FROSTBITE CASE STUDY

- 17 y/o intoxicated (alcohol/marijuana) male found down in snow without hat or gloves
- Taken home by police; after rewarming attempt at home transported to local ED
- Diagnosed with severe frostbite to both hands and transported by ground to UMHS (4 hours after injury)
UMHS CARE

- No pulses to left index and long finger
- Hands warmed in 40 degree Celsius bath for 20 min
- Tetanus
- CT head and cervical spine
- Transported to interventional radiology from ED
INTERVENTIONAL RADIOLOGY

- Bilateral femoral sheaths with selective arteriography of both forearms
- Infusion of 3000 Units heparin and 50mcg of NTG to bilateral brachial sheaths
- TPA (0.25mg/hr) and heparin (500U) infused bilaterally
- Repeat arteriograms at 8 and 12 hours followed by removal of femoral sheaths
- Heparin infusion (venous) continued for 72 hours
THROMBOLYTICS IN FROSTBITE INJURIES

• Two methods of injury-crystallization and intravascular ice crystals leading to inflammation, thrombosis, and ischemia

• Other tx studied-dextran, papaverine, urokinase, streptokinase, PGE-1, HBO, and heparin none with measurable improvement
TWO STUDIES IN U.S. WITH TPA

• Bruen (2007) and Twomey (2005)

• Similar criteria
  
  • Hand and/or feet within 24 hours of injury
  • Hemorrhagic blisters
  • Loss of Doppler pulses
  • Contraindications similar to TPA for cardiac but also patients with repeated thaw and refreeze cycles
STUDY RESULTS

• Twomey 174 digits at risk only 33 required amputation (19%); Began using TPA intravenously with similar results

• Bruen 59 digits at risk only 6 required amputation (10%)

• Bruen’s control group 237 digits at risk/ 97 amputated (41%)
Tc-99m scintiscan to evaluate distal circulation

tPA 0.15mg/kg/IV as a bolus followed by 0.15mg/kg/hr (maximum 100mg dose) infused over 4-6 hours

Therapeutic heparin for 3-5 days

Warfarin to INR two times control for 4 weeks

Considering aspirin therapy in lieu of warfarin/ibuprofen

IV/oral narcotics for pain control

ibuprofen 400-600mg po qid

Light dressings with topical antimicrobials

No ambulation on frostbitten feet
**Monitoring Parameters**
- Doppler pulses checks every 1 hour
- Angiography at 12 hours and 24 hours if perfusion defect persists
- H/H, Plt, Fibrinogen, PTT every 6 hours
- Bone scan on post injury day 3 or 4 (*aid in eval of viability of bone for muscle flap placement*)

**Indications for Discontinuation of tPA**
- Active bleeding
- Complete perfusion restored
- Completion of 48 hours of therapy
- Fibrinogen < 150mg/dL
- H/H < 7.0/21.0
- Platelets < 100
- PTT > 29.0

**Appropriate Candidate for intra-arterial tPA**

1. Placement of arterial catheter into brachial or femoral artery (*per IR*)
2. Administer papaverine (vasodilator) followed by tPA bolus of 2-4mg (*per IR*)
3. Administer tPA infusion at 1 mg/hr (dose divided by number of affected extremities)
4. Administer Heparin at 500 U/hr per extremity affected. Continue Heparin for 72-96 hours.

**GENERAL CARE GUIDELINES:**
- Confirm tetanus prophylaxis

**PAIN MANAGEMENT:**
- Ibuprofen 400-600mg PO QID
  - OK to use during tPA treatment
- IV narcotics in acute phase

**WOUND CARE:**
- Hemorrhagic blister treatment
  - Do NOT De-roof to relieve pressure
  - Place in dry gauze
- Non-hemorrhagic blister treatment
  - Drain using aseptic technique
  - Place in aloe vera and/or Mepilex

**NOTE:** Blister may be left in place per MD discretion
- If no blisters present:
  - Open to air, antimicrobial dressing, and/or topical aloe vera per MD

**ADJUNCTS TO CONSIDER:** (*per MD*)
- Antibiotic prophylaxis to cover Staph, Strep, Pseudomonas
- Pentoxifylline 400mg PO TID (adjust for renal failure)
  - Contraindications: Intolerance, recent retinal or cerebral hemorrhage, risk factors for hemorrhage
PRE-HOSPITAL CARE

• Recognize the injury
• Environmental exposure, psychiatric illness, substance abuse, fatigue, and vehicle failure
• Treat ABC’s and hypothermia first (life/limbs/looks)
• Prevent thaw and refreeze
• Insulate wound and provide analgesia
• Know where IR centers are located-time sensitive injury
SUMMARY

• Frostbite of the extremities can be successfully treated with thrombolytic therapy drastically reducing the rate of amputation
QUESTIONS