

Frostbite

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Question 1

An 8 year old male is brought in by EMS from an icy mountain. He was with his family skiing but was separated from them and alone in the cold for approximately 4 hours. On arrival to the ED, vitals were T 36C, HR 70, RR 20, BP 90/50. On PE, patient is alert and oriented but shivering. You notice large blisters on both of his feet that contain clear fluid surrounded by edema and erythema. The patient has no past medical history. This type of finding would be considered:

Question 1

- A. First degree frostbite
- B. Second degree frostbite
- C. Third degree frostbite
- D. Fourth degree frostbite

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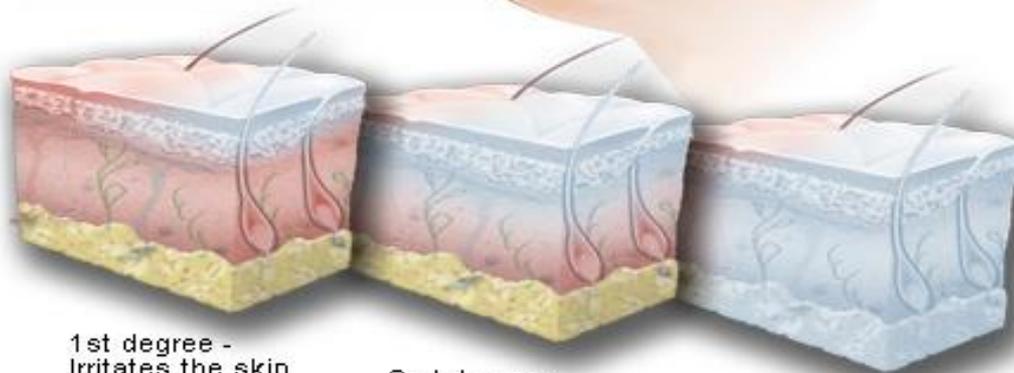
Question 1-Answers

The answer is B. First-degree frostbite tend to be very superficial and is characterized by a central area of pallor and anesthesia of the skin surrounded by edema. Second-degree frostbite is recognized by large blisters containing clear fluid surrounded by edema and erythema, developing within 24 hours and extending to or nearly to the tips of digits. The blisters can develop an eschar but it eventually sloughs off to reveal healthy granulation tissue with no tissue loss.

Question 1- Answers

Third-degree frostbite is different from second-degree in that the injury is deeper and the blisters are smaller, hemorrhagic and more proximal. The skin forms a black eschar in one to several weeks. Fourth-degree frostbite, which extends to muscle and bone, involves complete tissue necrosis. Mummification can be seen in 4 to 10 days.

Frostbite



1st degree -
Irritates the skin

2nd degree -
Blisters but has
no major damage

3rd degree -
Involves all layers
of the skin and
causes permanent
tissue damage

Question 2

A 13 year old female is brought in by EMS after being found unconscious by an ice fishing lake in Michigan. It is unclear how long she has been exposed to the cold, but it is estimated that she has been by the fishing lake for about 4 hours. After being given pre-hospital care, the patient's vitals were rectal temperature of 35 degrees celsius, HR 60, RR 15, BP 100/60, O2 sat of 97% on RA. Once airway, breathing and circulation are assessed, preliminary studies are ordered. PE exam reveals a lethargic female with cold, significant for pale extremities with small blisters that appear hemorrhagic on feet and hands. Of the following, which would be the ideal treatments used for frostbite?

Question 2 - Answers

- A. Rewarming with water heated no higher than 36°C as to prevent a painful warming process
- B. intravenous heparin given along with tetanus prophylaxis
- C. intra-arterial tPA given along with tetanus prophylaxis
- D. debridement of blisters and consult surgery

Question 2 - Answers

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Question 2--Answers

The answer is C. Several studies have been done in demonstrating the benefit from tPA, which helps prevent vascular thrombosis of the frostbite affected tissue. The recommended dose is a bolus of two to four mg followed by an infusion started 0.5 to 1 mg/hour given via the femoral or brachial artery * (child dose 0.01-0.06 mg/kg per hour). Repeat angiograms were done every 8 to 12 hours and treatment was continued until perfusion was restored or a time limit of 48 hours was reached. There is no evidence that intravenous heparin alone improves outcomes in frostbite. Tetanus is a reported complication of frostbite, which is why prophylaxis is recommended.

Questions 2 – Answers

Rewarming is most effectively accomplished by immersing the affected area in water heated to 37° to 39°C, ideally in a whirlpool. Higher temperatures do not warm the injured area any faster and cause the warming process to be much more painful. Dry heat is difficult to regulate and is therefore not used. There is some discord on the management of frostbite-induced blisters. Some believe blister fluid should be drained to eliminate high concentrations of inflammatory mediators.

Questions 2 – Answers

The other, more conservative approach is to drain, debride, and bandage large non-hemorrhagic bullae that interfere with movement, for instance over joints. *Hemorrhagic bullae* of comparable size and location are drained by aspiration, but are *not debrided*. They usually reflect more significant damage to the microvasculature. **Other minor bullae should be left intact.**

References

- An Open-Label Study to Evaluate the Safety and Efficacy of Tissue Plasminogen Activator in Treatment of Severe Frostbite—*Journal of Trauma Injury and Critical Care Dec 2005 Volume 59 Issue 6*
- Uptodate: Frostbite
- Uptodate: Treatment of hypothermia in children
- Low-dose tissue plasminogen activator thrombolysis in children. [J Pediatr Hematol Oncol](#). 2003 May;25(5):379-86.