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Salvage of a Severe Blast-Induced Open Hand Injury with Multiple Digital Amputations and First Carpometacarpal Dislocation: A Case Report

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Abstract: ***Blast-induced hand injuries are associated with extensive soft tissue destruction, fractures, joint disruption, and a high risk of infection, making limb salvage challenging. We report the case of a 22-year-old man who sustained a severe blast injury to the left hand with traumatic amputations of the distal segments of the second, third, and fourth digits, an open Gustilo-Anderson Grade IIIB injury, and first carpometacarpal (CMC) joint dislocation. Emergency management included prompt irrigation and debridement, intravenous antibiotics, tendon repair where feasible, anatomical reduction of the first CMC joint, stabilization with crossed Kirschner wires, and primary wound closure. Serial follow-up demonstrated uneventful wound healing without infection, maintained radiological reduction, and satisfactory recovery of wrist motion, grasp, and pinch function with only mild transient stiffness. This case highlights that early aggressive debridement, preservation of vascularity, stable skeletal fixation, and timely rehabilitation can achieve successful limb salvage and good functional outcomes even in devastating blast injuries of the hand.***

Keywords: Blast injury; Hand trauma; Gustilo-Anderson Grade IIIB; First carpometacarpal dislocation; Kirschner wire fixation; Limb salvage; Open hand injury

1. Introduction

Blast injuries to the hand represent a severe form of high-energy trauma and are commonly associated with complex patterns of injury involving bones, soft tissues, tendons, and neurovascular structures. These injuries often result from explosive materials and are characterized by a combination of laceration, crush, and avulsion mechanisms. Due to the extent of contamination and tissue destruction, management remains challenging and requires a multidisciplinary approach.

Injuries classified under the Gustilo-Anderson Classification Grade IIIB are particularly severe, as they involve extensive soft tissue damage with periosteal stripping and require surgical intervention for wound coverage. Such injuries are associated with a high risk of infection, delayed healing, and poor functional outcomes.

Restoration of hand function in these cases is often limited, especially when multiple digits and joints are involved. However, early presentation, prompt surgical debridement, preservation of vascularity, and stable skeletal fixation can significantly improve prognosis. This case highlights the importance of these principles in achieving a favorable outcome despite the severity of injury.

2. Case Presentation

A 22-year-old male presented to the emergency department with a history of blast injury to the left hand caused by explosive material approximately three hours prior to admission. The patient reported severe pain, active bleeding, and inability to move the affected hand.

On clinical examination, a large open wound measuring approximately 3 × 10 cm was noted over the palmar aspect of the hand. The wound was contaminated and showed exposed bone, tendons, and muscle tissue. Traumatic amputations of the distal segments of the 2nd, 3rd, and 4th digits were evident. Despite the severity of soft tissue damage, the vascularity of the hand was preserved, as confirmed by capillary refill and distal perfusion.

Radiographic evaluation revealed multiple structural injuries, including dislocation of the first carpometacarpal joint, intra-articular fractures at the base of the proximal phalanges of the 2nd to 5th digits, and fracture of the head of the 5th metacarpal. Based on these findings, the injury was classified as Gustilo-Anderson Grade IIIB.

3. Management

Initial management in the emergency department focused on stabilization of the patient, control of hemorrhage, and prevention of infection. Broad-spectrum intravenous antibiotics were administered promptly, and tetanus prophylaxis was provided.

The patient was taken to the operating room for emergency surgical intervention. Thorough irrigation and debridement of the wound were performed to remove all devitalized tissue and contaminants. Special care was taken to preserve viable structures, including tendons and neurovascular bundles.

Tendon repair and soft tissue reconstruction were carried out wherever feasible. The amputated distal segments were managed with appropriate stump closure. The first carpometacarpal joint dislocation was reduced anatomically.

Stabilization of the joint was achieved using crossed Kirschner wires, following principles similar to Bennett fracture fixation. This ensured stability of the thumb column, which is crucial for hand function, particularly for pinch and grasp activities.

Primary wound closure was performed after ensuring adequate debridement and tissue viability. Sterile dressings were applied, and postoperative antibiotic therapy was continued.

4. Outcome and Follow-Up

The patient was followed up regularly with close monitoring of wound healing and functional recovery. During the first two weeks, dressing changes and wound inspections were performed thrice weekly. Sutures were removed on the 14th postoperative day.

Subsequently, the patient was followed up weekly for the next two weeks, followed by a final evaluation at six weeks. The wound healed satisfactorily without any signs of infection or necrosis.

Radiological evaluation confirmed maintained reduction of the first carpometacarpal joint with stable fixation. There was no evidence of secondary displacement.

Functionally, the patient demonstrated preserved wrist mobility and satisfactory range of motion in the remaining digits. He regained the ability to perform activities of daily living, including grasping objects and basic pinch functions.

The only complication observed was mild stiffness during the early rehabilitation phase, which improved progressively with physiotherapy and guided exercises.

5. Discussion

Blast injuries to the hand are among the most complex forms of upper limb trauma due to the combination of high-energy impact, contamination, and extensive tissue destruction. These injuries frequently involve multiple anatomical structures, making management challenging and outcomes unpredictable.

In Gustilo-Anderson Grade IIIB injuries, the risk of infection and complications is significantly increased due to soft tissue loss and exposure of underlying structures. Traditionally, such injuries are associated with poor functional outcomes and often require staged procedures, including flap coverage and reconstructive surgeries.

In the present case, several factors contributed to the favorable outcome. Early presentation within three hours allowed timely surgical intervention, reducing the risk of infection. Preservation of vascularity played a critical role in facilitating wound healing and enabling primary closure without the need for complex reconstructive procedures.

Adequate and meticulous debridement is a cornerstone in the management of open injuries, as it reduces bacterial load and removes non-viable tissue. In addition, stable skeletal fixation is essential to restore anatomical alignment and allow early mobilization.

The stabilization of the first carpometacarpal joint using Kirschner wires, based on Bennett fracture principles, ensured maintenance of thumb stability. The thumb contributes significantly to hand function, particularly in pinch and grip, and its stabilization is crucial for achieving good functional outcomes.

Compared to previously reported cases of similar severity, which often require multiple surgeries and prolonged rehabilitation, this case demonstrates that early aggressive management combined with preservation of vascularity can lead to excellent functional recovery.

The favorable outcome in this case contrasts with commonly reported poor prognoses in similar injuries, highlighting its clinical significance.

6. Conclusion

Severe blast injuries of the hand, particularly those classified as Gustilo-Anderson Grade IIIB, present significant challenges in management due to the extent of tissue damage and risk of complications. However, timely and aggressive surgical intervention can result in favorable outcomes.

Preservation of vascularity, meticulous debridement, and stable skeletal fixation are key determinants of successful limb salvage and functional recovery. This case emphasizes that even in high-grade open injuries, excellent outcomes can be achieved with appropriate management strategies.

Figures

Figure 1: Preoperative clinical photograph

Legend: Severe blast-induced open injury of the left hand showing extensive soft tissue damage and traumatic amputations of the distal segments of the second, third, and fourth digits.

Figure 2: Preoperative radiographs (AP and oblique/lateral views)

Legend: Radiographs demonstrating first carpometacarpal joint dislocation, intra-articular fractures of the proximal phalanges, fifth metacarpal head fracture, and multiple digital amputations.

Figure 3: Immediate postoperative radiograph

Legend: Postoperative radiograph showing anatomical reduction of the first carpometacarpal joint stabilized with crossed Kirschner wires and satisfactory skeletal alignment.

Figure 4: Follow-up clinical photograph

Legend: Clinical photograph at follow-up demonstrating satisfactory wound healing, preserved thumb position, and soft tissue recovery.

Figure 5: Follow-up radiograph

Legend: Radiograph demonstrating maintained reduction of the first carpometacarpal joint, stable fixation, and satisfactory healing.