Utilization of Negative Pressure Therapy to Manage Traumatic Subcutaneous Emphysema

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Introduction

- High-pressure water-gun injection injuries associate with extensive subcutaneous emphysema with minimal soft-tissue inflammation or destruction, different from injection injuries caused by other agents
- Traditional treatment involves irrigation, minimal debridement, administration of antibiotics, monitoring for compartment syndrome
- Use of NPWT (Negative Pressure Wound Therapy): facilitate rapid resolution of traumatic subcutaneous emphysema (SE)

Fig.1 : Day of trauma with minimal skin injury and noticeable motor deficits

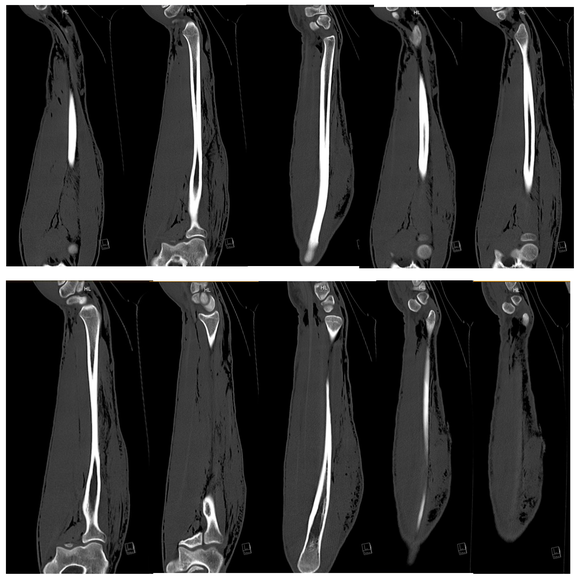

Fig. 2 : Day of trauma: CT performed showing extensive SE on forearm and wrist

Methods

•23-year-old male sustained a 3 cm wide laceration to proximal right forearm with high-pressure water gun injury at a car wash. On first examination:
- Extensive subcutaneous emphysema (SE) and crepitance of forearm
- Minimal pain with movement of the wrist
- Palpable radial and ulnar pulses
- Weak extensor function of thumb and small finger

•Diagnostic Imaging:
- CT scan revealed extensive SE of the arm
- Clear fluid drainage from laceration site

•Treatment Approach:
- Cleaning and culture collected at the bedside + IV antibiotics
- Application of NPWT at 125mmHg continuous with appropriate foam* tunneled beneath the skin
- Administration of broad-spectrum IV antibiotics

•Monitoring:
- Repeat X-rays taken daily
- No growth in cultures after 48h
- Near complete resolution of SE noted on day 3.

Fig.3 : Day 1 s/p trauma: NPWT in place with significant improvement of the forearm crepitance. Patient denied pain, but motor deficit was persistant

Fig.4 : Day 1 of NPWT with significant improvement of subcutaneous emphysema

Fig.5 : Day 2 of NPWT with near complete resolution of subcutaneous emphysema

Fig.6 : Day 3 s/p trauma, pre-operative view of improved edema and minimal soft tissue injuries.

Fig.7: Surgery on day 3 showing complete transection of the extensor digiti minimi and partial transection of extensor carpi ulnaris muscle at their muscle bellies, and complete transection of extensor pollicis longus at insertion.

Results

• NPWT:
- Rapid and near complete resolution of subcutaneous emphysema (SE)
- Prevented urgent surgical exploration while minimizing risk of compartment syndrome development

• Post-SE Resolution Examination:
- Complete physical exam performed with injuries to: extensor digiti minimi, extensor pollicis longus, possible posterior interosseous nerve injury

• Elective surgical Intervention for exploration and repair of injuries conducted and showing a clean cut made by the high-pressure water gun injury through skin and muscle with minimal collateral injury to surrounding structures

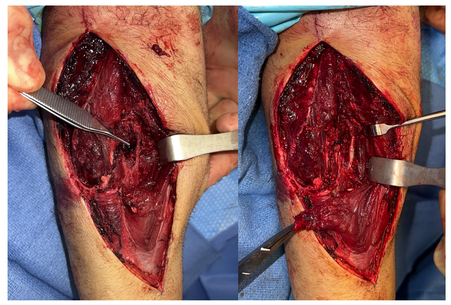

Fig.8 : Evidence of continuity of the nerve fibers of the posterior interosseous nerve (PIN), but partial injury to the nerve sheath which was involved in porcine matrix for accelerating nerve healing

Fig.9 : Post-operative day 10: excellent small finger extension, but still limited thumb extension. Recovery may be slower due to PIN injury.

Conclusion

Traumatic SE in high-pressure water jet accidents:

•Initial presentation usually with minor external wound but extensive subcutaneous emphysema. A careful evaluation can guide the physician for potentially avoiding unnecessary emergent surgical interventions

•NPWT successfully temporized traumatic SE clinically, allowing for thorough comprehensive physical examination eliminating the SE and associated symptoms more rapidly