Frostbite
Perils and Pearls

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2013-01-26
Foreword

- No financial or ethical conflicts to declare
- Please mute cellphones
Frostbite
Horrendous Injuries with Limb Involvement
What is Frostbite?

- Defined as the damage sustained by tissues subjected to temperatures below their freezing point (-0.5 to -2 degrees C.) (Mohr)

- Superficial: injures the skin and tissues just underneath, and usually does not cause permanent injury

- Deep: damages muscle, nerves, vasculature and bone. Causes tissue death, mummification, and usually results in auto- or surgical amputation
Pathophysiology

- Pre-frostbite stage is called frost-nip, where the vessels react between vasodilation and vasoconstriction in response to the cold insult. It is painful, but reversible upon rewarming.

- Progresses to deeper tissue cell injury when ice crystals form in the extra-cellular spaces, then into the actual cells and microvasculature.

- Intravascular intimal damage is followed by the formation of microemboli. Vascular flow is occluded.

- Inflammatory mediators are released, causing edema, blistering, spasm, loss of movement and sensation. (Mohr et al)
Who

- Adult men age 30-49 are most commonly affected
- ETOH/Drug users
- Homeless
- Military personnel
- Outdoor workers and enthusiasts (hunters, Nordic skiers etc)
- High altitude climbers
- Mentally ill/challenged
- Those in unforeseen circumstances (vehicle breakdown)
- Those with no common sense (teens who value their “coolness” over safety) *(Spears)*
- The unacclimatised, inexperienced *(Mohr et al)*
Factors Affecting Incidence

- Clothing or lack thereof
- ETOH/ Drug influence
- Lack of shelter (Hallam et al)
- Malnourishment/Dehydration
- Low O2 sats from COPD or high altitude
- Diabetes, PVD, Raynaud’s, neuropathy, paraplegia etc (Akhtar et al)
- Tight, wet clothing
- High wind chill, duration in the cold (Twomey et al)
- Medications- beta blockers, sedatives etc
- Growing participation in winter-related outdoor activities
What gets bitten?

- Extremities are most susceptible sites ~90%
- Ears, nose, cheeks, forehead, penis (Mohr, Imray et al)
Clinical Signs and Symptoms

- Frost-nip: intact sensation, with prickly, burning, itching pain described, with no blistering in rewarmed state
- Second degree: edema, clear to milky blisters
- Third degree: deep injury (subdermal plexus destruction) resulting in hemorrhagic blisters; skin is deep purley-red, soft and boggy; sensation is decreased; edematous
- Fourth degree: skin is mottled, waxy, cyanotic, insensate, infarcted areas mummify (Mohr)
Frostenipped Toes
Second Degree
Frostbite to Cheeks
Necrotic Fingers
Mummified Toes
Thick Eschar Toe
Treatment pre-ER

- Do not use snow or ice to thaw
- Never rub or massage the areas involved
- Do not use hot water bottles, open fires or heaters to thaw
- Remove jewelry
- Do not allow re-freezing
- Do wrap in warm blanket
- Give warm fluid drinks, ASA or Ibuprofen
- Offload/elevate
ER Assessment

- Location of frostbite
- When/where/how/duration of exposure
- Describe appearance of lesions, draw pictures in chart
- Too soon to estimate the degree of damage in ER!
- Tetanus status
- Medical history/allergies
- Predisposing factors
Treatment in ER

- Priority is to melt the ice crystals, re-perfuse the limb, attenuate the inflammatory cascade that causes reperfusion (Mohr)
- Rapid rewarming in 40-42 degree water for ~ 30 minutes will bring hyperemic flush to the area. Hydrotherapy or warm water basins/wet towels best (Gabriel)
- Assess pulse response with Doppler
- Provide adequate analgesia for the severe pain that ensues
- Td booster
- Blister debridement (or not—controversial). Leave hemorrhagic intact. (Mechem)
- +/- Silver dressings, silicone non-stick, loose wraps/padding and offload
- All patients should be referred to Burn Clinic
Warm Water Immersion
Treatment post-ER

- Sympathectomy: not a first-line treatment except in well-selected patients. Iloprost has superseded this.
- Hyperbaric Oxygen: no benefit until 5-10 days post-thaw, so not recommended.
- Anti-thrombotics—several US centres report a 75% success digit salvage rate (Mohr, Hallam).
- Hospitalization/burn physio for lesion treatments.
- Surgery*
- Long-term physio/debilitation requirements.
- Psychological evaluation.
Hemorrhagic Blister
Clear Blisters
Clear Blisters
Hyperemia Post-Thaw
Frostbite to Sole
Mixed Blister Types
clear and hemorrhagic
DI Investigations

- Tc Bone scintiscan is an accurate predictor of potential digit loss (Twomey et al)
- Angiogram
- MRA, MRI (Chauchy et al)
- Doppler US to determine need for fasciotomy
Medications

- ASA
- Pentoxifylline (Trental)
- Topical aloe vera gel (antiprostaglandin effect)
- Ketorolac gel
- Narcotics
- Ibuprofen
- IA Papaverine/tPA/TNK/Nitroglycerine *
- Heparin/Warfarin
- Iloprost
Frostbite Patients

- At FMC are managed by the Burn Team
- Requiring hospitalization are admitted to the burn unit
- Who can be managed at home are seen in the Burn Clinic for serial consistent care
Referrals

- From ERs, Urgent Care Centres
- Walk-in clinics
- Family physicians
- Rural and outlying centres
- Self referrals
Multi-disciplinary Team

- Doctors
- Nurses
- Occupational Therapists
- Physiotherapists
- Psychologists
- Social Workers
- Prosthetists/Orthotists
Assessment and Documentation in Burn Clinic

- Review of event, progression of symptoms, and interventions to date
- Past medical history, allergies, medications
- Risk factors (diabetes, PVD, Smoking)
- Location and degree of injury
- Wound Care and dressings
- Pain management
A and D (cont’d)

- ROM, functional assessment for ADLs, IADLs and hand dominance
- Mobility, gait, balance biomechanics and need for walking aids
- Social history and living arrangement
- Occupation, recreational, and leisure activities
- Wound management
  - Controversial i.e., expose vs. dressing, blisters!
Principles of Wound Care

- Maintain a moist environment
- Manage exudate
- Fill dead space
- Assess need for antimicrobial cleansing and dressings
- Primary and secondary dressings
- Reduce pain and allow movement
Dressing Choices

- Silver impregnated*
- Transparent films
- Alginates*
- Foams*
- Cadexomer iodine*
- Silicone coated*
- Collagen Matrix
- Polymeric membrane
- Composite dressings
- Honey impregnated
Sequelae

- Pain syndromes
- Sensory loss/numbness. Susceptibility to recurrent frostbite
- Hyperhidrosis
- Arthritis. Joint stiffness, immobility
- Amputation/disfigurement
- Disability. Loss of livelihood
- Nail abnormalities and scarring
- Need for prosthetics/orthotics. Aids to daily living
- Delayed healing/poorer outcomes in smokers (Doran et al.)
Joint Damage
Amputation
Deep Tissue Injury Toe
Necrotic Fingers
Catastrophic Loss
Post-op Amputation
Mummification of digits
Frostbite Fingers
Case Presentation

- Homeless 37 year old male with “weird feelings” in legs
- Vague, unreliable historian
- History of cold exposure over past few weeks

Exam
- ++ cold feet, no pulses, no sensation
- Compartment syndrome bilaterally. Elevated CK. Bone scan revealed devascularized bone to mid-calf
- Blisters, both intact and broken on feet
Outcome

- 4 compartment fasciotomies
- Bilateral below-knee amputation last Sunday
Pre-Amputation
Healing Slowly
Prevention/Reduction of Severity of Injury

- Dress for the weather (non-constrictive layers are best)
- Wear hats, mitts, socks and waterproof shoes
- Avoid smoking and alcohol
- Be aware of the weather forecast
- Drive with a safety kit/blankets/candles/phone in car
- Indigents-get into a shelter!
- Think twice about going out in cold weather
Even animals are not exempt.
Endword

- Frostbite has been a major crippler for centuries, but the treatment has not improved much over the last few decades. Many products were tried but abandoned as ineffective i.e. Dextran, Heparin, Urokinase, sympathectomy, hyperbaric oxygen etc. (Mohr)

- Thrombolytics are showing some promise, but have not been embraced in Canada

- Outcomes have improved with the use of silver dressings and consistent care in the Burn Clinic
Thank You

- Please complete your evaluations.

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- Downloads of session at:

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