PREOP EVALUATION AND OPTIMIZATION

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Disclosure of Potential Financial Conflicts of Interest

None
Agenda

What is a Preoperative Evaluation
Risk Assessment
Co-morbid conditions
What tests should be ordered
What meds should be continued
Summary
The preoperative evaluation is not simply clearing the patient for surgery.

“Avoid hypotension, tachycardia”
“General anesthesia contraindicated”
“Continue current medications”
An preoperative evaluation is a collaborative, multidisciplinary process.

Not a substitute for preventive services, but an opportunity to address preventive services.
What is the goal of the Preoperative Evaluation?

Prevent anesthesia from cancelling cases on the day of surgery.
What is the goal of a Preoperative evaluation?

The patient maximally benefits from our care

Perioperatively
Postoperatively
Longitudinally

Safe, efficient, humane, and cost-effective
Financial implications will become increasingly important.

https://www.cms.gov/hospitalacqcond/06_hospital-acquired_conditions.asp
https://www.aamc.org/advocacy/medicare/153882/selected_medicare_hospital_quality_provisions_under_the_aca.html
Starting the preoperative assessment in anesthesia clinic is too late
High risk patients should be evaluated prior to the day of surgery

**Cardiac**
- Unstable coronary syndromes
- Decompensated CHF
- Significant arrhythmias
- Severe valvular disease
- Poorly controlled HTN
- Congenital heart abnormalities

**Respiratory**
- COPD requiring O2
- Dyspnea at rest
- Asthma ?
- CF
- Airway tumor / obstruction

**Endocrine**
- Diabetes
- Adrenal disorders
- Active thyroid disease
- Malnutrition
- Obesity >140% IBW

**Anemia**

**Renal**
- Insufficiency
- Failure

**Neuromuscular**
- Seizures
- Other CNS disease
- Myopathy or other muscle disorders

**Hepatobiliary disease**

**Musculoskeletal**
- Kyphosis / scoliosis
- TMJ
- Cervical / thoracic spine injury

**Cancer / chemotherapy**

**GI**
- Reflux
- Hiatal hernia

**Shock**

**Sepsis**

Transfusion Med. 2010;11(3):22-29

Circulation 2007, 116:e418-e500
J Tinker, 2006
BUSH'S STAR-CROSSED TRIP

Why Are Men and Women Different?
It isn't just upbringing. New studies show they are born that way.
## Table 6. Physiological Differences Between Genders

### Body composition
- More muscle mass
- More bone mass
- Lower body fat percentage

### Pulmonary physiology
- Males have
  - Larger lungs
  - Wider airways
  - Greater lung diffusion capacity

### Neurocognitive function
- Males have
  - Lesser stress glucocorticoid response
  - Different pain threshold and cognitive style
  - Different level sex steroid receptors in the autonomic control regions

### Cardiovascular physiology
- Males have
  - Greater LV mass and size
  - Same EF as females—hence females have a smaller stroke volume
- Women have
  - Lower resting BP
  - Higher heart rate
  - Reduced tolerance to orthostatic stress
  - Impaired venous return
  - Prolonged Q-T interval

### Renal physiology
- Men have
  - 15% more creatinine clearance
  - 25% more GFR

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Consequence of effects of gonadal hormones on skeletal muscles  

Limited exercise capacity in females with aging  

Differences result from fetal exposure to steroid hormones and receptors for steroid hormones in multiple parts of brain  

1. Differences in HR and QT interval manifest after adolescence.  
2. BP lower in than men in premenopausal women.  
3. BP rises to levels equalants of men in postmenopausal women.  
4. Increased PP, reduced LV volume, and stiffness  

Lack of correction of reduced GFR and creatinine clearance during drug dosing can lead to toxic drug levels
A Woman’s Heart is different

Lower resting BP, higher resting HR, smaller SV, lower CO
- Reduced tolerance to orthostatic stress and impaired VR
- BP gradually rises after menopause to levels equivalent to men.

Q-T interval is longer in women
- Increased incidence of drug-induced torsades de pointes

CAD, not cancer, is leading cause of death in women
- CAD occurs a decade later and increases after menopause
- Normal EF less reassuring due to increased diastolic dysfunction

Only 1/3 of women have “classic” MI symptoms.
- Women commonly have fatigue, SOB, lack of energy

Coronary vasospasm and microvascular changes
- May explain false negative heart studies – risk factors more important
  - Wide QRS, > age 55, Cig, HTN, low HDL, +FHx, DM, CRI, PVD
Surgery and cardiac risk

10 - 40% postop mortality due to MI
Intraperitoneal surgery intermediate risk (1-5%)

Generalized inflammatory response
  C-reactive protein, IL6, and TNFα.
  Can lead to hypercoagulability, coronary lumina narrowing, plaque rupture

Laparoscopic procedures
  Cause minimal incisional tissue damage
  Pneumoperitoneum reduces VR and CO, increases SVR
  Increases risk of thrombus formation and growth.

In the absence of active cardiac conditions, cardiovascular testing in stable patients rarely results in a change in management
# Estimating Cardiac Risk

## Revised Cardiac Risk Index
- Ischemic heart disease
- CHF
- Cerebrovascular disease
- High risk surgery
- Insulin requiring DM
- Preop creatinine > 2 mg/dL

>3 risk factors – 11% risk

## NSQIP Predictors
- Age > 68yrs
- Active CHF
- BMI > 30 kg/m2
- Emergency surgery
- Previous cardiac intervention
- Cerebrovascular disease
- Hypertension
- Operative duration > 3.8 hrs
- One or more units of PRBCs

3+ risk factors – 17% risk

*Circulation* 2007, 116:e418-e500
*Anesthesiology* 2009; 110:58 – 66
Poor exercise tolerance is an independent predictor of serious postop complications

Table 3. Estimated Energy Requirements for Various Activities

<table>
<thead>
<tr>
<th>1 MET</th>
<th>Can you ...</th>
<th>4 METs</th>
<th>Can you ...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Take care of yourself?</td>
<td>Climb a flight of stairs or walk up a hill?</td>
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<td></td>
<td>Eat, dress, or use the toilet?</td>
<td>Walk on level ground at 4 mph (6.4 kph)?</td>
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<td>Walk indoors around the house?</td>
<td>Run a short distance?</td>
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<tr>
<td></td>
<td>Walk a block or 2 on level ground at 2 to 3 mph (3.2 to 4.8 kph)?</td>
<td>Do heavy work around the house like scrubbing floors or lifting or moving heavy furniture?</td>
<td></td>
</tr>
<tr>
<td>4 METs</td>
<td>Do light work around the house like dusting or washing dishes?</td>
<td>Participate in moderate recreational activities like golf, bowling, dancing, doubles tennis, or throwing a baseball or football?</td>
<td></td>
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<tr>
<td></td>
<td>Greater than 10 METs</td>
<td>Participate in strenuous sports like swimming, singles tennis, football, basketball, or skiing?</td>
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</tbody>
</table>

kph indicates kilometers per hour; MET, metabolic equivalent; and mph, miles per hour.
ACC/AHA 2007 Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery

Step 1
Need for emergency noncardiac surgery?
- Yes (Class I, LOE C) → Operating room → Perioperative surveillance and postoperative risk stratification and risk factor management
- No

Step 2
Active cardiac conditions*
- Yes (Class I, LOE B) → Evaluate and treat per ACC/AHA guidelines → Consider operating room
- No

Step 3
Low risk surgery
- Yes (Class I, LOE B) → Proceed with planned surgery†
- No

Step 4
Functional capacity greater than or equal to 4 METs without symptoms‡
- Yes (Class II a, LOE B) → Proceed with planned surgery§
- No
Pregnancy – “stress test for life”

PIH
   Increased risk of later HTN, CVA

Preeclampsia/eclampsia
   2x risk of subsequent CAD
   Increased risk of cerebro- & peripheral vascular disease
   “Dose response”
   Dysmetabolic syndrome with insulin resistance common
   Increased risk of microalbuminuria
      Early sign of renal disease
      Associated with ischemic heart disease and atherosclerosis

Poorly controlled HTN -- one of the most common reasons for delaying elective surgery

1/3 of US population
25% undiagnosed

“Unique opportunity” to diagnose HTN

- DBP DOS > 92 or
- SBP preop >140 + DOS >146
  96% specificity for HTN

Stage 3 (Severe) HTN

- SBP > 180 or DBP > 110

Increased risk if end organ changes
- LVH with strain
- Renal insufficiency
- Headache

Consider delay to determine cause and optimize meds.
- Decreased risk takes weeks for regression of vascular changes
- Lowering BP too much or too quickly may cause ischemia.

[http://circ.ahajournals.org/content/early/2007/04/19/CIRCULATIONAHA.106.183095.citation](http://circ.ahajournals.org/content/early/2007/04/19/CIRCULATIONAHA.106.183095.citation), Anesth. Analg. 2012;114:205-214]
Diabetes Mellitus

10% of US population

Hyperglycemia
  Increased mortality, length of stay, infection, subsequent nursing home care

End-organ damage
  More important indicator of perioperative outcome than the diabetes itself
  Men 4x and Women 5x higher rate of CAD than non-diabetics

Gestational Diabetes
  Chronic b-cell defect present before and after pregnancy
    Diagnosis includes some women with preexisting glucose intolerance
  35-60% develop Type II diabetes within 10 years of pregnancy
  2x risk of cardiovascular events later in life if BMI > 25

Diabetes Mellitus

Goals

Avoid significant variability, hypoglycemia, or hyperglycemia > 180 mg/dL

NICE-SUGAR – too aggressive control may increase morbidity / mortality

Identify undiagnosed DM (Fasting BG > 140 mg/dl, HbgA1C > 6.5%)

Schedule as first case in AM if possible to minimize NPO and insulin issues.

Optimum glucose levels in GDM unclear

Fasting < 96 mg/dL, Postprandial < 140 mg/dL?

Peacehealth criteria for postponing elective surgery:

<table>
<thead>
<tr>
<th>Absolute</th>
<th>Relative</th>
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<tbody>
<tr>
<td>Severe Dehydration</td>
<td>Poor control</td>
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<tr>
<td>Ketoacidosis</td>
<td>HbgA1C &gt; 7 or 8%</td>
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<tr>
<td>Hyperosmolar nonketotic state</td>
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<tr>
<td>HbgA1C &gt; 9%</td>
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</tbody>
</table>

Obesity

34% of US adults obese
67% of US adults overweight

Co-Morbidities
- OSA and hypoventilation syndrome
- Pulmonary dysfunction
- HTN
- Pulmonary HTN
  - 7-10% risk of postop mortality
- Diastolic dysfunction
- Metabolic syndrome

Increased risk of perioperative complications
4x risk of airway problems

4th National Audit Project, Royal College of Anaesthetists, 2011  J Trauma 2005; 59:1048-1051  National Kaiser Joint Replacement Registry
Obstructive Sleep Apnea

AHI > 5
- 2 x postop complication rate

Pregnancy
- Upper airway narrowing increases risk or worsens existing OSA
- OSA increases risk of LBW, preterm, and SGA infants, CSection, 
  low Apgar scores, and preeclampsia
- Unclear whether treatment with CPAP decreases risk
- Screening less useful during pregnancy
  - BMI, snoring, apnea indications for formal testing

STOP-BANG (Chung 2008)

<table>
<thead>
<tr>
<th>1. Snoring</th>
<th>5. BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you snore loudly (louder than talking or loud enough to be heard through closed doors)?</td>
<td>BMI more than 35 kg/m2?</td>
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</table>

<table>
<thead>
<tr>
<th>2. Tired</th>
<th>6. Age over 50 yr old?</th>
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<tbody>
<tr>
<td>Do you often feel tired, fatigued, or sleepy during daytime?</td>
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<th>3. Observed</th>
<th>7. Neck circumference greater than 40 cm?</th>
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<tr>
<td>Has anyone observed you stop breathing during your sleep?</td>
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<tbody>
<tr>
<td>Do you have or are you being treated for high blood pressure?</td>
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</tbody>
</table>

Preop anemia > 29% associated with increased risk of 30-day morbidity / mortality

NSQIP study of major non-cardiac surgery in 227,000 patients

Mortality 5-14x risk

Morbidity 3-7x risk
Heart, respiratory, CNS, renal, wound, sepsis, DVT/PE

Perioperative transfusion
  Increased morbidity and mortality, even with one unit PRBC

“In elective surgical cases, the treatment of preoperative anaemia before surgical intervention should be strongly considered”

Lancet 2011:378;1396-407
Renal Insufficiency

Perioperative issues
- Metabolic acidosis
- Volume overload
- Electrolyte disturbances
- Altered anesthetic drug effects

Creatinine level $> 2$ mg/dL
- Risk factor for postop cardiac complications and renal dysfunction

Dialysis within 24 hours but not immediately before surgery

$K < 6$ mEq/dL OK if within patient’s usual range.

_Circulation_ 2007, 116:e418-e500
B Sweitzer, 2012
Pulmonary disease more likely than cardiac issues to predict postop long-term mortality

Preop pulmonary function test (PFT)
   Helpful for diagnosis and guiding treatment
   Value before extra-thoracic surgery unclear

Preop CXR
   Impacts care 0.1-3%

Preop steroids and bronchodilators
   Lower risk of bronchospasm with intubation
   May shorten hospital and ICU stay.

Smoking cessation
   Unclear if beneficial within 2 months of surgery
   Important for longitudinal health

Anesthetic and surgical technique
   Epidural analgesia and short acting neuromuscular blockers beneficial
   No clear benefit with particular anesthetic type or surgical technique

Ann Intern Med. 2006;144:575-580
Liver blood flow is decreased in surgery

AST and ALT
Indicators of liver injury not function
Cancel elective surgery if acute hepatitis

“True” liver function tests
Albumin, bilirubin, PT, platelet count

In chronic liver disease, function predicts outcome

Child-Pugh score
Bilirubin, albumin, INR, ascites, and encephalopathy

MELD Model for End-Stage Liver Disease
Creatinine, bilirubin, INR

Periop renal insufficiency
Most ominous complication

Pregnancy screening

0.3-2.2% of child bearing age women presenting for surgery may have an unrecognized pregnancy.

It is possible, though controversial, that anesthesia and surgery during pregnancy can result in fetal complications.

- Preferable for women to avoid elective procedures while pregnant.
- Postpone non-elective surgery until 2nd trimester when possible.
- OB should be involved in perioperative decisions, monitoring, etc.

ASA does not require testing, but ACR does if the radiologic procedure will expose a fetus to high doses.

MRSA

Increases mortality, treatment failure, length of stay, costs

65% of post-sternotomy mediastinitis.

Preop nasal MRSA carriage increases risk of postop infection
Boston VA study of 4200 patients
6.6% had positive nasal swabs
12% positive preop had positive clinical cultures postop vs 0.75% negative preop
Despite chlorhexidine scrub or vancomycin

Screen high risk patients before elective surgery to enable decolonization

Swabbing multiple sites increases sensitivity

“Bundled Approach” may prove most effective

Screening
Chlorhexidine shower and scrub
Staff screening and decolonization

Intranasal mupirocin for ? all patients
Vancomycin prophylaxis for ? all patients
Mupirocin to chest tube sites on removal
Periodontal Disease

6 billion microbes in human mouth

Normal daily activities may result in bacteremia 90 hours a month

Periodontal disease increases incidence & magnitude of bacteremia

Predominant oral microbes causing endocarditis and septic prosthetic joints are viridans (α- hemolytic) streptococci

Consider dental consult to address poor oral hygiene before elective surgery that involves fusion or implantation

Treatment of inflammatory periodontal disease requires 4 to 6 weeks

What preop tests are required?

Laboratory & diagnostic tests including EKG are **NOT** necessary for low risk procedures unless a specific indication is present.

Will the test result impact care?

False positives and false negatives may result in wrong conclusions and/or further testing.

Controversy if age should be a criteria for lab testing. Risk factor for abnormal EKG is age > 65.

**History of increased DOE, new onset chest pain, or syncope more important than ECGs or blood tests.**
## Peacehealth Preop Testing Guidelines

<table>
<thead>
<tr>
<th>Condition</th>
<th>Hemogram</th>
<th>Basic panel</th>
<th>Comp panel</th>
<th>ECG</th>
<th>XRay</th>
<th>TSH FT4</th>
<th>Ion. Ca</th>
<th>PT/PTT</th>
<th>Urine HCG</th>
<th>CBG HgA1C</th>
<th>T/S T/X</th>
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<tr>
<td>Age &gt; 65</td>
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<td>Hepatitis B/C or Cirrhosis</td>
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<td>Rheumatoid Arthritis³</td>
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<td>Active Parathyroid</td>
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<td>Current Chemotherapy</td>
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<td>Signif. blood loss Possible⁴</td>
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<td>Probable ⁵ or signif. Preop anemia</td>
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<td>Signif. Chronic Disease</td>
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Medications

Diabetes
  Hold oral agents, give insulin day of surgery

Beta Blockers
  Continue for patients already on them
  Start preop for vascular surgery patients with positive stress test

Coumadin
  Bridge patients at thromboembolic risk
    Afib, mechanical valve, within 3 mo of bio-prosthetic valve, mitral repair, VTE

NSAIDs
  Hold ibuprofen 3 days prior to surgery, longer acting NSAIDs 10 days prior

Statins
  Acute cessation can cause rebound increase in platelet aggregability

ACE-I and ARBs
  Hold day of surgery unless for CHF

Herbals
  Hold week prior to surgery
Hormone replacement

No compelling evidence that OC or HRT needs to be discontinued for elective surgery.

OC and HRT are relatively weak risk factors for DVT compared with the risk associated with surgery alone.

Any possible additive effect is unlikely to be important in terms of the overall DVT risk.

With prior VTE, or anticipated prolonged postop immobility, appropriate management may include temporarily discontinuing the OC or HRT.

Aspirin is lifelong therapy which should never be discontinued after a coronary or cerebrovascular event.

- Decreases repeat MI rate by 30% and subsequent stroke by 25%.
- 2-3 x increase risk of cardiac complications with withdrawal
- In patients with stents, aspirin must never be stopped

2-20% increased bleeding but no differences in hemorrhage related complications or outcome in most procedures, except:

- Tonsillectomy
- THR
- TURP (KTP laser may decrease bleeding risk)
- Intracranial neurosurgery

Br J Anaesth 2007; 99:316-28
Antiplatelet Recommendations

Patients with aspirin (75–150 mg day$^{-1}$)

- Primary prevention
  - Intracranial neurosurgery
    - Stop 7 days before operation as needed

- Secondary prevention after MI, ACS, stent, stroke, PAD
  - All surgery

Patients with aspirin (75–150 mg day$^{-1}$) + clopidogrel (75 mg day$^{-1}$)

- High-risk situations: <6 weeks after MI, PCI, BMS, stroke <12 months after DES High-risk stents*
  - Only vital surgery
    - Risk of bleeding in closed space***

- Low-risk situations**
  - All surgery
    - Stop clopidogrel Maintain aspirin

Operation under continuous treatment
Summary

Goal of the preoperative evaluation
Minimize risk and maximize benefit to the patient.

The evaluation
Multidisciplinary, collaborative process
Should start BEFORE sending patient to anesthesia

Testing and consultation
Not necessary unless result will impact perioperative or longitudinal care.
Screening for diabetes cost effective
Involve PCP and cardiology in the process

Assessment and optimization of co-morbid conditions
Necessary to decrease perioperative risk
Delay elective surgery for unstable or unaddressed significant co-morbidities

The perioperative period is an opportunity to impact longitudinal health