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HIGH PRESSURE INJECTION INJURIES

A Deceptively Benign Wound That Demands an Emergent Work-up

Hand Surgery Resource provides concise, evidence-based education on hand trauma diagnosis and management. This issue reviews high-pressure injection injuries (HPII) of the hand, an uncommon but limb-threatening emergency.

Introduction

High-pressure injection injuries (HPII) are uncommon but limb-threatening emergencies that often present with deceptively benign wounds. A thorough history of the substance injected, pressure of injection, timing, work setting, and safety protocols used is essential. Most cases need prompt, extensive debridement; patient education about the injury's hidden severity is key.

Pathophysiology

Pressures near 100 psi can breach intact skin. Injected material tracks along the path of least resistance, often along neurovascular structures, until blocked by tendons, pulleys, or bone. Tissue necrosis and vascular thrombosis can appear within 1.5 hours of injection.

Related Anatomy

Skin, flexor tendons, the flexor sheath, digital nerves, and digital arteries are most commonly involved.

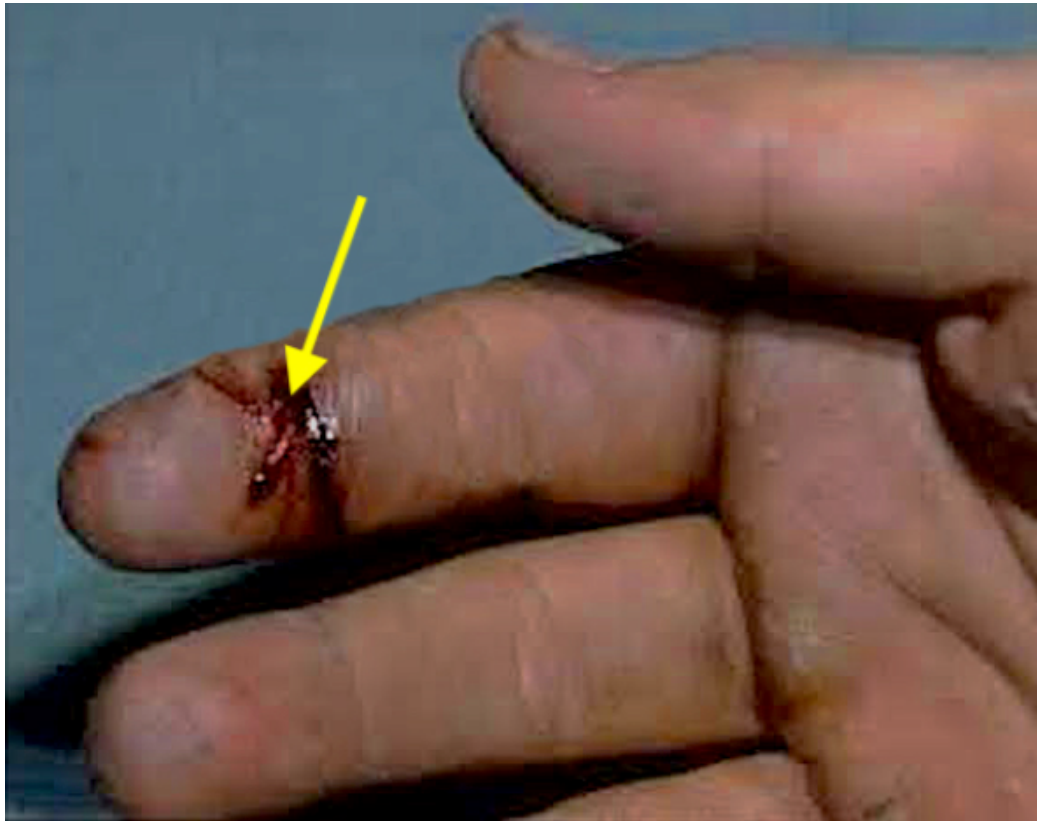
HPH cause roughly 1 in 600 hand traumas, occur in 92-99% of cases in men, and most often involve the non-dominant index finger. Related conditions include irritant and vesicant IV extravasation and accidental epinephrine autoinjector injection.

Differential Diagnosis

HPH (work-related or self-harm), IV extravasation, puncture wounds, and flexor tenosynovitis.

Symptoms

Initial presentation is often a painless, minor-looking puncture. Hours later, edema, pallor, and severe pain develop, sometimes mimicking digital compartment syndrome.



Typical History

A 40-year-old male laborer injects his non-dominant index finger with a high-pressure paint gun at work. The wound looks trivial, so he delays care. Within an hour, worsening pain, swelling, and erythema prompt an ER visit. This is a common clinical scenario.

Examination

injection. True injury extent is often unclear until debridement.

Workup Options

Baseline labs, plain radiographs for subcutaneous air or radiopaque material, and ultrasound help characterize injected material and tissue involvement. Imaging may help document the proximal extent of the injection which can guide the area requiring debridement.

Conservative Treatment

Reserved for select cases with known benign materials (saline, air, certain animal vaccines without oil adjuvant): tetanus prophylaxis, antibiotics, elevation, close monitoring. Worsening signs mandate prompt surgical reevaluation.

Operative Treatment

Most injections, especially oils, like hydraulic fluid, solvents, and vesicant extravasations, need urgent, wide debridement, compartment decompression, and tendon sheath exploration, ideally with magnification to protect neurovascular structures. Negative-pressure therapy and staged re-irrigation reduce residual contamination. For extravasation, particularly of cytotoxic drugs, the Gault flush-out technique (lidocaine, hyaluronidase, stab incisions, saline irrigation) is a useful adjunct, especially in children.

Complications

Non-operative management of oils or cytotoxic agents carries up to an 88% amputation rate. Digital stiffness and weak grip/pinch are common even after timely surgery.

Outcomes

Early debridement is linked to 16-38% amputation rates, rising to 58% when surgery is delayed past six hours. Stiffness and hypersensitivity are frequent; hand therapy is essential for maximizing recovery.

Key Educational Points

Examine for entry and exit wounds; true severity is rarely apparent before debridement. Serial X-rays can detect retained material. Most injections need immediate formal debridement, since delay raises morbidity and amputation risk. Solvents and oil-based materials carry the highest risk. Gault-treated patients need daily monitoring for compartment syndrome or necrosis.

Recent References

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