefully selected patients [11, 15].

This case highlights the importance of serial clinical assessment and cautious decision-making, particularly in pediatric patients, where tissue recovery potential is high [10, 12].

Limitations

This is a single case report, limiting the generalizability of the findings to broader pediatric populations

Absence of a control or comparison group prevents direct comparison between conservative and surgical management outcomes

The exact degree of arterial compromise could not be objectively quantified

Advanced vascular imaging, such as Doppler ultrasonography or angiography, was not performed

Pulse oximetry measurements of the affected digit were not documented serially

Lack of objective perfusion assessment tools may limit reproducibility of decision-making

The diagnosis of venous congestion versus arterial ischemia was based predominantly on clinical examination

Delayed initial diagnosis at the peripheral center may have influenced the clinical course and outcomes

The patient presented after prior treatment elsewhere, limiting assessment of the immediate post-injury status

The exact timing and severity of vascular compromise progression could not be precisely determined

Long-term follow-up was incomplete because the patient was lost to regular follow-up

Final functional outcomes, such as grip strength, dexterity, and fine motor function, were not objectively assessed

Long-term complications, including growth disturbances, stiffness, or physeal injury, could not be evaluated adequately

Radiological union and long-term fracture remodeling were not fully documented

Skeletal stabilization of the fractures was ultimately not performed, limiting assessment of fracture management outcomes

Follow-up clinical assessment relied partly on telephonic communication and photographs shared through messaging applications

The quality and accuracy of remotely shared clinical images

may not reliably reflect true functional recovery

Rehabilitation compliance and home-based physiotherapy adherence could not be objectively monitored

Conservative management success in this case may not be applicable to patients with complete arterial disruption or severe crush injuries

Larger prospective studies are required to establish standardized protocols for differentiating venous congestion from threatened arterial ischemia and to define indications for conservative versus surgical management in pediatric crush injuries.

Conclusion

Conservative management can be an effective treatment option in pediatric crush injuries with threatened digital ischemia, provided close monitoring is ensured.

Clinical Message

Pediatric crush injuries with threatened digital vascularity require careful serial assessment, as selected cases may recover successfully with conservative management and close monitoring.

This case emphasizes that not all cases of vascular compromise require immediate surgical intervention, and favorable outcomes can be achieved with appropriate non-operative care.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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