BACK FROM THE ABYSS
DROWNING EMERGENCIES

NEAR DROWNING

BLS 05/ALS 77/1.5 CEU

INTRODUCTION

- HELEN COMPTON
  - Paramedic since 1998
  - Started as an EMT in 1983
  - Work for two EMS Agencies (full-time)
  - Scuba Diver to Rescue Diver level and subsequent specialities
  - ALS Coordinator

INTRODUCTION

- CLAY OVERHOLT
  - Virginia State Trooper
  - Intermediate with Campbell Co Rescue
  - Scuba Diver Instructor

•OBJECTIVES

- Risk Factors for Drowning and Submersion
- Pathophysiology of Drowning and Submersion
- Response to Drowning and Submersion
- Management of Drowning and Submersion
- Post-resuscitation Complications
- Special Considerations
- Documentation and communication to ER

DROWNING AND NEAR DROWNING

- DROWNING
  - Death as a result of suffocation after submersion in water
  - Fifth leading cause of unintentional death
  - 85% male who don't know how to swim
  - Means that death occurred within 24 hours of submersion
- NEAR DROWNING
  - Survival, at least temporarily, after suffocation in water
  - Indicates that death either did not occur or occurred more than 24 hours after submersion
  - More sustain serious injury

In the US approximately 4500 persons die annually due to drowning

- Approximately 40 percent of these deaths are in children under 5 years of age
- There is second peak incidence in teens
- A final third peak in the elderly as a result of accidental drownings
- Most occur in freshwater and alcohol is involved

DROWNING PROCESS (Pathophysiology)

- Something goes wrong

  -swallowing of water, fatigue, unable to cope with currents, injuries, Cold, Entanglement in kelp, Loss of orientation, nitrogen narcosis

  Panic (loss of control)

  Inefficient Breathing (CO_2 retention-O_2 deprivation)

  Depressed Buoyancy

  Exhaustion

  Cardiac or Respiratory Arrest

Something Goes Wrong

- Swallowing of water – Fatigue – Unable to cope with currents – Injuries- Cold – Entanglement in kelp – Loss of Orientation – Nitrogen narcosis

- Panic (loss of control)

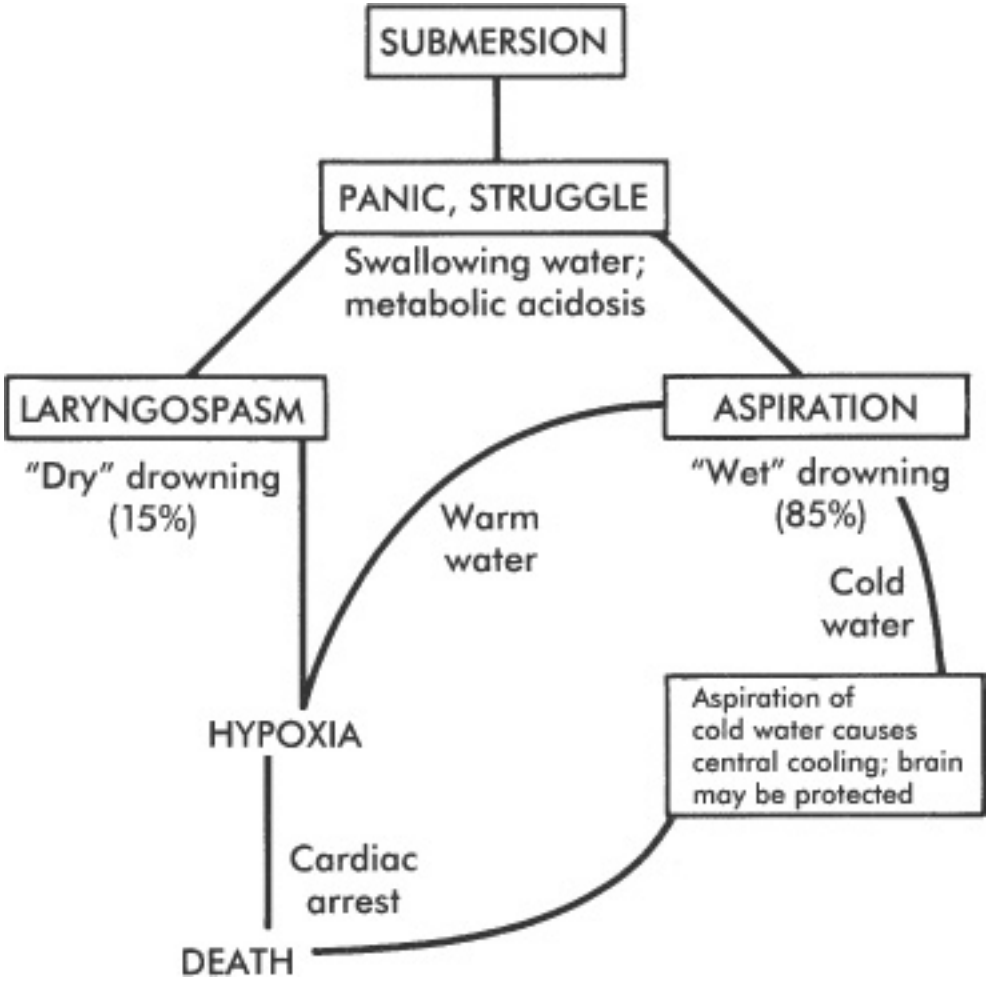
- Inefficient Breathing (CO_2 retention- 02 deprivation)

- Decreased Buoyancy

- Exhaustion

- Cardiac or Respiratory Arrest

DROWNING PROCESS



Pathophysiology (cont)

- A victim undergoes a period of apnea for up to three minutes
- This is an involuntary reflex as the victim strives to keep his/her head above water
- The mammalian dive reflex occurs which is when the blood is shunted to the heart and brain
- When victim is apneic the PAO2 in blood rises to greater than 50 mmHg
- The stimulus from hypoxia ultimately overrides the sedative effects of hypercarbia and causes stimulus of central nervous system

RESPONSE TO DROWNING EMERGENCIES

- The cause of submersion will be unknown
- Consider trauma and spinal injuries
- Frequently this occurs in cold water so hypothermia can occur. This slows the body's metabolic process thereby decreasing the need for oxygen.
- Treat the hypoxia initially
- Laryngospasm should be considered

DROWNING TYPES (Submersion Incident)

DRY LUNG

- 15% of cases
- Small amount of water aspiration
- Fluid in posterior oropharynx stimulates laryngospasm
- Patient asphyxiates

WET LUNG

- 85% of cases
- Large amounts of water enters the lungs
- Fluid, electrolytes imbalances occur

WET LUNG – FRESH WATER

- Water moves from the alveoli to bloodstream
- Hemodilution occurs which is an expansion in blood plasma volume and reduction in red blood cell concentration
- Oxygen carrying capacity decreases
- Water moves into red cells
- Red cells swell, rupture (potassium increases which causes arrhythmias) & release of hemoglobin into bloodstream = renal failure
- Loss of surfactant-collapse of alveoli

WET LUNG – SALT WATER

- Water moves from bloodstream to alveoli because of the hypertonic nature of sea water which is 3 to 4 times more hypertonic than plasma causing pulmonary edema and leading to profound shunting
- Hypoxemia occurs as result of oxygenation failure
- Respiratory and metabolic acidosis develop as result of CO2 retention
- Hemoconcentration occurs = shock

DROWNING AND NEAR DROWNING

- Primarily due to asphyxia from airway obstruction in the lungs secondary to the aspirated water or the laryngospasm.
- In the near drowning episode this process does not end in death, any fluid that has entered the lungs may cause lower airway disease

FACTORS AFFECTING SURVIVAL

- Cleanliness of water
- Length of time submerged
- General age and health of victim
- Children have a longer survival time and greater probability of successful resuscitation
- Water temperature is significant

FACTORS AFFECTING SURVIVAL (cont)

- Mammalian Dive Reflex is a complex cardiovascular reflex, resulting from submersion of the face and nose in water, that constricts the blood flow everywhere except to the brain
- Mammalian Dive Reflex
  - Water <68 degrees farenheit
  - Bradycardia, intense peripheral vasoconstriction
  - Blood, oxygen shunted to core organs, circulated very slowly

MANGEMENT OF DROWNING AND SUBMERSION

Essential First Aid Management

Conscious		Unconscious
Evaluate for Aspiration		CPR (prolonged) 100% oxygen
NO YES		
Observe	100% oxygen	transfer to hospital

MANAGEMENT (cont)

- Assess and manage ABCs
- If indicated start CPR and defibrillation
- Manage airway with proper airway adjuncts and suctioning and oxygen administration
- Trauma considerations (spinal precautions if MOI suggests)
- Postresuscitation complications (Adult Respiratory distress syndrome (ARDS) or renal failure often occurs
- Symptoms may not appear for 24 hours
- Treat all submersion patients for hypothermia
- Transport all submersion patients

Common Saying in Emergency Medicine states:

"The cold water drowning victim is not dead until he/she is warm and dead."

In other words, a person who has been submerged in cold water may only seem to be dead, but due to the continued supply of oxygen to the heart and brain may indeed still be alive.

- Patients may be able to survive for an extended period of time under water thanks to a lowering of the metabolic rate associated with hypothermia.

POST RESUSCITATION COMPLICATIONS

- Adult Respiratory Distress Syndrome (ARDS) is the most severe and high rate of mortality
- Hypoxia and acidosis lead to cardiac dysrhythmias, including v-fib and asystole
- May develop pneumonia but this is less common
- Brain abcesses, osteomyelitis, soft tissue infections

TRANSPORT DECISION

- Even if resuscitation appears to be successful you must always transport near-drowning patients to the Hospital
- Inhalation of any amount of fluid can lead to delayed complications lasting for days or weeks
- Perform all interventions en route

SPECIAL CONSIDERATIONS

- Scuba diving injuries
  - 4 stages (surface, descent, bottom and ascent)
  - Pressure disorders (decompression illness, pulmonary over-pressure accidents, aterial gas embolism, pneumomediastinum, nitrogen narcosis)

DECOMPRESSION ILLNESS

Referred to as “the Bends”

Occurs when bubbles of gas especially nitrogen obstruct the blood vessels from a rapid ascent from a dive

PULMONARY OVER PRESSURE ACCIDENTS

ARTERIAL GAS EMBOLISM

- Most dangerous and most common
- Air bubbles in the blood vessels
- Can occur in a shallow dive
- Occurs when a diver holds his/her breath during a rapid ascent

NITROGEN NARCOSIS

DOCUMENTATION AND COMMUNICATION TO ER

- Document the circumstances of the drowning and extrication
- Receiving facility will need to know
    - How long the patient was submerged
    - Water temperature
    - Clarity of the water
    - Whether the possibility of cervical spine injury existed
    - DIVER-a complete dive profile will be needed so that the facility can properly treat the diver (obtain from dive logs, dive partners or dive computers)
    - Take the divers's equipment to the Hospital
    - Document the dispostion

DOCUMENTATION AND COMMUNICATION TO ER (cont)

- Notify receiving facility of what you will be bringing them in event they have instructions for you
- May want to consider flying these patients or getting them to a facility that is capable of handling these situations

Test

Drowning is MOST accurately defined as:

a. temporary survival after submersion in water

b. Death from suffocation after submersion in water

c. Water in the lungs following submersion in water

d. Death beyond 24 hours after submersion in water

Test (cont)

Which of the following statements regarding drowning is MOST correct?

a. Hypoxia in the drowning victim initially occurs due to water in the lungs

b. Artificial ventilations can easily be performed in patients with a laryngospasm

c. Large amounts of water enter the lungs in a small number of drowning victims

d. Laryngospasm following submersion in water makes rescue breathing difficult

Test (cont)

- The EMT-B must assume that any unwitnessed water-related incident is accompanied by:
  - A. An air embolism
  - B. Alcohol intoxication
  - C. Possible spinal injury
  - D. Cold water immersion

Test (cont)

- The diving reflex may allow a person to survive extended periods of submersion in cold water secondary to:
- A. Bradycardia and a slowing of the metabolic rate
- B. Laryngospasm that protects the lungs from water
- C. Tachycardia and a lowering of the blood pressure
- D. Increases in the metabolic rate and oxygen demand

Test (cont)

- Most of the serious injuries associated with scuba diving are caused by:
- A. Water less than 70 deg F
- B. Too rapid of a decent
- C. Alcohol consumption
- D. Too rapid of an ascent