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Saltwater CPAP

Introduction

- Drowning accounts for 8000 deaths/year
- Risen steadily over past twenty years
- Drowning 4th most common cause of accidental death

GEMS, GCBP & UTMB

- Joint study with IRB approval through UTMB at Galveston
- Study effects of CPAP in saltwater near-drowning
- Trained Beach Patrol Lifeguards
 - S/S saltwater near-drowning
 - Physiology of saltwater aspiration
 - Mechanics of CPAP
 - How CPAP works in patients with saltwater aspiration

Study

- Study initiated June 1, 1998
- Evaluate the application CPAP by Beach Patrol
- 10 people were entered into the study
 - Nine responded successfully
 - One DC'd CPAP; was paralyzed using Anectine and orally intubated
 - Copious amount of sand in lungs and stomach

Mechanism of Pulmonary Injury

- Fluid accumulation in Lungs
- Movement of fluid from blood vessels into lungs
- Direct injury of blood vessels surrounding alveoli
- Dilution and decreased surfactant

Seawater

- Creates osmolar pressure gradient
- 3 1/2 - 4 times more concentrated than plasma
- osmolarity of seawater pulls fluid into alveoli from blood vessels
- Dilution of surfactant
 - Collapse of airways

Osmolarity

- Seawater 5% NaCl Plasma 0.9% NaCl
- Seawater act as a sponge inside lungs
 - Fluid is pulled into the region with high sodium content
 - Adverse effect from defense mechanism
 - Body attempts to dilute sodium concentration to equal that of the blood vessels.
 - ↑ fluid in lungs ↓ oxygenation of blood

Surfactant

- Oil based substance lining within the lungs
 - Maintains structural integrity of airway
 - Keeps airway open
 - Dilution of surfactant results in airway collapse
 - Prevents oxygen from reaching blood
 - Retention of Carbon Dioxide
 - Hypoxemia develops
 - Patient struggles to breath

CPAP Mechanism

- Maintains a constant positive airway pressure
- Airways at risk for collapse or closure from excess fluid are baro-stented open.
- Gas exchange is maintained
- Work of breathing is reduced

Indication

- Respiratory Distress
 - Accessory muscle use
 - Verbal Impairment
- Auscultation of rales secondary to saltwater submersion

Contraindications

- Unconscious
- Apnea
- Obstruction in airway (food, seaweed, etc.)
- Acute trauma, especially of the face, upper airway, or chest
- Asthma
- COPD, especially emphysema patient