Traumatic Degloving Injury: A Case Study

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Introduction

- ❑ Degloving injuries of the lower extremity refers to deep, penetrating injuries that extend into underlying structures such as muscle, tendon, ligament, bone, and neurovascular tissue structures.
- ❑ These injuries are often a result of shearing forces by sharp objects, high-energy trauma, or accidents that result in a puncture or deep laceration.
- ❑ Complications of degloving injuries include but are not limited to; infection, hemorrhage, compartment syndrome and permanent disability.

Case Presentation

A 37 year old female presented to the emergency room after sustaining a crush injury at work from a forklift. EMS reported having a difficult time finding pedal pulses due to the laceration. Upon arrival to the ED, her vitals were stable. She was also diagnosed with a posterior occipital hematoma. Trauma team evaluated patient prior and ruled out compartment syndrome.
She has a past medical history of obesity and tobacco use.
On physical exam, she was alert and oriented to time, place, and person.

- **Vascular**: nonpalpable DP and PT pulses. Pulses biphasic on doppler. CFT brisk to digits. Digits warm to the touch.
- **Neurologic**: protective and epicritic sensation intact.
- **Musculoskeletal**: digital dexterity intact. Unable to assess muscle strength secondary to pain.
- **Dermatologic**: significant degloving injury from lateral forefoot to proximal medial ankle, down to the level of muscle/ tendon. Debris present in laceration. Skin flap on dorsal foot is mobile, and warm. Measured 25 x 4.8 x 0.5 cm

Imaging

X-ray: Diffuse surrounding soft tissue swelling of the right foot. Probable laceration identified within the dorsum of the right foot. Fifth proximal phalanx fracture.

CT-Angio: Demonstrated no significant vascular injury.
Further imaging including a FAST exam, and trauma scans, revealing no additional injuries.

Interventions

1. Due to the extensive skin injury, primary closure was not an option without applying increased tension to the site. Therefore, a **tissue expander was applied to allow for gradual re-approximation** of the soft tissue. The tissue expander in place for five days before proceeding forward with delayed primary closure.
2. DPC was obtained using a combination of horizontal mattress and simple interrupted sutures. Staples were placed in areas of gapping in the laceration.
3. Patient was transferred to inpatient rehabilitation. **After post-operative day 2, soft tissue crepitation and fluctuance was appreciated** on the dorsal foot, tracking to the pretibial region, circumferentially. Patient taken urgently to the OR.
4. **Extensive serial OR debridements were performed removing all necrotic tissue leaving soft tissue deficit of 35.0 x 45.0 x 5.0 cm**. Cultures were obtained and demonstrated Pseudomonas. Patient was placed on culture specific IV antibiotics for 14 days.
5. Attempted to transfer patient to a specialized plastics facility, however they would not agree to transfer of the patient until after two weeks of negative pressure wound vac therapy (NPWT). **Patient underwent serial debridement and wound vac changes in the OR for 9 days.**
6. At this time, enough granulated soft tissue was appreciated**. Decision was made to augment granulation with hybrid synthetic fiber matrix allograft.** Two additional graft applications were performed along with NPWT. Instillation therapy with sodium hypochlorite was initiated due to Pseudomonas colonization for three days. **Serial OR debridement and NPWT applications were performed for wound bed preparation for split-thickness skin graft (STSG).**
7. Plastic surgery service was consulted to assist with harvesting of skin graft.
8. STSG was harvested applied with ***an external fixator to off-load the site of grafting and mitigate shearing forces***. A wound vac was applied to assist with bolstering the graft.
9. One week after split thickness graft applied, graft was evaluated and was incorporating well. The wound vac was discontinued and a bolster dressing applied.
10. ***Delta frame was removed*** 1 week after graft application. At this time, the graft site was remained undressed.

Timeline

4 days post-injury 1

- Following initial incision and drainage with tissue expander.
- Serous blisters with venous congestion

7 days post-injury 2

- Following removal of tissue expander with delayed primary closure
- Tissue necrosis

11 days post-injury 3

- Debridement of nonviable tissue
- 35.0 x 45.0 x 5.0 cm

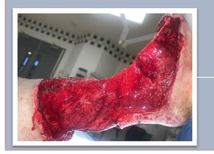
12-14 days post-injury 4

- Daily debridement
- NPWT application day 14

15-22 days post-injury 5

- NPWT changed in the OR weekly

27-41 days post-injury 6



- Weekly hybrid synthetic graft applications

48 days post-injury 7

- Debridement, washout and vac application
- Preparation of the wound bed for STSG

55 days post-injury 8

- Application of delta frame
- Application of STSG from thigh and NPWT

62 days post-injury 9

- Removal of NPWT
- STSG incorporation
- bolster dressing applied

103 days post injury: 10

Discussion

Benefits of Negative Pressure Wound Therapy (NPWT)

- Promotes granulation tissue formation by improving blood flow to the area facilitating nutrient delivery. [1]
- Manages excess exudate preventing maceration of surrounding tissue and reducing infection risk. [4]
- Promotes the adherence of the skin graft to the underlying tissue by creating a controlled vacuum environment with removes excess fluid and reduces hematoma or seroma formation.[1,2]

Use of Graft Materials

- A hybrid synthetic fiber matrix allograft was selected initially to provide a scaffold for cellular infiltration and allow for cleansing of the wound without degradation of the material.
- A STSG was employed to enhance the formation of the skin barrier while achieving a cosmetically superior appearance, as the graft closely resembled the surrounding skin.[3]

Complications in Wound Management

- NPWT was adjusted multiple times to ensure adequate suction was consistently maintained. Interventions included: adjusting the tubing to prevent kinks , replacing tubing and suction pad between surgeries, utilizing two NPWT systems running conjointly, and applying two suction pads connected with a Y-connector per machine.
- Persistent wound infection posed the challenge of weekly wash-outs in the operating room and attempt at sodium hypochlorite irrigation combined with NPWT which ultimately failed due to compromising suction pressure.

Collaboration with Plastic Surgery

- Upon observing significant tissue loss, the initial consideration was to transfer the patient to a facility equipped for reconstructive plastic surgery to facilitate a full-thickness skin graft or flap.
- Plastics team recommended use of NPWT before transfer, followed by application of a graft. Given the success of NPWT in addressing the tissue deficit, patient became an appropriate candidate for a STSG, which was performed at our facility with the assistance of our own plastic surgery team.

Conclusion

- ❑ The treatment plan should be ever evolving with the progression and presentation of a clinical outcome.
- ❑ Early recognition of infection and timely surgical interventions, including debridement and the use of NPWT, play a critical role in preventing further complications.
- ❑ The application of NPWT was instrumental in promoting granulation tissue formation and addressing the tissue deficit, facilitating successful wound healing.
- ❑ A multidisciplinary approach is optimal for the management of complex wounds with large areas of tissue loss.

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