



Is this Frostbite?



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Brittany's Case

History

Brittany is a 27-year-old female who presented on January 2nd. She had been out the night before drinking at a party and subsequently walked four blocks barefoot on her way home, rather than wearing her high heels, in -20°C weather. When she got home she soaked her feet in a hot bath to warm them up. She says she has large blisters on her feet which are also tingling and painful. She is otherwise healthy.

On examination, vital signs are normal. The soles of both feet are erythematous and covered in large non-hemorrhagic bullae, some of which have ruptured. The skin over the blisters had no sensation, but the area around them was painful on palpation. Sensation was equal on both sides for sharp and dull and motor tests were normal.



Figure 1. Non-Hemorrhagic Bullae, some of which have ruptured

1. What is the differential diagnosis?

The differential diagnosis for Brittany's case is:

1. Frostnip
2. Chilblain
3. Trench Foot
4. Frostbite

2. What is Frostbite?

Frostbite is a condition that occurs when tissue is exposed to freezing temperatures for prolonged periods of time. As the water both in and outside the cells freeze, it forms crystals which puncture the cells and kill them. This leads to inflammation and subsequent ischemia which in turn furthers the tissue necrosis. It is rarely lethal, but can cause significant morbidity.

Frostbite differs from chilblain and trench food in that it is brought about by a single exposure to subfreezing temperatures rather than prolonged exposure to damp near freezing temperatures. Unlike frostnip however, frostbite does not resolve with re-warming and causes tissue damage.

It is most commonly developed in exposed areas such as the head, feet and hands but frostbite can also be brought about by exposure to cold liquids, metals and even ice packs. The people most at risk of developing frostbite are mountaineers, but it is also common in soldiers, people who work in the cold and the homeless.

Frostbite is a clinical diagnosis based on the history, signs and symptoms. Radiographic investigations, however, are also very helpful in assessing the severity of the frostbite and predicting long-term viability of the affected area.

Back to our patient:

To minimize the chance of infection and increase mobility de-roofing was decided upon as the ideal treatment. The large blisters on pressure bearing areas of the foot were drained and debrided using a scalpel. Sterile dressing was applied and Brittany was instructed to elevate the foot as much as possible, shown how to reapply the dressings as the feet healed, and advised as to symptoms of infection that she should watch out for. She was encouraged to take ibuprofen to help with the pain as well as reduce inflammation. No antibiotics were prescribed.

3. How is Frostbite Staged?

Much like burns, frostbite has a staging system reflective of the degree of severity and tissue involvement.

- First-degree frostbite is characterized by a central area of pallor and anaesthesia of the skin surrounded by edema.
- Second-degree frostbite is recognized by blisters containing clear or milky fluid surrounded by edema and erythema, developing within 24 hours.
- Third-degree frostbite differs from second-degree in that the injury is deeper and the blisters are hemorrhagic, progressing to a black eschar over several weeks.
- Fourth-degree frostbite, which extends to muscle and bone, involves complete tissue necrosis.

4. How is frostbite treated?


Prehospital Treatment:

- Get patient into warm environment and remove wet clothing.
- Re-warming shouldn't be considered if there is a chance the affected area could re-freeze.
- Do not rub tissues to re-warm them.

Hospital Treatment:

- Re-warming of the tissue is best accomplished in a water bath of ~40 °C to 42°C for 15 to 30 minutes. This is often exquisitely painful so use of opioid analgesia is recommended.
- Sterile dressing is important, making sure the first layer is non-adherent.
- Daily hydrotherapy, splinting to prevent contractures and elevation to reduce edema are used for severe (Stage 3 and 4) frostbite, until a decision can be made as to whether surgery is needed.
- For non-hemorrhagic blisters that interfere with movement (soles of feet, joints etc.) drainage, debridement and bandaging is the recommended treatment. Tetanus Prophylaxis is appropriate. Other blisters can be left intact, with close monitoring for infection and or the need for debridement.
- Topical antibiotics should be avoided, but aloe and oral ibuprofen are recommended to help with inflammation.

5. What is our role in preventing cold injury?

Education is very important in the prevention of frostbite. Proper layering, keeping dry, and having backup clothing should be emphasized to patients who are at a higher risk of getting frostbite. As well, frostbite is a life and limb altering condition, but is not lethal. More immediate life threatening concerns associated with the frostbite (e.g. Hypothermia) should always be identified and addressed first before dealing with the frostbitten area. 

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