

The Prehospital Phase:

Management Guidelines

1. Definitions:

- a. **Frostnip** is associated with pallor, numbness and pain on re-warming. It is completely reversible with warming and leads to no resulting tissue loss
- b. **Frostbite** is defined by the actual freezing of the tissues. This leads to intracellular ice crystal formation and cell destruction, associated micro-vascular occlusion, tissue anoxia and reperfusion injury.
- c. Frostbite is described in degrees:
 - i. 1st Degree
 1. Hyperemia with significant edema – non-blistered
 - ii. 2nd Degree
 1. Partial skin thickness necrosis – forms large clear blisters
 - iii. 3rd Degree
 1. Full skin thickness and possible subcutaneous tissue loss – forms Hemorrhagic blisters and/or a dark eschar
 - iv. 4th Degree
 1. Full-thickness skin necrosis involving bone, tendon or muscle

2. Recognition/Diagnosis:

- a. When the patient has unthawed frostbite, the skin may appear either pale/blanched or mottled. Movement by the patient of joints in the affected area (not passive movement) may be severely limited. The extremity may appear hard, cold, and/or white, and the patient may describe or appear to have clumsy movements. Sensation may be lost completely or significantly decreased. The frostbite may involve only the digits, the hands or feet, or the entire extremity (ies).
- b. When the frostbitten area has been re-warmed, the skin will appear pale or mottled, dark or bright red. It may be either intensely painful or anesthetic. Blisters will form after re-warming over the course of hours to days and may eventually cover the entire involved area. The actual character of the wound will change significantly after 24-72 hours of re-warming.

3. Management:

a. Unthawed frostbite

- i. **DO NOT THAW**
- ii. Protect the affected area from further trauma. Do not allow the patient to walk or use frozen hands or feet. The intracellular crystals that have formed will cause additional cellular damage with movement.

- iii. Keep the rest of the patient warm to prevent overall hypothermia (example: warm the room, IV fluids, warm blankets, etc)
- iv. **Contact the on call Burn staff physician** to alert him/her of the patient's current condition.
- v. Start a large bore peripheral IV and start fluids dependent on the patient's status.

b. Thawed frostbite

- i. Protect the affected areas from further trauma.
- ii. Do not allow the patient to walk on or use the affected extremities.
- iii. Do not break blisters. If there are ruptured blisters try to prevent further soilage by wrapping the areas gently with gauze or cover with clean linens.

The Burn Center/Emergency Department Phase:

Unthawed frostbite:

1. Start 2 large bore IV's if not already in place. Run NS or LR at a rate appropriate to the patient's hydration status.
2. Keep the patient NPO until determined if they are a candidate for thrombolytic treatment (alteplase)
3. Determine the severity of the frostbite and/or hypothermia by completing a full physical examination including Doppler pulses in the affected extremity. Examine for any associated injuries or illnesses. If indicated complete a full trauma work-up including:
 - a. Chest x-ray
 - b. Head, neck, chest and abdominal CT scan
 - c. Any further indicated radiological exams
4. Obtain admission photographs of all affected areas.
5. Draw blood for labs including:
 - a. CBC with platelets
 - b. Basic metabolic panel
 - c. PT, PTT, INR
 - d. Blood alcohol
 - e. Ionized calcium, magnesium and phosphorus
 - f. Liver function tests
6. Send urine specimen for a urine tox screen
7. Rapidly re-warm the affected extremities as follows:
 - a. Immerse in 40 degree C water for 15-30 minutes until fully thawed – obtain new patient photographs

- b. Administer IV narcotics for pain management. The pain may be severe and the patient may benefit from a CADD/PCA
 - c. Check the affected extremity for Doppler pulses, if not present and/or obvious lack of perfusion the patient needs a stat bone scan to determine blood flow to the affected areas.
 - d. Dry the affected area and dress in aloe vera topical gel, aloe vera and wrap gently in gauze. Take care to keep even bedding off of the affected area.
8. Other considerations:
- a. Ibuprofen, 800 mg every 8 hours
 - b. Neurontin 300 mg every 8 hours
 - c. Update tetanus status

Alteplase Infusion for Severe Frostbite to Limbs and Digits:

Inclusion criteria:

- a. Positive bone scan (shows lack of distal perfusion)
- b. < 12 hour since the time of unthawing

Exclusion criteria:

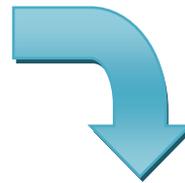
- a. Recent trauma, GI bleed, stroke or pre-existing bleeding disorder
- b. Severe HTN
- c. Pregnancy
- d. Repeated freeze thaw cycles

Burn Center

Thrombolytic Therapy

Management Guidelines

1. Assess frozen limb(s)
2. Check for palpable or dopplerable pulses of digits
3. Labs: Coags, BMP, CBC



1. Rapidly rewarm affected area on 40-45 °C
2. Skin discoloration persists with poorly dopplerable or no pulses
3. < 12 hours post rewarming
4. Contact the on-call burn attending

Bone Scan shows poor perfusion



YES Thrombolytics

- + bone scan
- <12 hours post rewarming

NO Thrombolytics

- Recent trauma, GI bleed, stroke or bleeding disorder
- Severe HTN
- Pregnancy
- Repeat freeze thaw cycles
- Any contraindication to anticoagulation