Diver Down
Management of dive injuries

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How dangerous is it?

- 1 out of every 5,555 of drivers dies in car accidents
- 1 out of every 7,692 pregnant women die from complications
- 1 out of every 116,666 skydives ended in a fatality in 2000
- 1 out of every 126,626 marathon runners died of sudden cardiac arrest while running a marathon between 1975–2003
- 80–100 divers die annually
- – 3 million US divers / 6 million worldwide
Top reasons for injuries

- Poor Diver Health
- Procedural Errors
- Environmental Issues
- Equipment Problems
Pre-dive / Surface

- Sea sickness
- Sprains and strains
- Sun burn
- Blunt trauma
- Near drowning
Near Drowning

- **Cause**
  - Respiratory interruption due to fluid inhalation
  - Mammalian diving reflex

- **Signs and symptoms**
  - Not breathing
  - Cyanosis – ashen grey / blue appearance
  - Weak or absent pulse

- **Treatment**
  - CPR PRN
  - Recovery position
  - Evacuate to medical attention
    - Even if apparently fully recovered
Carbon Monoxide Poisoning

- **Cause**
  - breathing gas contaminated with carbon monoxide

- **Effect**
  - Carbon Monoxide combines about 200 times more readily with hemoglobin than does oxygen
  - Interferes with the blood's ability to transport oxygen
  - Acts as a cellular poison
Carbon Monoxide Poisoning

- **Signs and symptoms**
  - headache
  - pale or greyish appearance
  - weakness
  - dizziness, nausea
  - tunnel vision
  - vomiting
  - rapid pulse
  - rapid breathing
  - coma
  - convulsions

- **Treatment**
  - Support respiratory effort
  - High concentration O2
Barotrauma

- Result of pressure imbalance in gas–filled spaces in the body
  - Can affect any gas–filled space in the body
- Middle Ear Squeeze
  - Tympanic membrane rupture
    - Nausea / Vomiting
    - Vertigo
    - Panic / rapid ascent
- Treatment:
  - Loose dressing for bleeding ear
  - IV anti–emetics or sedatives
Nitrogen Narcosis

- Altered mental status from breathing compressed nitrogen–containing air at depth

- Signs and symptoms:
  - Euphoria
  - Inappropriate and dangers behavior
  - Tingling of lips, gums, and legs
  - May panic and surface too quickly

- Treatment:
  - Reduce depth
  - Symptoms resolve
  - No long term consequences
At depth

- Bites
- Stings
- Wounds
- Toxicity
- Hypothermia
CNS Toxicity

Symptoms:

V  – Vision
E  – Ears, hearing disturbances
N  – Nausea
T  – Twitching
I  – Irritability
D  – Dizziness

Until convulsions begin, minor symptoms:
- Can occur in ANY order or combination
- Increase in severity
Hypothermia

- Body temp
- S/S
- Tx
Nitrogen bubbles in blood and tissues come out of solution during rapid ascents. Bubbles cause damage by:

- Interfering mechanically with tissue perfusion
- Triggering chemical changes in body
- Can potentially affect every organ in the body
Decompression Sickness

Signs and symptoms
- *Denial!*
- Itches, rashes
- Numbness, tingling, joint pain
- Vision disturbances
- Dizziness, nausea, headaches, confusion
- Weakness, paralysis
- Shortness of breath
- Shock, unconsciousness
- Any abnormality after a dive

- Can appear hours after surfacing
Decompression Sickness

Management:
- Administer 100% oxygen
- Manage acute problems
- Transport to hospital – even if symptoms appear to resolve
- Contact DAN

- Send diving equipment with the patient for analysis if possible
Pressure Disorders

- If divers fail to exhale during ascent, pressure in lungs increases.
  - Pneumothorax
  - Subcutaneous emphysema
  - Alveolar hemorrhage
  - Arterial gas embolism (AGE)

- Can occur in depths as shallow as 6’
  - Treatment
    - Treat as a pneumothorax
    - Provide rest and supplemental oxygen
Pressure Disorders

- Signs and symptoms depend on where escaping air ends up, causing:
  - Full sensation in throat
  - Pain on swelling
  - Dyspnea
  - Substernal chest pain
  - Crunching noise synchronous with heartbeat audible by auscultation (Hamman’s crunch)
Air bubbles from ruptured alveoli enter pulmonary capillaries and travel back to left side of heart.

- Bubbles may enter coronary arteries and produce effects of MI.
- Majority rise to head, causing strokelike symptoms.
Arterial Gas Embolism

- Dramatic clinical picture, with symptoms:
  - Involving most cerebral functions
  - Appearing within seconds to minutes after surfacing
  - Weakness or paralysis of extremities
  - Seizure activity
  - Unresponsiveness
  - Paresthesia
  - Visual disturbances
  - Deafness
  - Changes in mental status
Arterial Gas Embolism

- Treatment includes:
  - Ensure adequate airway.
  - Administer 100% supplemental oxygen.
  - Transport in supine position by ground.
  - Establish IV access, and administer normal saline.
  - Monitor cardiac rhythm.

  - If medevac, fly lower than 1000 ft or in pressurized aircraft
General Assessment: Diving History

- When did symptoms start?
- Type of diving and equipment?
- Type of diving gas?
- Diving site and water temperature?
General Assessment: Diving History

- Number of dives in the last 72 hours, and:
  - Depth?
  - Bottom time?
  - Surface interval?
- Dive computer used?
- Safety stops used?
- Any attempts at in-water decompression?
- Any dive complications?
- What were pre-dive and post-dive activities?
Positive end–expiratory pressure (PEEP)
  ◦ Maintains some positive pressure at end of expiratory phase.
  ◦ Indicated for intubated patients with long transports
  ◦ Some BVMs allow PEEP adapter
Treatment Pearls

- Do not give up on submersion patient.
  - Successful resuscitation with complete neurologic recovery in more than 1 hour of submersion in icy water
    - Hypothermia protects body and brain from hypoxia
    - Hypothermia more often dangerous than protective
Post resuscitation complications
- Occur hours to days after submersion:
  - Adult respiratory distress syndrome
  - Hypoxic brain injury
  - Multi-organ failure
  - Sepsis syndrome
QUESTIONS?