

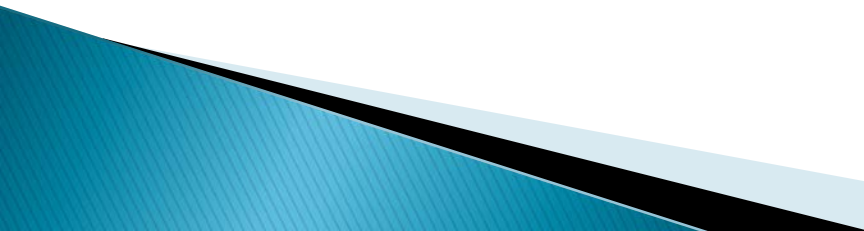
Diver Down Management of dive injuries



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How dangerous is it?

- ▶ *1 out of every 5,555 of drivers dies in car accidents*
 - ▶ *1 out of every 7692 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 world wide*
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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

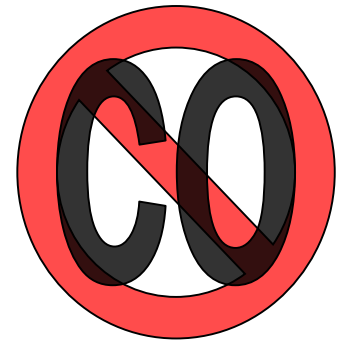
- CPR PRN
- Recovery position
- Evacuate to medical attention
 - Even if apparently fully recovered



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

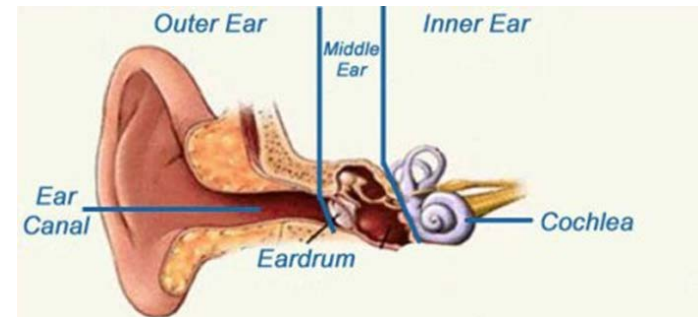
Treatment

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 dangerous 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

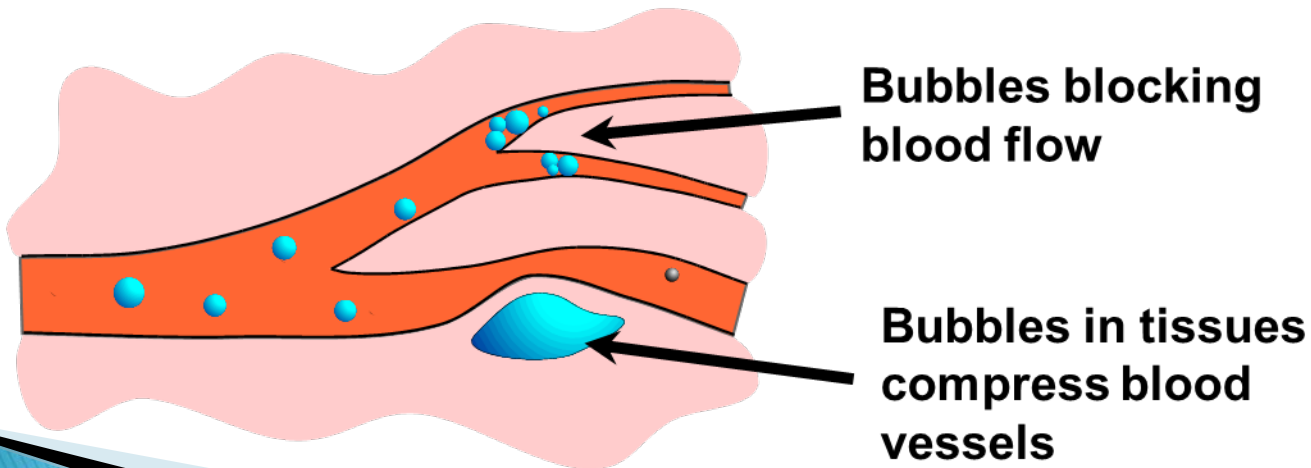
Hypothermia

- ▶ Body temp
- ▶ S/S
- ▶ Tx



During Ascent

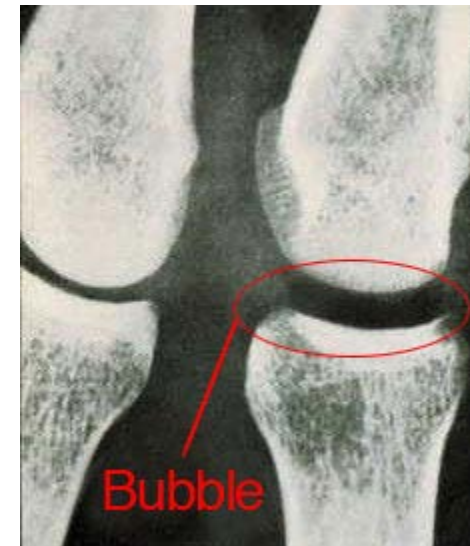
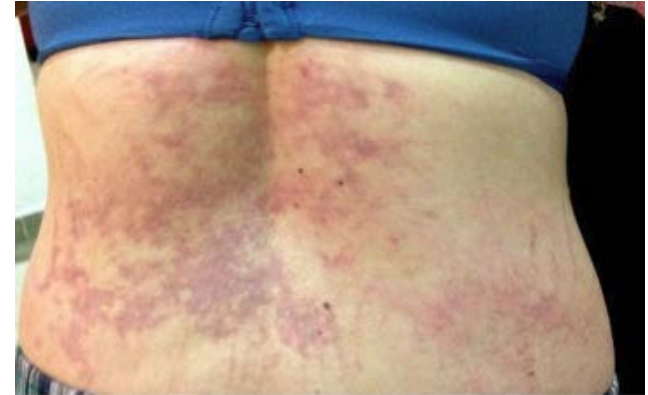
- ▶ Nitrogen bubbles in blood and tissues come out of solution during rapid ascents.
 - Bubbles cause damage by:
 - Interfering mechanically with tissue perfusion
 - Triggering chemical changes in body
 - Can potentially affect every organ in the body



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

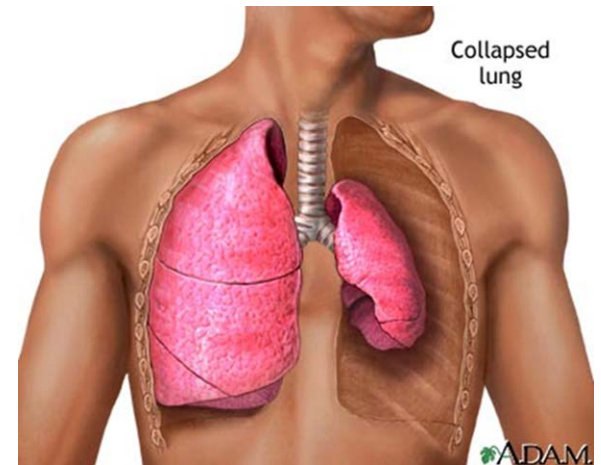
- ▶ Management :
 - Administer 100% oxygen
 - Manage acute problems
 - Transport to hospital – even if symptoms appear to resolve
 - Contact DAN

- 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

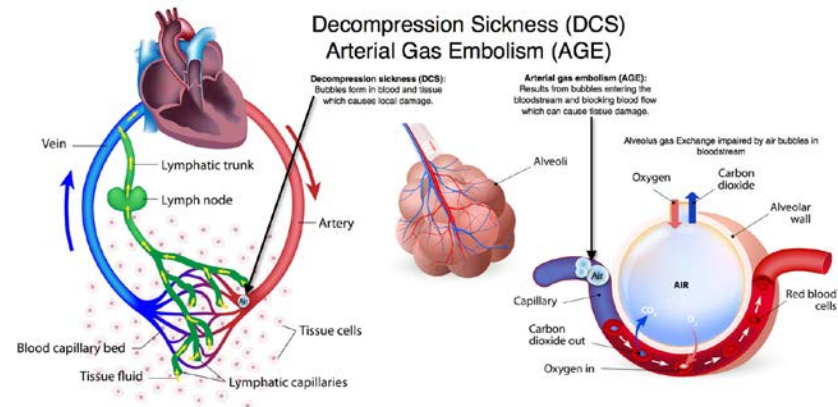


Pressure Disorders

- ▶ 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)

Arterial Gas Embolism

- ▶ 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.



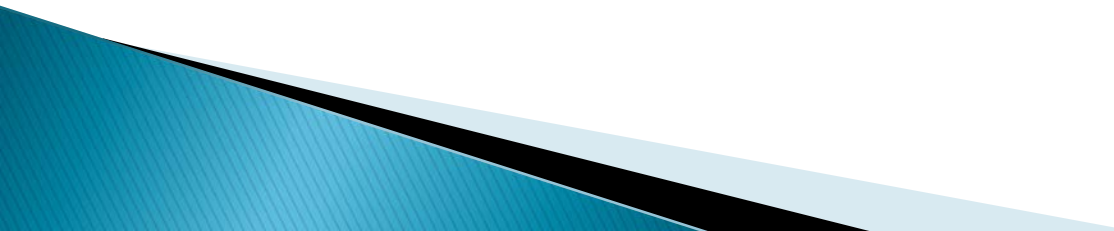
Arterial Gas Embolism

- ▶ 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

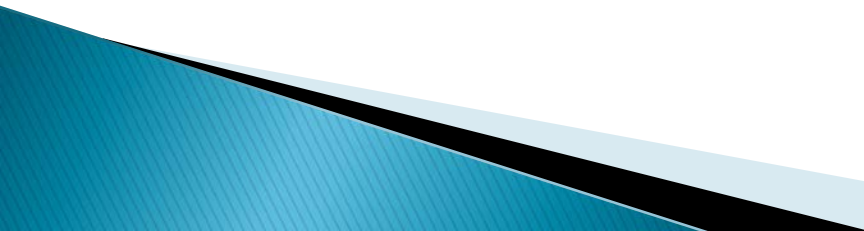
Arterial Gas Embolism

- ▶ 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?
- 

Treatment Pearls

- ▶ 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



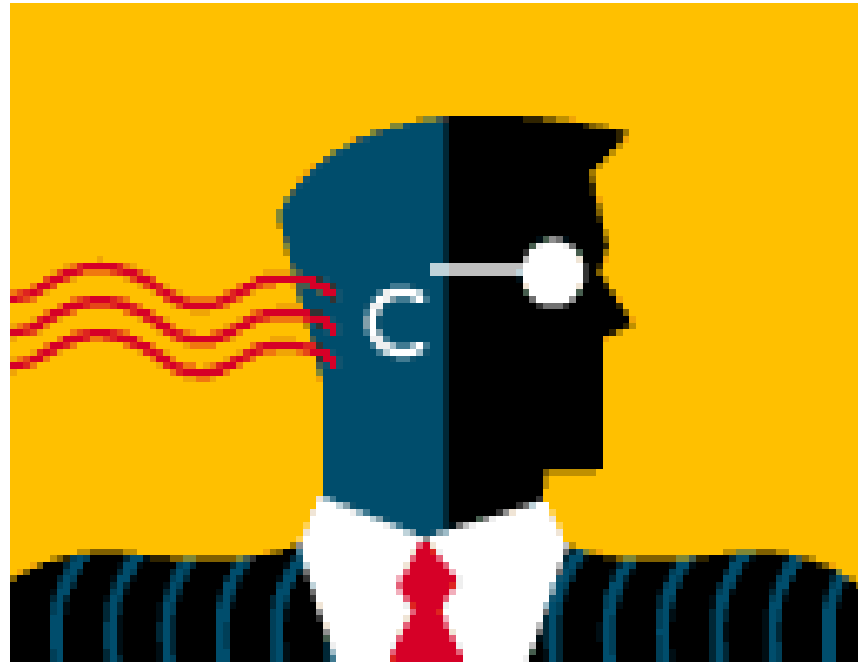
Treatment Pearls

- ▶ Do not give up on submersion patient.
 - Successful resuscitation with complete neurologic recover in more than 1 hour of submersion in icy water
 - Hypothermia protects body and brain from hypoxia
 - Hypothermia more often dangerous than protective

Treatment Pearls

- ▶ Post resuscitation complications
 - Occur hours to days after submersion:
 - Adult respiratory distress syndrome
 - Hypoxic brain injury
 - Multi-organ failure
 - Sepsis syndrome

QUESTIONS ?





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