Anesthesia and Your Patient: A Not Entirely Benign Procedure
There Are No Conflicts of Interests
At the end of this session the participant will be able to:

- Describe the history and indications for general anesthesia
- Discuss the patients that are at risk for complex airway management
- Identify the risk factors for a cardiac event during surgery
- Expound upon the complications of aspiration risk, malignant hyperthermia, cognitive dysfunction and prone positioning
History of Anesthesia

- Ether synthesized in 1540 by Cordus
- Ether used as anesthetic in 1842 by Dr. Crawford W. Long
- Ether publicized as anesthetic in 1846 by Dr. William Morton
- Chloroform used as anesthetic in 1853 by Dr. John Snow
Adjuncts

- Endotracheal tube discovered in 1878
- Local anesthesia with cocaine in 1885
- Thiopental first used in 1934
- Curare first used in 1942 - opened the “Age of Anesthesia”
Simpson and Queen Victoria
Definition of General Anesthesia

- Reversible, drug-induced loss of consciousness
  - Depresses the nervous system
- Anesthetic state
  - Collection of component changes in behavior or perception
    - Amnesia, immobility in response to stimulation, attenuation of autonomic responses to painful stimuli, analgesia, and unconsciousness
Principles of General Anesthesia

- Minimizing the potentially harmful direct and indirect effects of anesthetic agents and techniques
- Sustaining physiologic homeostasis during surgical procedures
- Improving post-operative outcomes
Principles of Anesthesia

- Anesthesia defined as the abolition of sensation
- Analgesia defined as the abolition of pain
- “Triad of General Anesthesia”
  - need for unconsciousness
  - need for analgesia
  - need for muscle relaxation
The Body and General Anesthesia

- Hemodynamic effects: decrease in systemic arterial blood pressure
- Respiratory effects: reduce or eliminate both ventilatory drive and reflexes maintaining the airway unblocked
- Hypothermia: body temperature < 36°C
- Nausea and Vomiting
  - Chemoreceptor trigger zone
- Emergence
  - Physiological changes
American Society of Anesthesiologists Score

- **ASA-1**: A completely healthy patient.
- **ASA-2**: A patient with mild systemic disease (1%)
- **ASA-3**: A patient with severe systemic disease that is not incapacitating (5%)
- **ASA-4**: A patient with incapacitating disease that is a constant threat to life (14%)
- **ASA-5**: A moribund patient who is not expected to live 24 hours with or without surgery (23%)
Dying During Anesthesia

- Child Birth: 5-10 /100,000
- Hysterectomy: 120-160/100,000
- Cholecystectomy: 500-1400/100,000

GETA: 10-20/100,000
Evaluation for Surgical Readiness

- It’s All About the “A”
  - Airway assessment
- History of difficult intubation
- Head and neck examination for airway evaluation
- Face
- Oral cavity: mouth opening
  - mandibular space
  - tongue
  - teeth
  - Mallampati classification
Predicting A Difficult Airway

- Difficult for the Bag Valve Mask
  - presence of a beard
  - BMI of > 26 kg/m²
  - history of snoring
  - endentulousness
  - >55 years old

With > 2 of these factors there will be significant difficulty to bag with a 75% sensitivity and specificity

Predictors of Difficult Intubation

The LEMON Law:

L = Look externally
- Short neck
- Full dentition
- Facial trauma
- Receding mandible

E = Evaluate the 3-3-2 rule

- The opening of the mouth should accommodate **3 fingers**

- The distance from the jaw to the hyoid should be **3 fingerbreaths**

- The distance from the floor of the mouth to the thyroid cartilage should be **2 fingerbreaths**
- O = Obstruction
  -- blood in airway
  -- expanding hematoma
  -- edema in the oral cavity
  -- foreign body
  -- laryngeal edema
- **N**: Neck mobility
  - in-line stabilization
  - collar intubations have > 5mm movement at c56
  - >75 years have 30% loss of neck excursion
Orotracheal Intubation

- Adult tube size ~ 6-8 mm
- Most adults tracheas are ~15 cm long and the tube usually extrudes 5-7 cm from the mouth ~21-23 cm at the teeth
- Blades: MacIntosh or Miller
- Suction
- High flow oxygen
Difficult intubation

- Mouth opening less than 3 cm.
- Limitation of neck movement
- Micrognatia
- Macroglossia
- Protrusion of teeth
- Short neck
- Morbid obesity
“There Must Be A Plan B”
Fiberoptic Intubation

- Oral or nasal routes
- Topicalization is key
  - Aerosolized lidocaine 4%
  - Airway blocks
- Thin bronchoscope inserted into trachea
Other airway options

- GlideScope
- Needle cricothyroidotomy
Cardiac Risk Stratification Proposals

- Goldman
- Detsky
- Eagle
- ASA
Revised Cardiac Risk Index

- High risk surgery
- History of ischemic heart disease
- History of CHF
- History of CVA
- Diabetes requiring insulin
- Cr > 2.0 mg/dl
Revised Cardiac Risk Index

Major Cardiac Complications*
(n=4315)

*Cardiac death, MI, pulmonary edema, arrhythmic arrest, heart block

Risk Factors

0.5 1.2
5 9.6
0 2 4 6 8 10
%
0 1 2 >2

*Cardiac death, MI, pulmonary edema, arrhythmic arrest, heart block
Preoperative Testing
Positive Predictive Value

Eagle et al. JACC 2001;27:910.
PROBLEMS WITH PREOP CORONARY INTERVENTIONS

No proven benefit

May not treat the "culprit"

Delays surgery versus higher coronary risk

PTCA: only few days but higher restenosis risk

Stent: two to six weeks (BMS)
BETA-BLOCKER Update

- Used to diminish ischemic heart events during surgery
- **2001 DECREASE Study** - good outcomes with the use of BB **BUT** all patients had CAD and undergoing high risk surgery
- **2008 POISE Trial** – a mixed population and found an increased incidence of hypotension and cerebral ischemia
Current AHA/ACC Guidelines:

- Initiate therapy for those with:
  1. Known CAD
  2. Abnormal stress studies
  3. High risk patients undergoing intermediate risk surgery
  4. Multiple risk factors undergoing CV procedures
  5. START BEFORE THE OR
Minor Clinical Predictors

- Advanced age
- Abnormal ECG
- Rhythm other than sinus
- History of CVA
- Uncontrolled HTN
Major Clinical Predictors

- Acute or recent MI (< one month)
- Unstable or severe angina
- Large ischemic burden (stress testing)
- Decompensated CHF
- Significant arrhythmias
Intermediate Clinical Predictors

- Remote MI ( >1 month)
- Stable angina
- Compensated CHF
- Creatinine ≥ 2.0
- Diabetes
Surgery Specific Risk
High (>5% Mortality)

- Emergent (esp. in the elderly)
- Aortic/heart
- Peripheral vascular
Surgery Specific Risk
Intermediate (1-5% Mortality)

- Intraperitoneal/intrathoracic
- Orthopedic
- Head & neck
- Carotid endarterectomy
Surgery Specific Risk
Low (<1% Mortality)

- Endoscopic
  (cholecystectomy, arthroplasty, urologic, etc.)
- Breast
- Skin
- Cataracts
Functional Capacity
Metabolic Equivalents (METs)

- **Low** (< 4 METs)
  - increased surgical risk
- **Intermediate** (4-10 METs)
- **Excellent** (> 10 METs)
Functional Capacity

Metabolic Equivalents (METs)

- **Low** (< 4 METs)
  - Increased surgical risk

- **Intermediate** (4 - 10 METs)
  - Climbing a flight of stairs
  - Level walking at 4 mph
  - Scrubbing floors
  - Moving heavy furniture
  - Golf

- **Excellent** (> 10 METs)
Functional Capacity
Metabolic Equivalents (METs)

- Low (< 4 METs)
  - increased surgical risk

- Intermediate (4 - 10 METs)

- Excellent (> 10 METs)
  - Swimming
  - Singles tennis
  - Basketball
Operative Risk Stratification

Surgical Urgency

Emergent OR

Operative Risk Stratification

1. **Surgical Urgency**
   - **urgent or elective**

2. **Prior (<5 years) revascularization**
   - **yes**
   - **no**

3. **Recurrent signs/symptoms**
   - **yes**
   - **no**

4. Further Risk Stratification
   - **yes**
   - **no**
Operative Risk Stratification

Clinical Predictors

- Major
- Intermediate
- Minor/none

Operative Risk Stratification

Clinical Predictors

Major

Intermediate

Minor/none

Postpone Surgery?

Medical Rx and Risk Factor Optimization

Coronary Angiography
Operative Risk Stratification

Clinical Predictors

- Major
- Intermediate
- Minor/none

Stress Testing

- < 4 METs
- > 4 METs

Surgical Procedural Risk

- High
- Intermediate or Low

OR
Operative Risk Stratification

Clinical Predictors

- Major
- Intermediate
- Minor/none

Surgical Procedural Risk

- < 4 METs
- > 4 METs

Intermediate or Low

OR
Operative Risk Stratification

Clinical Predictors

- Major
- Intermediate
- Minor/none

< 4 METs

Stress Testing

High

Surgical Procedural Risk
Risks of Aspiration

History

- **James Simpson** - First one to suggest aspiration as cause of death during anesthesia - 1932
- California obstetrician published report of 15 cases of aspiration in 1940
  
  5/15 patients died
- **Curtis Mendelson** described Mendelson Syndrome in 1946
Mendelson's Syndrome

- **Def:** bronchopulmonary reaction following aspiration of gastric contents during general anesthesia due to abolition of the laryngeal reflexes

- **Clinical features:**
  * General hypoxia, two to five hours after anaesthesia.
  * Pulmonary edema can cause sudden death or death may occur later from pulmonary complications.
RISK FACTORS

- Full stomach < 8 hrs fast
- Trauma/organ transplant/emergency surgery
- Pregnancy
- Obesity
- Ileus or intestinal obstruction or inflammation
- Gastric paresis: diabetes, uremia, infection
- Hiatus hernia, gastro esophageal reflux disease
- Patients on enteral feeding
- Uncertainty about intake of food or drink
- Patients undergoing laparoscopic procedures
- Difficult or failed intubation during induction of GETA
### PERCENTAGE OF POPULATION AT RISK FOR ASPIRATION

<table>
<thead>
<tr>
<th></th>
<th>pH &lt; 2.5 (%)</th>
<th>Volume &gt; 25 mL (%)</th>
<th>pH &lt; 2.5 and Volume &gt; 25 mL (%)</th>
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<tbody>
<tr>
<td>Pregnant</td>
<td>57-80</td>
<td>51-54</td>
<td>31-43</td>
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<tr>
<td>Nonpregnant</td>
<td>75-95</td>
<td>45-67</td>
<td>45-60</td>
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<tr>
<td>Postpartum</td>
<td>54-93</td>
<td>61</td>
<td>60</td>
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<tr>
<td>Children</td>
<td>93-100</td>
<td>64-78</td>
<td>64-77</td>
</tr>
<tr>
<td>Obese, nonpregnant</td>
<td>88</td>
<td>86</td>
<td>75</td>
</tr>
</tbody>
</table>
Relationship between weight and risk factors for pulmonary aspiration as reported in four studies (Amalraj S, personal communication)
REPORTED INCIDENCE

- 4.7 aspirations/10,000 anesthetics
- Incidence of 1 in 2131 in general population, 1 in 661 in patients undergoing cesarean delivery
- Most affected: obese and children
- 88% cases: one or more risk factors
- 43% emergency operation
- 16% upper abdominal or emergency abdominal surgery
- 61% History indicating delayed gastric emptying e.g., peptic ulcer/gastritis, pregnancy, obesity, unusual stress or pain, elevated ICP
ASA TASKFORCE GUIDELINES ON PREOPERATIVE FASTING

- Clear fluid (black coffee, water, carbonated beverages, clear tea): 4 hrs (3 hrs peds)
- Breast milk: 4 hrs
- Infant formula: 6 hrs
- Non-human milk: 6 hrs
- Light meal (toast and drink): 6 hrs
- Heavy meal (fried or fatty food or meat): 8 hrs
ANTACIDS

- Not recommended for routine prophylaxis
- Efficacious in raising gastric pH
- Not effective in reducing volume

Disadvantages: Unpleasant taste, emesis, variable duration of effect and decreased efficacy as compared to $\text{H}_2$ receptor antagonists
H₂ RECEPTOR ANTAGONISTS

- Not recommended for routine prophylaxis
- Efficacious in $\uparrow$ pH and $\downarrow$ volume
- Onset within 30 min following IV administration
- Maximal effect within 60-90 min
- Effective during emergence due to prolonged duration of action
PROTON PUMP INHIBITORS

- Not recommended for routine prophylaxis
- Inhibit H ion pump on gastric surface
- Efficacy probably similar to H₂ receptor antagonists

- Omeprazole: 20-40 mg PO
- Lansoprazole: 15-30 mg PO
- Esomeprazole: 20-40 mg PO
- Pantoprazole: 40 mg PO or IV
CRICOID PRESSURE

- Prevents regurgitation and prevents flow of gas to stomach
- First described by Sellick in 1961
- Bimanual cricoid pressure
  Locate cricoid cartilage before induction of anesthesia
- Should be applied continuously from time patient loses protective airway reflexes until ETT placement and cuff inflation
- Proper amount of cricoid pressure very uncomfortable in awake patients
History of MH

- 1961 Proband family identified in Australia
- 1971 First international symposium on MH; caffeine-halothane contracture test developed
- 1970s Relation of masseter muscle rigidity to MH realized
- 1975 Dantrolene treatment of MH
History of MH

- 1979 FDA approves dantrolene
- 1982 National society formed establishing the MH hotline
- 1980s End tidal CO2 identified as an early sign
- 1990s Ryanodine receptor identified
- 2000 Genetic testing
Characteristics of MH

- Sustained, significant hypermetabolism
- Inherited component; autosomal dominant
- Abnormal handling of intracellular calcium levels
- “Triggered” by pharmacologic agents
Triggering Agents for MH

- Trigger agents
  - Sevoflurane
  - Isoflurane
  - Desflurane
  - Succinylcholine
  - Halothane

- Non-trigger agents
  - Opioids
  - Non-depolarizing muscle relaxants
  - Ketamine
  - Propofol
  - Anxiolytics
  - Nitrous oxide
Current Concepts of MH

- Muscle rigidity may not be present
- Temperature increase is a late sign
- Increased end-tidal CO2 is an early sign
- MH may occur at any point during an anesthetic – even on emergence and in PACU
- May reoccur despite treatment
Signs of MH

- Specific
  - Muscle rigidity
  - Increased CO2 production
  - Rhabdomyolysis
  - Marked temperature elevation

- Non-specific
  - Tachycardia
  - Tachypnea
  - Acidosis
  - Hyperkalemia
Masseter Rigidity

- May occur after succinylcholine
- More common in children
- Precursor to MH in 20-50%
- Generalized rigidity not always present
- When present, generally associated with MH susceptibility
Diagnosis of MH

- Halothane/caffeine contracture test using muscle biopsy – the gold standard
  - $6,000 not covered by insurance
  - Must go to specialized centers

- Genetics looking for mutation of RYR-1 receptor – hits only 30% of MH positive so far
Incidence of MH

- One in 20,000 – 50,000 anesthetics, depending on drugs and location
- One in 2,000 – 3,000 based on genetic testing
Immediate Therapy of MH

- Discontinue triggering agents
- Hyperventilate with oxygen
- Get help
- Dantrolene 2.5 mg/kg Continue for 24-48 hours
- Cool patient PRN
- Do not give calcium channel blockers
- Labs as necessary for K+, myoglobin
- Supportive
Prevention of MH

- Get Hx of MH susceptibility, muscle diseases, family anesthesia problems
- CO2 and temperature monitoring during anesthesia
- Recognition of masseter rigidity
- Investigation of unexplained tachycardia, hypercarbia and hyperthermia
Prevention of MH

- Use succinylcholine only when indicated
- Avoid triggering agents in MH susceptible patients
- Have dantrolene available in any location using general anesthesia
Anesthesia for MH Proven

- Anxiolytic
- Propofol-narcotic induction
- Non-depolarizing muscle relaxant
- Maintenance with nitrous-narcotic-propofol-relaxant technique
- Reversal of muscle relaxant
- Observe for 4 hours
Complications of Prone Positioning

Goals:

- Optimal position: offers maximum anatomical access; yet is physiologically safe for the anesthetized patient.

- First article in literature on effects of body position on anesthesia published by Dutton in 1933.
General anesthesia abolishes normal protective reflexes → significant physiologic and functional hazards for the prone patient.

Peripheral nerve injury: 2nd most common anesthetic complication represented in the ASA Closed Claims Database.
Physiologic Effects

**Circulatory**

- ↑ intraabdominal & intrathoracic pressure → ↓ cardiac output, ↓ BP
- IVC obstruction → vertebral venous plexus engorgement → ↑ bleeding, ↑ risk of thrombosis
- Head low position: venous congestion of face and neck → facial, conjunctival and airway edema
- Head high position: risk of venous air embolism
Physiologic Effects

• Several studies to assess hemodynamic response to prone position
  - ↓ Stroke volume, ↓ Cardiac index
  - ↑ SVR, ↑ PVR
  - HR, PAOP, Right atrial pressure: no change
  - Recommend invasive hemodynamic monitors in patients with precarious cardiovascular status
Respiratory

- Cephalad shift of diaphragm, compression abdominal viscera → ↓ FRC, ↑ work of breathing, ↑ airway pressures
- Ventral supports: improved lung volumes, oxygenation, and compliance, esp in obese patients
- Ventilation and perfusion are more uniform in prone position → ↓ V/Q mismatch → Improved oxygenation
Establishing Prone Position

Figure 10–1

Classic prone position. A. Flat table with patient’s arms above head. Note cephalad end of chest roll just below clavicle with pillow across caudal end. Forearms are supported ventrad to transverse axis of thorax. Elbows and knees are padded; legs are flexed on thighs. B. Arms are snugged alongside torso. Head is turned on C-shaped face piece (see Fig. 10-16). C. Eventual flexed table top to minimize lumbar lordosis. Thrust of gluteal straps must be cephalad to retain torso against weight of lower extremities on tilted table.
Complications

Risk Factors

- Peripheral neuropathies
- Nerve entrapment syndromes e.g. carpal tunnel
- Diabetes mellitus
- Osteoarthritis, Rheumatoid arthritis
- Pre-existing decubiti
- Venous stasis
- Previous traumatic injury, fractures

- Advanced age
- Alcohol abuse
- Malnutrition
- Vitamin deficiencies
- Corticosteroid use
- Contractures
- Morbid obesity
- Hypothyroidism
- Renal disease
Complications

- **Airway**
  - Accidental extubation
  - Obstruction of ETT bloody secretions/sputum plugs
  - Facial, Airway edema
    - Prolonged head low position, ↑ crystalloid infusion
    - Problems with extubation
Injuries: Eye

- Corneal abrasions
- Orbital edema
- Postoperative visual loss (POVL)
  - Rare; unclear etiology
  - **ASA Closed Claims Project**: management of anesthesiologists frequently implicated
  - ASA Professional Liability Committee created the POVL Registry in 1999
POVL Registry

- Goal: Identify risk factors associated with POVL
- Retrospective analysis of patients who reported visual loss < 7 days postop

Distribution of cases from the ASA POVL Registry

- SPINE 72%
- CARDIAC 9%
- VASCULAR 5%
- ORTHO. 4%
- MISC. 10%
**POVL**

<table>
<thead>
<tr>
<th></th>
<th>Ischemic Optic Neuropathy (ION)</th>
<th>Central Retinal Artery Occlusion (CRAO)</th>
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<tbody>
<tr>
<td><strong>Etiology</strong></td>
<td>Intraop ↓ BP  Prolonged surgery  ↑ Blood loss  ↑ Crystalloid infusion</td>
<td>Direct external pressure  Emboli</td>
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<tr>
<td><strong>Mechanism</strong></td>
<td>Ischemia  Orbital edema → stretch and compression of ON</td>
<td>↓ Ocular perfusion pressure</td>
</tr>
<tr>
<td><strong>Clinical Features</strong></td>
<td>Painless  Bilateral  ↓ Light perception  ↓ Visual fields</td>
<td>Painless  Unilateral  Periorbital swelling or  ecchymosis</td>
</tr>
</tbody>
</table>
Injuries: Nerves

- **Mechanisms**
  - ↑ stretch, compression → ischemia
  - Occur despite adequate protection → other factors?

- **Prone patient**
  - Supraorbital, facial, mandibular nerves
  - Brachial plexus and its peripheral components
Injuries: Brachial Plexus

Sources of potential injury to the brachial plexus and its peripheral components in a pronated patient. Head position stretching plexus against anchors in shoulder (A). Closure of retroclavicular space by chest support with arms at side; neurovascular bundle trapped against first rib (B). Head of humerus thrust into neurovascular bundle if arm and axilla are not relaxed (C). Compression of ulnar nerve in cubital tunnel (D). Area of vulnerability of radial nerve to compression above elbow (E).
Complications

- **Other**
  - Compartment syndrome, Rhabdomyolysis
  - Venous air embolism
  - Visceral ischemia: pancreatitis
  - Undiagnosed space occupying lesions
Support Devices – Head & Neck

- Surgical pillow/foam donut, C-shaped face piece, horseshoe head rest, Prone Positioner, Prone View Helmet.

- Mayfield tongs: most stable; recommended in cervical disc disease
Support Devices - Ventral

- Rolls of tightly packed sheets, bean bags, convex frames (e.g. Wilson frame), pedestal frames (e.g. Relton), special OR tables (e.g. Jackson)

- Jackson spine table: minimal effects on cardiac function
Novel Regional Anesthetics in the Post-Operative Patient

Benefits

- Decreased narcotic requirements and associated adverse (N/V, sedation, confusion, pruritis, respiratory depression)
- Earlier recovery of bowel function
- Improved tolerance of ambulation and ADLs
- Improved pain scores
- Increased patient satisfaction
Complications of Regional Anesthesia

- **Bleeding**
  - Epidural hematoma
  - Local hematoma

- **Infection**
  - Epidural abscess
  - Local infection

- **Nerve injury**

- **Post dural puncture headache (PDPH)**

- **Local anesthetic toxicity**
Paravertebral Block

- A somatic block of the mixed nerve soon after exiting the intervertebral foramina

- Allows profound anesthesia/analgesia without the associated effects of central or neuraxial anesthesia
- Anatomy
- Nerve stimulator
- Ultrasound guided
- Incremental injection
Paravertebral Block With Ropivacaine 0.5% Versus Systemic Analgesia for Pain Relief After Mastectomy

Marret E, Ann Surg 2010;79:2109 –14
**TAP Block**

- Used for post-operative analgesia for lower abdominal surgery (e.g. inguinal hernia, abdominal hysterectomy, Caesarean section)

- Midline incisions require bilateral injections

- Serious complications are extremely rare, and this block can be safely performed in an anesthetized patient
Local Anesthetic Systemic Toxicity (LAST)

- **Neurologic**
  - Signs/Symptoms
    - Lightheadedness
    - Peri-oral numbness
    - Tinnitus
    - Seizures

- **Cardiovascular**
  - EKG findings
    - Atrio-ventricular conductional blockade
      - 1\textsuperscript{st} degree, 2\textsuperscript{nd} degree, or complete (3\textsuperscript{rd} degree)
    - Ventricular fibrillation
    - Ventricular tachycardia
Treatment of LAST

• **Supportive therapies**
  - ACLS/Maintain oxygenation and ventilation
  - Treat seizures
  - Treat arrhythmias
    - Epi, atropine, vasopressin, amiodarone
    - DO NOT USE LIDOCAINE
    - Low dose epi may be better
    - Defibrillation

• **Specific therapy**
  - 20% Intralipid
    - 1cc/kg bolus
    - 0.5cc/kg/min infusion
    - Creates a “sink” that LA can be sequestered into
Nursing Care/Assessment

- Perform sensory/motor/VAS assessment
- Inspect site for bleeding/leaking/dressing integrity
- Ensure catheters are free when moving
- Assess for side effects
- Protect insensate areas
- Monitor for signs of LAST
- Ensure adjunct medications are ordered when appropriate
Anesthesia and Cognitive Dysfunction

- First identified in 1955
- Post-operative Cognitive Dysfunction (POCD)
  * Excessively tired
  * Inability to concentrate
  * Memory dysfunction
  * Decreased ability to do math and problem solve

(no former dementia identified, no EtOH)
<table>
<thead>
<tr>
<th>Age/Surgery</th>
<th>After 1 Week</th>
<th>After 3 Months</th>
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<tbody>
<tr>
<td>18-39/major</td>
<td>Up 36%</td>
<td>6%</td>
</tr>
<tr>
<td>40-59/major</td>
<td>5-30%</td>
<td>5-8%</td>
</tr>
<tr>
<td>60+/major</td>
<td>4-42%</td>
<td>7-13%</td>
</tr>
<tr>
<td>60+/minor</td>
<td>7-9%</td>
<td>6-7%</td>
</tr>
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</table>
POCD

- Issue...Is it the surgery-the anesthesia...or both???

- **What we Know**
  1. Greater with major surgery
  2. Equivalent with GETA and regional
  3. Greater with heart disease
  4. Greater with EtOH abuse
  5. Greater in those with less education
  6. Greater with baseline cog dysfunction
  7. Greater with hx of CVA
POCD

- If present at age 65 ~10% will never recover

 Causes:

1. Drug residual (anti-cholinergic)
2. Hyperventilation induces prefrontal dysfunction
3. Metabolic response to “injury”
4. PTSD
5. Pre-existing mental decline not apparent and now exacerbated
POCD- Diagnosis and Treatment

- Usually not formally identified until patient is home
- TAKE IT SERIOUSLY
- < 1 week manage the symptoms
- > 1 week imaging and neuropsych testing
- Supportive interventions