

# cold injuries



# Freezing Injury Cascade

## **PREFREEZE PHASE**

- Superficial tissue cooling
- Increased viscosity of vascular contents
- Microvascular constriction
- Endothelial plasma leakage

## **FREEZE-THAW PHASE**

- Extracellular fluid ice crystal formation<sup>a</sup>
- Water movement across cell membrane
- Intracellular dehydration and hyperosmolality
- Cell membrane denaturation or disruption
- Cell shrinkage and collapse

## **VASCULAR STASIS AND PROGRESSIVE ISCHEMIA**

- Vasospasticity and stasis coagulation
- Arteriovenous shunting
- Vascular endothelial cell damage and prostanoid release
- Interstitial leakage and tissue hypertension
- Necrosis, demarcation, mummification, or slough

<sup>a</sup>Extremely rapid cooling produces more initial intracellular than extracellular ice crystallization.

Frostnip	Frostbite
Minor discoloration	Variable discoloration
Partial anaesthesia	Complete anaesthesia
Return to normal sensation and colour with rewarming	Persisting or worsening symptoms after rewarming



**Fig. 131.1.** Frostbite that is still frozen. The victim is thawing the foot using a car heater. This technique is not advisable due to a high likelihood of causing further damage. (Courtesy Dr. Nicholas Kanaan.)



**Fig. 131.2.** Severe frostbite of the toes immediately after thawing. The injury appears deceptively benign. (Courtesy Dr. Ken Zafren.)



**Fig. 131.4.** Early appearance of severe frostbite of the foot. A purple color and absence of blisters are very unfavorable prognostic signs. (Courtesy Dr. Ken Zafren.)

# Prognostic indicators

Favourable	Unfavourable
Blisters	Residual violet colour
Return of sensation	Complete anaesthesia
Warm to the touch	Black dry eschar
Return of colour	Frozen superficial skin
Edema	Other systemic features present



**Fig. 131.7.** Severe frostbite of the hand. Dry gangrene is clearly demarcated. There was significant tissue loss. (Courtesy Dr. Ken Zafren.)



# Prehospital management

Don't

- .Rewarm/thaw
- .Massage

Do

- .Remove wet clothes
- .Remove restricting clothes

# Hospital management

- .Pre-thaw resuscitation
- .Thaw (rapid rewarming)
- .Disposition

# Non-freezing injury management

- .Pre-thaw resuscitation
- .Slow rewarming
- .Disposition