

Non-Dysbaric Dive Injuries

Underwater Blast Injuries

- EOD, explosives in salvage, UW cutting/welding, thunderflashes, combat explosives
- UW blast injuries
 - Primary due to shock wave = damage to gas containing organs (GI, lung, ENT, CNS)
 - Secondary due to displaced debris
 - Tertiary due to collision with stationary objects
 - Misc. - burns, radiation, etc.
 - Press wave travels 4x faster UW than in air
 - Typically no damage to non-gas containing organ unless impact/penetration wounds
- Tx
 - ABCs, ABCs, ABCs
 - O₂ – lung damage may not be immediately apparent
 - HBOT only if signs of AGE, DCS
 - If require ventilation
 - Risk of AGE, pneumo
 - Judicious use of fluids
 - Avoid worsening pulmonary edema
 - Early use pressors vs IVF
 - NPO - May not absorb from GI
 - Specialist consult as PRN

Heat-related Illnesses

- Heat cramps
 - Exertion, significant sweating, excess hypotonic fluid replacement -> salt depletion
 - Tx – PO salt solution (1/4 -1/2 tsp salt in quart of water), rest in cool env
- Heat Edema
 - Minimal edema, esp. feet & ankles
 - Diuretic not indicated
 - Tx – leg elevation +/- support stockings
- Heat Syncope
 - Generally elderly due to cutaneous vasodilation, pooling blood in lower limbs
- Heat Exhaustion (temp <40 °C)
 - Vague malaise, fatigue, headache, thirst, weakness, anxiety
 - Tachycardia, orthostatic hypotension, +/- dehydration
 - Tx
 - Cooling – ice packs (axillae, groins, neck), skin wetting/fans
 - Fluids, oral salt solution, +/- IVF
- Heat Stroke (temp > 40 °C)
 - Mild to severe CNS dysfx (delirium, LOC, seizure), skin hot/dry
 - Tx
 - Cooling – ice-water immersion, cold packs, skin wetting, fan, iced gastric lavage etc.
 - IVF (hypovolemic, rhambo -> ARF)
 - Lytes, glucose replacement PRN

Cold Water Immersion

- Thermal conductivity water >> air
 - Body cools ~4-5x faster in water
 - EtOH impairs thermal perception
- Stage I – Initial immersion (0-3 mins)
 - **Cold shock rxn**= initial gasp, hypervent, intense vasoconstriction (due to rapid skin cooling)
- Stage II – Short-term response (3-30mins)
 - Superficial nerves & muscles cool
 - Immediate chilling hands/feet = inability to complete survival actions, swimming failure
- Stage III – Long-term immersion (>30mins) = hypothermia
 - Age, cold habituation delay onset shivering – faster fall body temp
 - Mild (35°C), mod (32-35°C), severe (25-32°C), profound (<25°C)
- Stage IV – post-immersion/ circumrescue collapse
 - ~15-20% immersion deaths during/immediately following rescue
 - Heart muscle cold, less efficient, increase viscosity blood, prone to arrhythmias
 - Rapid tissue warming may increase off-gassing before adequate periph blood flow restored, ?bubbles
 - During rescue – maintain pt horizontal
 - Collapse worse if rescued vertically, increased time of immersion
 - Cephalic redistribution of blood, BP maintained due to hydrostatic pressure

Near-Drowning/Drowning

- Drowning ~100-150 scuba deaths per year
 - Entanglement, running out of air, cardiac events
 - Secondary to other injury, ?AGE/POS
- Major pathophys is hypoxemia
 - 10-15% do not aspirate water – laryngospasm
 - V/Q mismatch
 - Fluid-filled alveoli – perfused, not ventilated
 - Decreased ventilation -> increase PaCo₂, cardiovascular collapse
 - Dilute surfactant
 - Elevation diaphragm from gastric distention -> vomit & aspirate gastric contents
- Tx
 - Ventilation must be reestablished prior to developing end-organ injury from hypoxemia
 - ABCs, 100% O₂
 - +/- ETT, NG tube
 - Monitor serial Arterial Blood Gas
 - Antibiotics
 - Ocean water/pool generally not required unless dev fever, purulent excretions, new infiltrates on CXR
 - If aspirate known contaminated water, consider Abx
 - Ventilation – based on clinical presentation
 - BiPAP, PEEP etc.