WHEN
YOUR PATIENT HAS
FROSTBITE

Your quick action may save life and limb.

AT THE HEIGHT of a blizzard, an elderly man limps into the deserted emergency department. His feet, wrapped only in rags, are very cold and numb. He has frostbite, but just how seriously he's injured is hard to determine, at least initially.

With superficial frostbite, he'll have a sharp, aching pain, or loss of feeling and sensitivity to cold in the affected area. The skin will be white and waxy. It won't blanch when pressed but will feel soft and resilient. With deep frostbite, he'll have complete loss of sensation and a feeling of heaviness in the affected area. Again, the skin will be white, waxy, and won't blanch when pressed. But it will feel hard and solid.

The patient is assessed for hypothermia, which can accompany the frostbite—if present, this is treated first. Blood is drawn for a complete blood count and electrolyte, blood sugar, blood urea nitrogen (BUN), and creatinine levels and a clotting profile. X-rays of the injured area are also taken. An intravenous (I.V.) line is started at a keep-vein-open rate for fluid and medication administration.

Now, review how you'd care for a patient with frostbite.

Thawing first
Begin by thawing the patient's frostbitten area immediately and rapidly. Most cellular damage occurs during the freezing and thawing processes, so you want to avoid slow thawing.

Immerse the frostbitten part in a warm-water bath (100° to 108°F [37.8° to 42.2°C]), preferably with a whirlpool. If the patient's face or ears are affected, pour warm water over the area or apply warm, moist soaks. Change soaks frequently to maintain the desired temperature. Handle the affected part gently, and protect it from friction and pressure. Don't massage it—this can cause tissue damage. If clothes are frozen to the area, don't try to remove them until after thawing is completed.

Your patient will experience considerable pain as the affected area thaws. Expect to administer an analgesic and a sedative such as intramuscular or I.V. morphine or meperidine (Demerol) as ordered.

With thawing, a pink flush will appear; on an extremity, it will progress distally until the area's flushed to the tip. Keep the area immersed until it's completely flushed, is warm to your touch, blanches when you press it, and stays flushed when you remove it from the water bath. Don't apply any dressings to it. If the patient's fingers or toes are frostbitten, place sterile cotton between them to minimize friction. Check the color of the flush after you re-warm the area. This may help indicate the injury's severity. The area may be mottled blue or purple if your patient has superficial frostbite, and blue, violet, or gray if he has deep frostbite. But if his frostbite is extremely severe, the affected area may remain gray and cold even after it's completely thawed. If so, your patient won't regain function in that area.

Check your patient's neurovascular status as soon as the frostbitten area is completely thawed. The area may appear transiently cyanotic; this should disappear unless the patient has an underlying injury such as a fracture or sprain. You should be able to feel pulses—if they're weak or absent, this may indicate thrombus formation. The doctor may prescribe I.V. low-molecular-weight dextran to reverse intra-vascular red blood cell aggregation and to improve microcirculation. Expect to give tetanus prophylaxis as ordered.

Continuing your assessment and intervention
After you've rewarmed the frostbitten area, the patient will be placed in protective (reverse) isolation to minimize the chances of infection. Use sterile sheets, and protect the affected area from pressure and friction (for instance, use a bed cradle for his legs). Keep the patient on bed rest, and keep the area elevated.

When your patient's condition is stable, perform a thorough assessment and take a complete history to provide baseline information. In particular, find out the condition of the area before frostbite occurred. Any neurovascular dysfunction will affect

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FROSTBITE (continued)

These signs and symptoms may mean your patient’s developing compartment syndrome. Don’t overlook the significance of these signs and symptoms; they may mimic the ones you’d expect your patient to have immediately after rewarming. But if they’re persistent, something’s wrong. Be sure that you keep careful track of them and report them to the doctor.

The doctor may order pain medication, such as propoxyphene (Darvon) or acetaminophen with codeine (Tylenol with codeine). And he may order phenoxybenzamine (Dibenzyline) orally. An alphadrenergic blocking agent, Dibenzyline decreases vasospasm and also causes vasodilation. When you give this drug, watch for orthostatic blood pressure changes and provide plenty of fluids, because vasodilation makes your patient subject to relative hypovolemia.

Reserpine or tolazoline may be administered intraarterially. These vasodilators cause a temporary medical sympathectomy that decreases pain, edema, and vasospasm and increases blood flow to the area, enhancing the survival of marginal tissue.

Inspect the affected area frequently. Blebs should begin to form 12 to 24 hours after the injury. (If your patient develops few or no blebs, this may mean that circulation isn’t returning to the area.) Don’t rupture the blebs; they’re sterile and help protect the underlying tissue.

Start whirlpool treatments of the area, as ordered, to clean and debride it. You’ll probably do this twice daily for 20 minutes each, using water heated to 90° to 98° F. (32.2° to 36.7° C.) and pHisoHex or another mild disinfectant soap. Encourage the patient to move the area actively during whirlpool treatments. After each treatment, allow the area to air dry, and place sterile cotton between fingers, toes, or other affected parts that touch. Don’t use a dressing.

To increase blood flow and to prevent stiffness and formation of a tight eschar, start the patient on a regular exercise program.

If his frostbite was severe and he continues to have significant edema and pain, the doctor may perform a surgical sympathectomy. This procedure has several beneficial effects: It reduces edema rapidly, decreases pain, speeds demarcation of viable from nonviable tissue, stops vasospasm, and promotes healing.

Therapeutic care
Your patient’s blebs will rupture spontaneously 3 to 7 days after he was rewarmed. Don’t remove the flaps of skin that remain; they’ll provide some coverage and help reduce his pain. Instead, continue the
WHAT HAPPENS IN FROSTBITE

The body's response to extremely cold temperatures is vasoconstriction. This decreases blood flow and oxygen supply to peripheral tissues as blood is shunted to the core. Thus deprived of oxygen, the peripheral tissues are especially susceptible to damage from cold.

Frostbite occurs when tissue temperature drops below its freezing point of -2°F. (−18.9°C). Extremities and exposed areas—especially the hands, feet, ears, and face—are most susceptible. The extent of tissue damage depends on the degree of cold and the duration of exposure. The diagram below shows how frostbite develops.

- Exposure to cold
- Peripheral vasoconstriction
- Drop in tissue temperature to freezing point
- Extracellular fluid crystallization
- Increased sodium concentration in extracellular fluid
- Fluid shift out of cells
- Increased extracellular freezing
- Cellular dehydration and ice crystal compression
- Cell membrane rupture
- Release of histamine from damaged cells
- Increased capillary permeability
- Third-space fluid shifting
- Tissue edema
- Red blood cell aggregation in capillaries
- Microvascular stasis and occlusion
- Tissue cell necrosis

whirlpool treatments, which will debride the bleb flaps slowly and naturally.

Watch for infection after the blebs rupture. Culture any purulent drainage, and expect to administer antibiotics as ordered once the culture results return from the laboratory. Continue protective isolation of your patient, and keep the affected area dry, protected, and on sterile sheets. Remind the patient to perform his exercises frequently, and check his neurovascular status regularly.

After they rupture, the blebs will dry into a hard, dark eschar, which won't be debrided unless it's infected. If it becomes tight and stiff and restricts movement of the area, the doctor may split the eschar gently along its dorsal surface (if a digit is involved) or along its lateral borders. Don't remove the eschar. As with ruptured blebs, allow the eschar to slough off naturally during whirlpool treatments.

The full extent of your patient's injury may not be apparent for several weeks. Watch for demarcation between viable and nonviable areas. Where tissue has been completely destroyed, soft tissue will spontanously mummify and slough off, causing a spontaneous amputation. The doctor may inject technetium 99 (a radioactive isotope) intraarterially, to determine the extent of the patient's microcirculatory damage and to help predict what areas will ultimately be nonviable. After the process of spontaneous amputation is complete (usually 3 to 4 weeks), the doctor will perform surgery to remove any remaining nonviable tissue.

Your patient may be discouraged and depressed about his condition. Be prepared to help him cope with the emotional stress of his frostbite injury. Explain to him that, as the healing process continues, his injury will temporarily look worse rather than better. If tissue starts to mummify and slough off, he'll wonder what's going to be left. Reassure him that he's making progress, but don't minimize the fact that the healing process will be lengthy or that he may need surgery and may lose some function permanently.

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