The “A-Z’s of PeriAnesthesia Emergencies

0800-1000

Identify emergent situations that can impact the perianesthesia patient.
Describe treatment and management of perianesthesia emergencies.
• Airway
• Allergic Reactions
• Aspiration
Airway Obstruction

- **Causes**
  - Soft Tissue obstruction
  - Tongue displacement
  - Airway edema
  - Foreign body
  - Laryngospasm

- Hypoxemia
- Hypoventilation
AIRWAY OBSTRUCTION

• Snoring - Flaring of nostrils - Retraction
• Asynchronous movement of chest and abdomen
• Increased accessory muscle usage
• Increased pulse
• Decreased Oxygen saturation
• Decreased Breath Sounds
INTERVENTIONS

• Chin support/Jaw thrust
• Positive Pressure with mask/ambu
• Artificial airways
Allergic Reactions Signs & Symptoms

- Conjunctivitis
- Urticaria
- Angioedema
- Gastrointestinal disturbances
- Laryngeal edema
- Bronchospasm
- Hypotension
- Dysrhythmias
- Cardiac arrest
- Coma
TREATMENT

• Adrenergic agonists (Epinephrine)
• Methylxanthines (Aminophyllin)
• Anticholinergics (Atropine, Glycopyrrollate, Scopolamine)
• Antihistamines (Benadryl)
• Corticosteroids
ASPIRATION

• Factors related to aspiration pneumonitis
  – Increased gastric residual volume
  – Decreased gastric pH
  – Presence of particulate matter in stomach
  – Difficulty in protecting airway
HIGHER RISK POPULATIONS

• Morbid obese
• Diabetics
• Surgical factors
  – 1. Upper abdomen surgery
  – 2. Straining on ETT
• OB patients
• Emergency patients: MVA
TYPES OF ASPIRATION

• Large particle - immediate intervention required
• Clear acidic fluid - pH of aspirated material determines extent of pulmonary injury
• Clear nonacidic fluid - depends on volume and composition
• Food stuff or small particle - within 6 hours may see severe hemorrhagic pneumonia
• Contaminated material - bowel, dental
ASPIRATION
SIGN & SYMPTOMS

- Tachypnea
- Tachycardia
- Hypoxia
- Chest infiltrate
- Wheezing
- Coughing - dyspnea
- Apnea
- Hypotension
- Bradycardia
INTERVENTIONS

• Position on side with head turned
• Bronch if large particles
• Oxygen
• Ventilate if needed
• Inotropic medications
• Antiemetics
Bathing (Code Brown)
Breathing
Bleeding
Bronchospasm
BRONCHOSPASM

• Causes
  – Light anesthesia
  – Residual effect of muscle relaxants
  – Irritable tracheobronchial tree
  – Mechanical factors
SIGN & SYMPTOMS

- Wheezing
- Shallow noisy respiration
- Chest retractions
- Dyspnea
- Tachypnea
- Decreased P02
INTERVENTIONS

• Remove irritant
• Increase Oxygen
• Administer muscle relaxants
• Deepen anesthesia
• Administer medications
• Compartment Syndrome

• CPR- Cardiac or Respiratory Arrest
Compartment Syndrome

• Increased pressure within muscle compartment causes circulatory compromise

• 2 Main causes:
  – Constriction from outside
  – Increased pressure within compartment
Compartment Syndrome

• When edema or bleeding increases pressure within a compartment impending circulation

• Signs & Symptoms
  – Intense deep throbbing pain out of proportion to the injury without improving with analgesia
  – Numbness & tingling distal to affected muscle
  – Absent peripheral pulses
  – Pallor or mottling of affected area
  – Decreased movement, muscle strength & sensation in affected extremity
  – Sharp pain on passive stretching of middle finger or large toe of affected extremity
Compartment Pain measurement

5 P’s

- P Pain
- P Paresthesia
- P Pallor
- P Paralysis
- P Pulselessness - poor prognostic sign

RISKS

- Constrictive casts & dressings
- Long bone fractures
- Orthopedic Surgery
- Crush injuries
- Thermal injuries
• Delayed Arousal
• Delirium
• Dysrhythmias
Delayed Arousal

• **Etiology**
  – Prolonged action of anesthesia medications
  – Metabolic causes
  – Neurologic causes
Delayed Arousal ANESTHESIA CAUSES

• Residual anesthesia
• Hyperventilation due to high concentration of inhaled agents
• Narcotics may contribute to hypercarbia and sedation
• Hypothermia
Delayed Arousal

**METABOLIC CAUSES**

- Hepatic dysfunction
- Renal disease
- Diabetic ketoacidosis
- Thyroid dysfunction
- Malignant hyperthermia
- Electrolyte imbalance
  - Hypocalcemia
  - Dilutional hyponatremia
  - High magnesium levels especially eclamptic patients
Delayed Arousal

NEUROLOGIC CAUSES

• Ischemia
• Cardiovascular accident
• Intracranial hemorrhage
• Air emboli
• Uncontrolled hypotension
• Embolism
• Mass lesions
• Seizure disorders
Delayed Arousal
INTERVENTIONS

• Assess oxygenation needs
• Ensure adequate oxygen exchange
• Reverse narcotics and benzodiazepines
• Warm patient if cold
• Treat electrolyte disturbance appropriately
• Identify causes to treat specifically
Delirium/Agitation/Dysphoria

Common in children as well as healthy patients
EMERGENCE DELIRIUM CAUSES

• **Anesthetic Agents**
  – Ketamine - Atropine
  – Lidocaine - Droperidol
  – Scopolamine
  – Residual neuromuscular blockers
  – Residual inhalation agents
EMERGENCE DELIRIUM CAUSES

- Pain
- Urinary bladder distension
- Anxiety
- Substance abuse including alcohol withdrawal

- Metabolic endocrine problems
- Hypoglycemia
- Hyponatremia
- Hyper/hypo thyroidism
EMERGENCE DELIRIUM CAUSES

• Hypoxia
• Hypercarbia
• Hypoadrenalism
• Cerebral hypoxia
• Sepsis
SIGNS & SYMPTOMS
Emergence Delirium

• Responsive or unresponsive agitation
• Unable to follow commands
• Irrational talking, screaming, shouting Low saturation levels
• Restlessness - Crying
• Disorientation - Tachycardia
• Confusion - Verbalizations
INTERVENTIONS
Emergence Delirium

• Treat underlying cause
• Oxygen if indicated
• Narcotics or sedation if needed
• Reverse narcotics or benzodiazepines
• Provide quiet environment
• Speak softly and directly to patient
• Maintain safety
Pediatric Problems

• SIGNS & SYMPTOMS
  – Dissociative state
  – No response to verbal commands
  – Confused & disoriented
  – Delirious state that can last from 30 seconds to 5 minutes
Pediatric Problems

• Medications associated with:
  – Ketamine
  – Droperidol
  – Atropine
  – Scopolamine
  – Benzodiazepines
DYSRHYTHMIA CAUSES

- Electrolyte Imbalance - Hypokalemia & hypocalcemia
- Hypoventilation
- Pain
- Hypertension
- Hypothermia
- Preop cardiac dysrhythmias
- Hypovolemia
- Myocardial ischemia
- Anticholinesterase meds
- Respiratory Acidosis
- Hypoxemia
- Fluid overload
DYSRHYTHMIAS REQUIRING TREATMENT

- Atrial Flutter
- Atrial Fibrillation
- Paroxysmal Atrial Tachycardia
- Nodal Tachycardia
- Second & third degree heart blocks
- Premature Ventricular Contractions
- Bradycardia if symptomatic
DYSRHYTHMIAS REQUIRING TREATMENT

• Ventricular Tachycardia
• Ventricular Fibrillation
• Asystole
• PEA (Pulseless Electrical Activity)
DYSRHYTHMIA TREATMENT

• Correct underlying cause
• Assure patency of airway
• Provide adequate oxygenation
• Bradydysrhythmias
  – Disruption in conduction system
  • Heart surgery
  • MI
• Treat with Dopamine, epi
DYSRHYTHMIA TREATMENT

• Tachydysrhythmias
  – Pain
  – Anxiety
  – hypovolemia
  – hyperthermia
  – Treat with Beta blockers
E-F

- Electrolyte imbalance
- Epidural Hematoma
- Embolus
  - Fat
  - Pulmonary
FAT EMBOLISM

- Seen with fractures of long bones
- Release of fat droplets into circulation
- Migrate to lungs
- Break down into acids
  - irritates vascular walls
  - causes extrusion of fluids into alveoli
  - alters ventilation leading to hypoxemia
FAT EMBOLISM

- Tachypnea
- Tachycardia
- Anxiety
- Petechiae over chest
- Mechanical ventilation

- PO2 < 60 mm Hg
- Fever
- Confusion
- Pallor
FAT EMBOLISM

• Interventions
  – Oxygen
  – Keep patient quiet
  – Prevent motion of fractured site
PULMONARY EMBOLISM

• Precipitating factors
  – Venous stasis
  – Hypercoagulability
  – Vascular wall damage
SIGNS & SYMPTOMS

- Hypoxia
- Tachycardia
- Hypotension
- Restlessness
- Headache
- Apprehension
- Delirium
- Sudden anginal or pleuritic chest pain
- Splinting
- Retractions
- Peripheral edema
- Distended neck veins
INTERVENTIONS

- Oxygen
- Bedrest - HOB↑
- Cardiac monitoring – dysrhythmias
- Mechanical ventilation
- Heparinization
- Narcotics
- Fluids
- Elastic hose
- Vasopressors
Fluid Imbalances

Centigrade = \((F^0 - 32 \times 5/9)\)

Fahrenheit = \((9/5 \times C^0 + 32)\)
Fluid Imbalances

• Dehydration
  – Loss of 1% or more of body weight
  – Increase in BUN & HGB
  – Signs & Symptoms: dizziness, fatigue, weakness, irritability, delirium, extreme thirst, increased heart rate, hypotension, decreased urine output

• Hypervolemia
  – Excess of water and sodium in Extracellular fluids (kidney failure, cirrhosis, Heart failure, steroid therapy)
  – Signs & Symptoms: edema, weight gain, distended neck & hand veins, heart failure, Initial rise of BP and CO and later falling values
Normal Blood Volumes

- Premature = 100 ml/kg
- Full term = 85-90 ml/kg
- Infant  = 80 ml/kg
- Adult = 65-70 ml/kg
GI complications
  – Gas embolus
  – Perforation
<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Sudden ↑ followed by rapid ↓ in ETCO2</td>
<td>• Immediate cessation of insufflations</td>
</tr>
<tr>
<td>• Hypotension</td>
<td>• DC Nitrous Oxide</td>
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<tr>
<td>• Hypoxia</td>
<td>• Steep left lateral decubitus position</td>
</tr>
<tr>
<td>• Cyanosis</td>
<td>• Hyperventilation</td>
</tr>
<tr>
<td>• Cardiac Arrest</td>
<td>• Place Central Venous access for diagnosis &amp; aspiration of air</td>
</tr>
<tr>
<td>• “Mill-wheel murmur with pre-cordial &amp; TEE doppler ultrasonography</td>
<td>• CPR</td>
</tr>
</tbody>
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H

• Hypoventilation
• Hypoxia
• Hemorrhage
• Hypovolemic
• Hypotension
• Hypertension
HYPOVENTILATION

• Desaturation most frequent event
• Greater than 60 years of age
• Obese patients
• Longer operations
• High dose muscle relaxant use
• High dose opioid use
Hemorrhage classification
Class I – II

• Class I:
  – Loss up to 750 ml (lose 1-15% total blood volume)

• Class II:
  – Loss of 750-1500 ml (15-30% blood volume)

• Treatment for Class I & II
  – Rapid infusion of 1-2 liters balanced salt sol.
  – Maintain renal output of > 0.5 ml/kg/hr.
Hemorrhage classification
Class III – IV

• Class III
  – Loss of 1500-2000 ml blood (30-40% total volume)
  – Fluid administration but consider blood transfusion

• Class IV
  – Loss of >2000 ml blood (40% total blood volume)
  – Fluid administration ++ Blood administration
HYPERTENSION

• Major Organs at Risk
  – Heart - Myocardial Hypertrophy
  – Kidney - Decreased perfusion, Renal Failure
  – Brain - Loss of autoregulation
HYPERTENSION CAUSES

- Emergence
- Pre-Existing
- Pain
- Hypervolemic
- Respiratory Insufficiency
- Hypothermia
- Increased Intracranial Pressure

- Full Bladder
- Stress
- Drugs
- Abrupt Withdrawal of Clonidine
- Tricyclic Antidepressants
TREATMENT

- Correct underlying etiology
- Diuretics
- Vasodilators
  - Hydralazine
  - Nitroglycerin
  - Nitroprusside
- Beta Blockers
  - Propranolol
  - Labetolol
  - Esmolol
- Calcium Channel Blocker
  - Nifedipine
HYPOTENSION CAUSES

- Hypoxia
- Hypovolemia
- Decreased Myocardial Contractility
- Sepsis
- Pulmonary embolus
- Pneumothorax

- VasoVagal
- Cardiac Tamponade
  - Anesthetics
    - Muscle Relaxants
    - Narcotics
    - Regional Anesthesia
- Artifact with equipment
HYPOTENSION TREATMENT

- Confirm accuracy of equipment
- Fluid Replacement
- Treat Dysrhythmias
- Reverse anesthetics
- Afterload Reduction
  - Elevate Legs
  - Ephedrine
HYPOTENSION TREATMENT

• Inotropic Agents
  – Calcium
  – Dopamine
  – Epi
  – Dobutamine

• Cardioversion for tachydysrhythmias
• Intestine

• Intracranial pressure elevation
J – K – L

- Jaw Thrust
- Kidney
- Laryngospasm
- Latex
LARYNGOSPASM

• Anesthetic agents
• Asthma history
• Irritable airway
• Smoking
• COPD
• Endotracheal tube usage

• Vocal cord irritation
  — Secretions
  — Blood
  — Vomitus
SIGNS & SYMPTOMS

- Dyspnea
- Hypoxia
- Hypoventilation
- Crowing Sounds
- Hypercarbia
INTERVENTIONS

• Hyperextend head
• Elevate Head of Bed
• Intubation
• Positive pressure ventilation

• Medications
  — Oxygen
  — Racemic Epinephrine
  — Decadron
  — Lidocaine
  — Atropine
  — Muscle Relaxants
Latex Allergy
Natural Rubber Latex

• Milky fluid derived from the rubber tree (Hevea Brasilinsis)

• Two methods of treatment prior to use
  – Coagulate to solidify
    • Dry natural rubber i.e. tires, shoe soles
  – Ammonionate to prevent coagulation
    • Gloves, condoms
  – Proteins can cause range of allergic reactions
Latex Allergy

- Latex allergy affects 18 million Americans
- 60 per 1000 in a 1996 estimate up from 1 per 1000 in 1980’s and continues to increase
- Increasing rates of sensitization
  - 18-73% sensitization rate in children with Spina Bifida
  - 33% sensitization rate in those having 3 or more surgeries
  - 15% sensitization rate in RN’s
Latex Allergy

• 17% sensitization rate in ALL health care workers

• Increased sensitivity in operating room personnel from 2.95% to 15% in less than 10 years

• Increased rates in dental personnel from 13.7% to 38% in 4 years
Suspected populations at risk

- Congenital neural tube disorders
- Urologic disorders requiring catheterizations
- 3 or more surgeries
- History of systemic reactions to balloons, latex gloves, condoms, cosmetics, rocket handlers, Poinsettias
Suspected populations at risk

• History of allergy to fruits with cross reactive proteins
  – Hay fever, asthma, contact dermatitis
  – Food allergies to:
    • bananas, avocados, tropical fruits, kiwis, chestnuts, potatoes, tomatoes, Celery, Hazelnuts, apples, pears, peaches, cherries, melons,
Onset & Symptoms Type I: Immediate Hypersensitivity

- Progresses in 15-20 minutes
- Resolves spontaneously over 1-2 hours
- Immediate, localized pruritus, stinging or discomfort over exposed area
- May progress to anaphylaxis
- Typically within 30 minutes after exposure
- Cutaneous, GI, CV, Respiratory
- Laryngeal edema and CV collapse most common cause of death
- Immunoglobulin & mediated systemic reaction to the latex proteins that if untreated lead to fatality
Onset & Symptoms Type IV: Delayed Hypersensitivity

• Contact Dermatitis
  – Appears in 18-24 hours
  – Resolves in 72-96 hours
  – Redness & inflammation over exposed sites
  – Blister formation

• Allergic Dermatitis
  – T-cell mediated delayed localized reaction to chemicals used in manufacture of gloves
Equipment Issues

- GLOVES
  - act as a vector for patient sensitization
  - Workers are at risk as a population from multiple exposures
  - 8-9 billion gloves sold per year in the United States
  - 5-6 million workers wear gloves regularly
Equipment Issues

• Latex gloves can cause contact allergic reactions
  – itching, hives, vesicles, erythema, and eczema
  – Usually a delayed hypersensitivity reaction
  – Workers may have concurrent chemical sensitivities to additives in latex
Environmental Issues

• Latex particles are suspended in indoor air in health care settings
• Powder in gloves is the vehicle for latex particle aerosolization
• Aeroallergens are higher in areas where workers frequently apply and discard gloves
• When latex particles are inhaled, workers become sensitized
M – N

- Myocardial Infarction
- Nausea and Vomiting
- Noncardiogenic Pulmonary Edema
ACUTE MYOCARDIAL INFARCTION

• Patients at risk
  – Pre-existing coronary artery disease
  – Diabetics
  – Obesity
  – Debilitated state
Risk Factors for CAD

• Non Modifiable
  • Sex
  • Age
  • Ethnicity
  • Genetics

• Modifiable
  • Diabetic
  • Hypertension
  • Smoking
  • Hyperlipidemia
  • Obesity
  • Sedentary Lifestyle
  • Stress
His “n” Hers Signs & Symptoms

- Pain: Substernal characterized by heavy, crushing or squeezing commonly occurring with exertion or emotion. Rest or NTG may relieve pain

- Pain: heaviness, squeezing, pain in left chest, neck, abdomen, midback or shoulder or arm pain without pain in the mid chest. Pain is accompanied by N&V, indigestion, dyspnea, fatigue, diaphoresis, dizziness, fainting, upper abdominal pain. May not respond to NTG or rest but Antacids may relieve pain
His “n” Hers Signs & Symptoms

• EKG: Concurrent ST segment elevation is common
• Exercise Stress test is “gold standard” in detecting MI Stress echocardiogram useful to text valves or ventricular function
• Cardiac Catheterization is a reliable diagnostic tool

• EKG: Concurrent ST elevation is less likely during MI
• Echocardiogram is more reliable than the exercise stress test
• Cardiac catheterization is reliable but more risky in the woman.
His “n” Hers Signs & Symptoms

• Man’s larger vessels allow better visualization & fewer complications during percutaneous coronary intervention or CABG

• Bleeding at the surgical site or hemorrhagic stroke is more likely with invasive procedures because of woman’s smaller vessels
NONCARDIOGENIC PULMONARY EDEMA

• Causes
  – Pulmonary aspiration
  – Allergic reactions
  – Upper airway obstruction
  – Rapid Naloxone administration
  – Sepsis
SIGNS & SYMPTOMS

• Tachypnea with respiratory distress
• Shortness of Breath
• Adventitious Breath Sounds
• Pink frothy sputum
• Pulmonary infiltrates
INTERVENTIONS

- Oxygen
- Pulmonary toilet
- Maintain unobstructed airway
- Diuretics
- Fluid restriction
- Morphine Sulfate
• Obstruction
  – Airway
  – Gastric
• Obstructive Sleep Apnea (OSA)
• Orthostatic hypotension
AIRWAY OBSTRUCTION

• Residual effects of medications
  – Anesthetic agents
  – Muscle relaxants
  – Analgesics

• Splinting
OBSTRUCTION SIGNS & SYMPTOMS

• Lethargy
• Confusion
• Restlessness
• Anxiety

• Cyanosis
• Decreased Pa02
• Increased PCO2
• Dysrhythmias
INTERVENTIONS

• Stir Up Regimen
• Ventilatory assistance
• Oxygen
• Elevating Head of Bed
• Reversal of sedatives, narcotics, muscle relaxants
Obstructive Sleep Apnea
Clinical Manifestations

• **Nighttime symptoms**
  – Heavy snoring
  – Restlessness
  – Diaphoresis
  – Nocturia
  – Dry mouth
  – Awakening with choking sensation
  – Nocturnal snorting
    » Gasping
    » Cessation of breathing

• **Daytime features**
  • Daytime somnolence
  • Morning headaches related to nocturnal CO2 retention
  • Impaired memory & concentration
  • Decreased dexterity
  • Cognitive difficulties associated with fatigue
  • Personality changes
    – Irritability, anxiety, depression, decreased libido
Clinical Consequences of OSA

• Cardiovascular Disorders
  – 50-60% of pts with sleep apnea are hypertensive
  – 50% pts with hypertension have sleep apnea
  – Cardiac dysrhythmias
• Pulmonary disorders
  – Enhanced asthma severity
• Endocrine dysfunction
  – Higher levels of Fasting blood glucose, insulin and glycosylated hgb independent of body wt.
• Depression
Considerations for Surgical patients with OSA

- Frequent monitoring of VS
- EKG
- Pulse oximetry monitoring
- Apnea monitor
- Supplemental oxygen
- Avoid supine position
- Use of nasal or face mask  CPAP
- Judicious use of opioids
- Analgesic supplementation with NSAIDs
• Pain Management
• Peripheral Circulation compromise
• Pneumothorax
• Pseudocholinesterase deficiency
• Positioning
Peripheral Circulation Compromise

• Causes:
  – Too tightly applied encircling bandage, splint or cast
  – Formation of thrombus or embolus
  – Symptoms: Color changes of extremity
    • Swelling
    • Diminished pulses
    • Delayed or absent capillary refill
    • Numbness, prickling sensation
Pseudocholinesterase Deficiency

• Atypical pseudocholinesterase unable to break down succinylcholine.

• Pseudocholinesterase breaks down Succinylcholine within 3-5 minutes normally.
Pseudocholinesterase Deficiency

- Affects 1 in 2500 - 2800
- Normal dibucaaine number is 60-100
- Atypical heterozygotic is 20 - 60
- Atypical homozygotic form is < 20
PROLONGED DURATION OF SUCCINYLCHOLINE

• Patients with liver disease
• Patients with severe anemia
• Patients with malnutrition
• Pregnant patients
• Dialysis patients
• Acidosis
SIGNS & SYMPTOMS

• Apnea
• Lack of muscle control - “Floppy fish”
INTERVENTIONS

• Ventilate until efficient respirations obtained
• Offer psychological support
• May need to administer sedative
• Educate family and patient of not receiving Succinylcholine in the future
• Laboratory studies may be indicated (Dibucaine levels)
POSITIONING

• SUPINE
  – Pressure points
  – Nerve Injuries
• LITHOTOMY
• SITTING
  – Postural Hypotension
  – Airway embolism
POSITIONING

• PRONE
  – Eye abrasion
  – Ear compression
  – Neck pain
  – Nerve injury
  – Joint damage

• LATERAL
Q – R - S

• Renarcotization
• Reparalysis
• Shivering
• Shock
• Sickle Cell Crisis
• Splinting
Shivering

• Heat production by muscular contractions

• Causes of:
  – Intraoperative hypothermia
  – General anesthesia
  – Regional anesthesia
Implications of Hypothermia & shivering

• Increased Oxygen consumption up to 400 - 500 %
• Cardiac dysrhythmias
• Decreased Level of Consciousness
• Decreased metabolism parenteral medications
• Delayed excretion sedatives, narcotics, muscle relaxants
SIGNS & SYMPTOMS

- Postoperative shivering
- Difficult to deliver care
- Interference with monitoring
- Increased risk of trauma
- Elicit marked increase in Cardiac Output and Minute Ventilation
- Tonic and clonic activity
INTERVENTIONS

- Supplemental Oxygen
- Maintain core temperature
- Warm ambient air
- Warm Intravenous fluids
- Warm irrigation fluids
- Passive assistance with radiant lighting
- Bair Hugger
- Blankets
- May try medications
- Body heat from another
SHOCK

- Hypovolemic
- Cardiogenic
- Distributive Maldistribution of Blood Volume
  - Anaphylactic
  - Neurogenic
  - Septic
HYPOVOLEMIC SHOCK

• Loss of blood plasma leading to decreased circulating blood volume and venous return, decreased cardiac output therefore inadequate tissue perfusion.

• Most Common type of shock
HYPOVOLEMIC SHOCK

• **SYMPTOMS**
  – Hypotension
  – Tachycardia
  – Cool clammy skin
  – Decreased CVP
  – Decreased Urine Output

• **CAUSES:**
  – Hemorrhage
  – Burns
  – Multiple Trauma
  – Severe Dehydration
  – Intestinal Obstruction
HYPOVOLEMIC SHOCK

• TREATMENT:
  – Correct Underlying problem
  – Volume replacement
  – Volume Expanders
  – *Treatment within first hour is associated with low mortality*
  – *Filling the vascular tank provides adequate CO and perfusion of tissues*
CARDIOGENIC SHOCK

• Inadequate cardiac pumping resulting in decreased Stroke Volume and Cardiac Output therefore inadequate tissue perfusion.

• SYMPTOMS
  – Hypotension
  – Bradycardia or Tachycardia
  – Increased Blood Pressure
CARDIOGENIC SHOCK CAUSES

- MI,
- Pulmonary embolism,
- Cardiac Contusion,
- Congestive Heart Failure,
- Tamponade,
- Dysrhythmias,
- Myocardial depression
CARDIOGENIC SHOCK TREATMENT

- Correct underlying problem
- Vasopressors
- Vasodilators
- Hemodynamic Monitoring
- Thrombolytic agents
- Corticosteroids
- IABP
ANAPHYLACTIC SHOCK

- Histamine released into the blood stream following allergic antigen-antibody reaction.
- See increased capillary permeability
- See Dilatation of arterioles & capillary beds.
- SYMPTOMS:
  - Bronchospasm    Hypotension
  - Dysrhythmias    Tachycardia
ANAPHYLACTIC SHOCK

• CAUSES:
  – Drug / Food allergy
  – Plant / insect sensitivity

• TREATMENT
  – Correct Underlying Cause
  – Sympathomimetics - Antihistamines
  – Bronchodilators - Oxygen
  – Adrenocortical Steroids
NEUROGENIC SHOCK

• Generalized vasodilation because of decreased vasomotor tone.
• Capacity of blood vessels increases.
• Get peripheral pooling resulting in diminished venous return and decreased cardiac output.
NEUROGENIC SHOCK

• SYMPTOMS:
  – Hypotension
    • Spinal Anesthesia
    • Spinal Cord Damage
  – Early Hypertension
  – Tachycardia early then bradycardia
NEUROGENIC SHOCK

• CAUSES:
  – Spinal Cord Injury or Anesthesia

• TREATMENT:
  – Correct Underlying Problem
  – Vasopressors
  – Volume
SEPTIC SHOCK

• Inadequate tissue perfusion usually follows endotoxemia or bacteremia with gram negative bacilli or gram positive cocci.

• SYMPTOMS:
  – High Fever – Marked vasodilation
  – Sludging of Blood
  – Hypotension – Tachycardia
SEPTIC SHOCK

• CAUSES:
  – Gram Negative Bacilli

• TREATMENT:
  – Correct Underlying Problem
  – Antibiotics - Diuretics
  – Beta Receptor Stimulants
  – Vasopressors - Vasodilators
SICKLE CELL ANEMIA

• Hereditary condition most commonly affecting 1% African-Americans, Caribbean.
• Persons lack normal Hb A and are homozygous for Hb S.
• Low oxygen tension, acidosis, & fever causes red cells to change shape to sicklelike form.
SICKLE CELL ANEMIA

• Sickle-shaped red cells get caught in capillaries causing stasis leading to thrombosis and ischemic necrosis.

• AVOID
  – HYPOXEMIA
  – HYPOTHERMIA
  – ACIDOSIS
SICKLE CELL ANEMIA

• CLINICAL SIGNS
  – Diffuse pain in stomach, legs, arms, joints
  – Bone pain
  – Ischemic necrosis of bone
  – Ischemia and infarction in lungs, liver, spleen, kidney, eyes and CNS
SICKLE CELL ANEMIA

• CLINICAL SIGNS
  – Cardiomegaly with systolic murmur
  – Scleral jaundice
  – Prone to infections

• SICKLE CELL TRAIT
  – Occurs in about 10% African-Americans
  – Asymptomatic- with normal life expectancy
T

• Toxicity of Local Anesthesia
  – Metallic Taste
  – Ringing in the ears
• TUR Syndrome (Hyponatremia)
  – Hysteroscopy
  – N&V
• Thermoregulation
• Thyroid concerns
HYPOTHERMIA

• Causes
  – Anesthesia
  – Surgery
  – Cold Operating Room
HYPOTHERMIA

- **Radiation** - Heat transfer between two surfaces of different temperatures
- **Convection** - Heat loss at a surface caused by fluid flowing across at a lower temperature
- **Conduction** - Heat transfer due to a temperature difference between two objects in contact
- **Evaporation** - Insensible water loss from skin, the respiratory tract, open incisions and wet drapes
POTENTIAL COMPLICATIONS

• Wound infection
• Cardiac disturbances
• Altered medication effect
• Coagulopathy
• Shivering
• Increased oxygen consumption
• Delayed emergency from anesthesia
INTERVENTIONS

• Forced air warming devices
• Warmed cotton blankets
• Thermal drapes
• Fluid warmers
• Heat-moisture exchangers
• Heated humidifiers
• Warm operating rooms
• Infrared lights
Malignant Hyperthermia

- Anesthesia catastrophic event
- Hypermetabolic syndrome
- Inherited disorder
- Affects Skeletal muscle
- Occurs in either sex
- Occurs in young adults and older children
Incidence

• Anesthetics administered
  – 1:15,000 in children
  – 1:20,000 to 1:50,000 in adults

• Many cases are undetected
  – Never anesthetized
  – Short anesthetic period
  – Pretreated with nontriggering agents
Normal Muscle Cells

- Calcium stored inside
- Muscle contracts
  - Calcium leaves
- Muscle relaxes
  - Calcium returns
- MH Trait

*How body stores calcium*
*How body releases calcium*
MH is Triggered By...

• Inhalation agents
  – Halothane
  – Enflurane
  – Isoflurane
  – Desflurane
  – Sevoflurane

• Depolarizing Muscle Relaxant
  – Succinylcholine
Safe Agents

- Barbiturates
- Propofol
- Local anesthetics
- Benzodiazepines
- Opioids
- Etomidate
- Ketamine
- Nitrous Oxide
- Nondepolarizing Muscle Relaxants
  - Pancuronium
  - Mivacurium
  - Atacurium
  - Doxacurium
  - Vecuronium
  - Pipecuronium
PRESENTING SIGNS

• Trismus,
• Masseter Muscle Rigidity,
• Tachycardia,
• Dysrhythmias,
• Body rigidity,
• Increased carbon dioxide in expired gas,
• Increased temperature
• Skin mottling
SIGNS & SYMPTOMS

• Hypercapnia,
• Metabolic and Respiratory acidosis,
• Hyperkalemia,
• Increased Creatine Kinase,
• Myoglobinuria
• Hypercalcemia
• DIC
Interventions in MH

• Prompt early recognition
• Stop triggering anesthetic
• Hyperventilate with 100% O₂
• Administer Dantrolene
• Institute Cooling measures
Dantrolene

- Fast acting Muscle Relaxant
- Contains 20 mg Dantrium + 3 Grams of mannitol
- Administer 2.5 - 10 mg/kg
- 36 vials Dantrolene should be available - crystalline powder
- Dilute with 60 cc sterile water without a bacteriostatic agent
Side Effects of Dantrolene

- Difficulty walking
- Fatigue
- Muscle weakness
- Dizziness
- Blurred vision
- Nausea
- Thrombophlebitis
Interventions

• Monitor acidosis with ABGs
• Monitor serum Potassium and Glucose
• Administer Insulin & Glucose (10 U regular insulin in 1 liter $D_{10}W$
• Treat dysrhythmias
• Hydrate aggressively - NACL
Interventions

• Cool patient
• Lavage stomach, bladder & rectum
• Lavage peritoneal cavity
• Extracorporeal cooling
• DC cooling when temp reaches 38°C
• Repeat Dantrolene every 4-6 hours up to 48 hours
• ICU monitor patient for 36 hours postop

• Follow CK for several days
EMERGENCY CART CONTENTS

- IV Solutions
- Sterile Water
- Foley Catheters
- ABG Syringes
- Blood/urine collection supplies
- Nasogastric tube
- Large plastic bag
- 60 cc Syringes
- Ice packs
- Dantrolene
- Sodium Bicarbonate
- Lidocaine
- Procainamide
- 50% Dextrose
- Insulin
- Diuretics:
  - Furosemide
  - 25% Mannitol
TEACHING

• Alert family to dangers of MH in other family members
• Prepare patient for potential occurrences in the future
• Register with North American MH registry
• consider Medic bracelet
• Always inform medical providers of having the MH trait
• Consider medic Alert bracelet
Diagnosis

• Muscle biopsy only method to determine if patient has trait
• Cost usually greater than $2500 which is covered by most insurances
• Must go to site that does biopsies - cannot send muscle
• Patient’s muscle exposed to caffeine halothane contracture test.
Testing Sites in USA

- Bethesda, MD
- Northwestern University in Chicago
- University of California, Los Angeles
- University of Minnesota
- Thomas Jefferson University in Philadelphia
- Rochester, Minnesota
- Sacramento, CA
- Winston Salem, NC
MH Treatment

• STOP surgery!
• Administer 100% Oxygen
• Administer Dantrolene every 4-6 hours up to 48 hours.
• Cool patient to 38°C
• Maintain fluid and electrolyte balance
• Monitor cardiac output
• ICU monitor for at least 36 hours postop
PACU CARE

• Continue cooling – ice packs, lavage, cooling blankets

• Maintain fluid and electrolyte balance
  – Monitor CVP or PAP
  – Treat Metabolic Acidosis – Bicarb per ABG
  – Monitor urine output
  – IV Fluids
  – Lasix and Mannitol
  – Glucose/Dextrose and Insulin for hyperkalemia (10 U Regular in 1 liter D$_{10}$W)
LABS to WATCH

• Electrolytes – expect hyperkalemia, hypercalcemia. Acidosis increases K+
• ABGs – expect elevated PaCO2, metabolic and resp acidosis
• Glucose
• CK level – elevated...peaks in 6 – 12 hours
• PT/PTT
• Myoglobin – blood and urine
Diagnosis

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TEACHING about MH

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Testing Sites in USA

- Thomas Jefferson University in Philadelphia
- Mayo clinic in Minnesota
- Northwestern University in Chicago
- Uniformed Services Univ of Health Sciences in Bethesda
- University of California, Davis
- University of California, Los Angeles
- University of Minnesota
Known MH-susceptible patients having surgery

• Anesthesia should:
  • Avoid the use of MH triggering anesthetics
  • Be familiar with the signs & symptoms of MH
  • Continuously monitor the patient’s CO2 concentration
  • Continuously monitor the patient’s temperature
  • Have an MH kit or cart readily available stocked with Dantrolene
MHAUS
Malignant Hyperthermia Association US
39 East State Street
Box 1069
Sherburne, NY 13815
607-674-7901
1-800-98 MHAUS
HOTLINE 1-800-MH HYPER
http://www.mhaus.org
# Hypothyroidism

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lethargy</td>
<td>Bradycardia</td>
</tr>
<tr>
<td>Fatigue</td>
<td>Decreased pulse pressure</td>
</tr>
<tr>
<td>Cold Intolerance</td>
<td>Nonpitting edema of subcutaneous tissues</td>
</tr>
<tr>
<td>Deep coarse voice</td>
<td>Decreased scalp and body hair</td>
</tr>
<tr>
<td>Weight gain with diminished appetite</td>
<td>Coarse, dry, cool skin</td>
</tr>
<tr>
<td>Paresthesias &amp; joint pain</td>
<td>Enlarged heart shadow on CXR</td>
</tr>
<tr>
<td>Constipation</td>
<td>Delayed relaxation of DTR</td>
</tr>
<tr>
<td>Muscle Cramps</td>
<td>Memory loss &amp; Hypothermia</td>
</tr>
</tbody>
</table>
Hyperthyroidism

**Symptoms**
- Weight loss
- Diarrhea
- Palpitations
- Heat intolerance
- Perspiration
- Nervousness
- Tremor
- Emotional Lability

**Signs**
- Tachydysrhythmias
- Widened Pulse Pressure
- Warm Smooth Skin
- Hyperdynamic precordial impulse
- Tremors
- Proximal muscle weakness
Postop Complications with Hyperthyroidism/Thyroid Storm

- **Presentation**
  - Sinus tachycardia
  - Hyperthermia
  - Tachydyssrhythmias

- **Therapy**
  - Beta Blockers
  - Acetaminophen
  - Propylthiouracil
  - Glucocorticoids
High Total Spinal

- **Nursing Interventions**
  - Immediate recognition
  - Intubate and ventilate
  - Increase intravenous fluids
  - Trendelenburg - constant monitoring
  - Emotional support
Toxicity of Local Anesthetic

• CNS
  – Tinnitus
  – Light headedness
  – Confusion
  – Circumoral numbness
  – Tonic-clonic convulsions
  – Generalized CNS depression
  – Unconsciousness
Toxicity of Local Anesthetic

• Cardiovascular
  – Hypertension
  – Tachycardia
  – Myocardial depression
  – Peripheral vasodilatation
  – Sinus bradycardia
  – Ventricular dysrhythmias
  – Circulatory collapse
Toxicity of Local Anesthetic

• **Treatment**
  – Postpone surgery
  – Maintain patent airway
  – Symptomatic treatment
  – Observe for delayed toxicity
  – Epinephrine reduces risk of toxicity
U - V

• Urinary Retention

• Voiding

• Vomiting
Urine Retention

• Absence of voiding for 1st 12 hours post op
• Bladder distention above symphysis pubis
• Complaints of discomfort & pain in bladder area
• Anxiety & restlessness

– Hypertension

• Help pt. ambulate ASAP
• Help into normal voiding position
• Prepare for catheterization
W – X – Y

• Waste Gases

• X-ray Exposure
Waste Gases

• N20 – No > 25 ppm

• Halogenated Hydrocarbons – No > 5 ppm
www.aspan.org

Exposing the Invisible Risk Video
Z  (Z END)

THANK YOU