Cold Injuries

- kūno audinių sužalojimas *žema temperatūra* (structural & functional disturbances in small blood vessels, cells, nerves, skin).

**I. Freezing cold injury (frostbite, congelatio)**

**II. Nonfreezing cold injury** (įvyksta esant t-rai > 0°C): immersion foot, chilblain

frostbite

pathophysiology

* ice crystals form within / between cells.
* RBCs and platelets clump and obstruct capillaries, causing ischemic damage.
* vasoconstriction occurs to reduce heat loss from skin and peripheral tissues.

N.B. much of damage occurs during rewarming (**reperfusion injury**)!

* increased susceptibility to cold injury:
  1. girtumas, substance abuse
  2. bloga kraujotaka (ankšta avalynė), hipoksija, nuovargis
  3. drėgmė, kontaktas su metalu
  4. alkis, dehidratacija
  5. kūdikiai ir senukai.

KLINIKA

Ikireaktyvinis periodas (*nuo žemos temperatūros veikimo pradžios iki audinių temperatūros sunormalėjimo*):

* blyškumas / cianozė.
* audiniai standūs / kieti, išnykęs distalinis pulsas.
* skausmas, parestezijos, vėliau nejautra.
* galūnių temperatūra matuojama tarpupirščiuose.

REAKTYVINIS PERIODAS (*prasideda sušildžius audinius*):

* išryškėja **nušalimo laipsnis** (Bilroto testas):

**I°** (frostnip) – reversible injury: skausmas, niežėjimas, parestezijos, paburkimas; peeling / blistering (as from sunburn) may occur in 24-72 h.; mild hypersensitivity to cold may persists for life.

**II°** – serozinės pūslės pagrinde distalinėse galūnių dalyse.

**III°**– hemoraginės pūslės proksimalinėse dalyse.

**IV°** – apmirę visi minkštieji audiniai ir kaulai, nejautra.

* when warmed, tissue becomes blotchy red (erythema) → swollen and painful → blisters.
* pasireiškia toksemija, septikopiemija.
* *superficial damage* heals without residual tissue loss;

*deeper damage* causes ***dry gangrene*** with hard black carapace over healthy tissue (***wet gangrene***, which is gray, edematous, and soft, develops less commonly - may become infected; broad-spectrum antibiotics should be used).

* all degrees of frostbite may produce **long-term symptoms** (sensitivity to cold, excessive sweating, faulty nail growth, numbness).

PIRMA PAGALBA

1. Bendrinė:
2. perkelti į **šiltą** patalpą, **šiltai** užkloti nepažeistą kūną, duoti **karštos** arbatos.
3. neleisti rūkyti.
4. būtini **analgetikai** (e.g. ibuprofen 400 mg) – severe pain during rewarming!

N.B. Atšildymas turi būti lėtas, iš vidaus! - kol nepanaikinta hipotermija (> 34°C) nėra prasmės šildyti galūnę!

1. Nušalusi galūnė:

* should be ***warmed rapidly in water*** that is tolerably hot to attendant hand (idealu 40-42° C) - avoid scalding anesthetized tissues!

N.B. longer part remains frozen, greater ultimate damage may be.

* rewarming is continued until erythema occurs on most distal parts.
* negalima trinti, masažuoti, dėti sniegą, tepti tepalus, durti pūsles.
* yra situacijų ***kuomet geriau nušalusios galūnės neatšildyti***:

1. when victim must walk some distance to receive care and lower extremity is affected - thawed tissue is further damaged by walking trauma.
2. jei yra pakartotinio nušalimo pavojus - if refrozen, tissue is certain to be severely damaged.

frozen part should be gently cleaned, dried, and protected in sterile compresses until thawing in warmer, more stable situation.

1. Apsaugoti nuo sužeidimo, transportuoti pakelta galūne.

STACIONARINĖ PAGALBA

1. Rewarmed extremities should be kept dry, open to warm air, and as sterile as possible.
2. Microwave thermography, laser-Doppler flowmetry, angiography, MRI may be used to assess peripheral circulation.
3. Goal is to restore microcirculation - low mol wt dextran, ibuprofen, buflomedil, UAD, spazmolitikai, futliarinės novokaino blokados, heparinas i/v, hidrokortizonas 0,1×2/d, aspirinas 0,5×4/d.
4. Tetanus profilaktika (if immunization is not up to date).
5. Išnirimai ir lūžimai reponuojami tik reaktyviniame periode.
6. Pašalinti leidžiama tik serozines pūsles, bet ne hemoragines.
7. III-IV° nušalimai gali sutrikdyti kraujotaką dėl paburkimo ir “timpos efekto” - atliekama nekrotomija, fasciotomija.
8. Most victims are dehydrated / hemoconcentrated → rehydration, electrolyte levels restored.

Tolimesnis gydymas reaktyviniame periode:

* chemical or surgical **sympathectomy** are seldom used acutely but may be useful for late causalgia.
* **nekrektomijos**; esant reikalui ir **amputacijos**, tačiau su jomis nereikia skubėti - surgery should be delayed as long as possible ("freeze in January, operate in July") - black carapace is often shed, leaving viable tissue (clear demarcation).
* daily **whirlpool baths** (followed by gentle drying) - the best long-term management.
* no treatment for long-lasting symptoms (e.g. numbness, hypersensitivity to cold) is known.

Prevention

* several layers of warm **clothing**, protection against moisture and wind.
* **gloves & socks** should be kept as dry as possible.
* insulated **boots** that do not impede circulation.
* warm **head covering** (N.B. ***30% of heat loss occurs from head***!).
* ample **fluids & food** helps sustain metabolic heat production.
* immediately **warming** body parts that become cold and numb.
* shivering, exertion, warm clothing, and hot drinks may prevent hypothermia.

Immersion (trench) Foot

- injury due to prolonged (several days) **wet** cold at temperatures above freezing.

* džn. homeless patients.
* soggy edema, blotchy cyanosis, numbness, paresthesias, and pain due to autonomic dysfunction.
* tissue maceration and infection during rewarming are common (!!!) - **sterile conditions** and **broad-spectrum antibiotics** are essential until acute edema has subsided; otherwise, liquefaction gangrene can occur.
* increased sweating, pain, and local hypersensitivity to temperature change (autonomic nervous system dysfunction) may persist for years.

Chilblains (s. pernio)

- injury due to chronic exposure to **dry** cold at temperatures above freezing.

* džn. mountain climbers, women.
* 12-14 hours after exposure - localized areas of **erythema, swelling, pruritus, vesicles, superficial ulcerations**.
* most commonly affects dorsa of fingers & toes.
* self-limited, no permanent damage.
* no effective treatment is known (cold avoidance, skin moisturizers).

*Panaudota literatūra*:

Merck Manual 1999

Sąsiuvinys “ Nacionalinis egzaminas 2 “

NMS Emergency Medicine, Pathological Anatomy