Updates in Preoperative Evaluation and Perioperative Care

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Disclosures

• No financial relationships with commercial interests within the past year
• No discussion of investigational or 'off label' use of medications or products

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Outline and Scope

• Scope:
  • Non-cardiac, elective procedures
• We will review:
  • Guidelines for testing
  • Updates over the last two years
  • Issues for selected populations (women, geriatrics) in perioperative care
• Methodology:
  • Case based learning
  • We will take several pauses in order to help improve information retention

Take Home Points

1. Routine preoperative testing is usually NOT indicated
2. NO preoperative testing is indicated for cataract surgery
3. Surgical risk evaluation involves using RCR/NSQIP and functional status
4. For patients on warfarin, bridging anticoagulation is indicated ONLY for patients with high risk of thromboembolic event
5. Probably safe to HOLD aspirin in the perioperative setting unless the patient has a recent coronary stent
6. Screen for Obstructive Sleep Apnea (OSA) and treat if indicated
Summary of Recommendations

**DO:**
- Evaluate Surgical Risk
- Evaluate Functional Status
- Review medications
- Continue Statin, Beta-Blocker
- Screen for Sleep Apnea

**DON'T:**
- Routinely obtain testing in low risk patients
- Routinely obtain chest x-ray, ECG, echocardiogram, or PFTs
- Bridge anticoagulation except in patients with high risk of thromboembolic event
- Start beta-blocker unless medically indicated

Sources of Recommendations

- American College of Physicians
- American College of Surgeons
- American Society of Anesthesiologists
- NEJM Review Article 2015
- ACOG Guidelines
- AHA/ACC 2014
- US Preventative Services Task Force
- University of Washington Medicine Consult Service

Some of these sources do not entirely agree

Goals of Perioperative Management

- Evaluate risk of procedure to allow patient, primary care physician, surgeon, and anesthesiologist to make informed decisions regarding surgical management
- Optimize medical conditions
- Minimize unnecessary testing
- Minimize complications

Prevalence, Cost, and Risk of Preoperative Testing

- ~30 million people undergo surgery per year in the United States, most are ambulatory
- ~18% of patients undergoing cataract surgery had a preoperative consultation
- ~ 50% of perioperative consultants recommended an unnecessary test
- Preoperative testing is estimated to cost $18 Billion annually in the U.S.

**Risks:** unnecessary delay in procedure, unnecessary testing and harm from investigating results, unnecessary cost to patient

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Case 1: Mrs. Marte

Mrs. Marte is seeing you in clinic prior to left eye cataract surgery. Her ophthalmologist has contacted you and has asked you to determine what testing and management is needed prior to her procedure.

Mrs. Marte is a 68 year old woman with a history of:
- heart failure with reduced ejection fraction (EF 45%) (Rx: furosemide, metoprolol, lisinopril)
- diabetes (HgbA1c 7.5%) (Rx: metformin)
- mild COPD (FEV1/FVC 0.65, FEV1 85% pred, current non smoker) (Rx: albuterol)
- and atrial fibrillation (Rx: metoprolol, apixaban)

What pre-operative evaluation should you perform?
- History & Physical exam:
  - No recent chest pain
  - No murmurs or wheezes on exam
  - No evidence for volume overload
  - Normal creatinine 3 months ago
- Functional Status
  - She can walk up 3 flights of stairs without difficulty
Case 1: Mrs. Marte, continued

- Pre-operative evaluation:
  - Chest xray?
  - ECG?
  - Labs?

  **NO** additional testing is indicated

- Medication Management:
  - Continue apixaban: for procedures with low risk of bleeding (i.e. cataract), interruption of anticoagulation is usually **NOT** necessary. However, consulting with surgeon and anticoagulation clinic and adhering to your local practice is always advisable
  - Continue lisinopril, furosemide, metoprolol
  - Hold metformin (NPO)

Case 1: Take Home:

- For cataract surgery preoperative testing has **NOT** been shown to affect outcomes. Rates of adverse events in patients were similar (~3%) whether or not they underwent testing (American Academy of Ophthalmology Guideline 2014).

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Determined Surgical Risk

- **LOW RISK:**
  - Combined patient and surgical procedure characteristics result in a predicted risk of ≤ 1% of a Major Adverse Cardiac Event (MACE = death or myocardial infarction)

- **ELEVATED RISK:**
  - MACE ≥ 1%
Why Determine Surgical Risk?

- LOW RISK patients (MACE < 1%) do NOT need preoperative testing except as indicated by H&P (as you would normally practice)

- ELEVATED RISK patients (MACE ≥ 1%) MAY need preoperative testing depending on functional status. Surgical procedure may need to be modified

Tools for Determining Surgical Risk

- Revised Cardiac Risk Index (RCRI)
- American College of Surgeons NSQIP Surgical Risk Calculator

Revised Cardiac Risk Index (RCRI)

- Clinical Predictors (1 point each)
  - 'High Risk' surgery (intrathoracic, intraperitoneal, supravascular vascular)
  - Ischemic Heart Disease
  - Heart Failure
  - Diabetes Requiring Insulin
  - Creatinine > 2.0
  - CVA or TIA

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Complications</th>
<th>MACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0%</td>
<td>0.4%</td>
</tr>
<tr>
<td>1</td>
<td>1.3%</td>
<td>1%</td>
</tr>
<tr>
<td>2</td>
<td>3.4%</td>
<td>3.4%</td>
</tr>
<tr>
<td>3+</td>
<td>9%</td>
<td>5.4%</td>
</tr>
</tbody>
</table>

Pros:
- Simple
- Validated outside original cohort

Cons:
- Older
- Smaller sample
- Other tools with greater predictive ability
American College of Surgeons NSQIP Surgical Risk Calculator

- http://www.riskcalculator.facs.org/RiskCalculator/
- Pros:
  - Provides other outcomes
  - Probably best predictor
- Cons:
  - Only validated within cohort
  - Need specific surgery
  - Need ASA class
  - MI defined as STEMI

Functional Status, defined

- MET = Metabolic Equivalent of Task
- 1 MET = basal oxygen consumption of a 40 year old, 70 kg male

<table>
<thead>
<tr>
<th>METs</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 4</td>
<td>Simple activities of daily living, walk &lt; 2 blocks</td>
</tr>
<tr>
<td>4 - 6</td>
<td>Walk 2 flights of stairs, heavy housework/yardwork</td>
</tr>
<tr>
<td>7 - 10</td>
<td>Jogging, bicycling (light effort)</td>
</tr>
<tr>
<td>&gt; 10</td>
<td>10-minute mile</td>
</tr>
</tbody>
</table>

Note: capability of less than 4 METs of activity associated with higher cardiac risk.

Cardiac Testing and Intervention

- Even in patients with known, stable coronary disease revascularization does NOT improve long-term survival
- CARP trial: 510 patients with 1+ coronary artery with 70% occlusion. Randomized to revascularization vs. not prior to major vascular surgery.
  - No difference in death or MI
  - Excluded: unstable angina, left main stenosis > 50%, severe aortic stenosis, and LVEF < 20%

Case 2: Mrs. Cano

Mrs. Cano is seeing you in clinic prior to left knee arthroplasty surgery. Her orthopaedic surgeon has contacted you and has asked you to determine what testing and management is needed prior to her procedure.

Mrs. Cano is a 68 year old woman with a history of:
- heart failure with reduced ejection fraction (EF 45%) (Rx: furosemide, metoprolol, lisinopril)
- diabetes (HgbA1c 7.5%) (Rx: insulin glargine PM)
- mild COPD (FEV1/FVC 0.65, FEV1 85% pred, current non smoker) (Rx: albuterol, one 5 day steroid burst in last year)
- CAD (DES to RCA 5 years ago) (Rx: ASA, atorvastatin, metoprolol)
- hypertension (Rx: metoprolol)

Case 2: Mrs. Cano, continued

• What pre-operative evaluation should you perform?
  • History & Physical exam:
    – No recent chest pain
    – No murmurs or wheezes on exam
    – No evidence for volume overload
    – Normal creatinine 3 months ago
    – BMI 24
  • Functional Status
    – She can walk up 3 flights of stairs without difficulty

ACC / AHA Flowchart (2014)

Case 2: Take Home

• Cardiac Testing?
  • RCRI: 3 (ischemia, insulin, HF);
    NSQIP MACE: 0.2%
  • Higher risk by RCRI, but good functional status, so NO cardiac testing

Bottom line: if a patient has low risk of MACE, or higher risk but good functional status, then proceed with surgery. If higher risk of MACE and functional status cannot be assessed then may consider further cardiac testing.
Pause Procedure

- Please take 1-2 minutes to pair share about:
  - 1 or 2 things you have learned so far about pre-operative cardiac testing
  - How what you have learned may change your clinical practice

Mauna Kea Beach - http://www.habitat.noaa.gov/habitatblueprint/pacificislands.html

Case 2: Mrs. Cano, continued

- What preoperative labs and studies SHOULD we obtain? And when?
  - CBC and Chemistry panel?
  - LFTs?
  - INR?
  - ECG?
  - Echocardiogram?
  - PFTs?
  - Chest x-ray?

Optimal Time Interval for Laboratory Testing?

- Unknown exactly
- IF laboratory testing is indicated, a normal result within 4 months should be sufficient
- Abnormal results are usually predicted clinically and usually do not effect management
- In a study of 1109 patients undergoing elective surgery only 0.4% had a change in test results from normal (median 2 months prior to surgery, 70% within 4 months)

Electrocardiography (ECG)

- NOT INDICATED:
  - Asymptomatic, low risk patients (< 10% 10-year risk of coronary disease)\(^1\)
  - Patients with coronary, peripheral arterial, cerebrovascular disease, structural heart disease, or known arrhythmia undergoing low-risk surgery (<1% major adverse cardiac event) [ACC/AHA, 2014]\(^2\)

- REASONABLY INDICATED:
  - Patients with coronary, peripheral arterial, cerebrovascular disease, structural heart disease, or known arrhythmia undergoing an intermediate or high risk surgery
  - Optimal time interval unknown, general consensus is within 1-3 months prior to surgery


1. Coronary Heart Disease: Screening with Electrocardiography. USPSTF. October 2014
Echocardiography

*Routine evaluation for asymptomatic patients is not indicated [ACC/AHA 2014]*

*Consider if:*
  * New onset of dyspnea or symptoms of heart failure
  * Clinically stable patient with known LV dysfunction or valvular disease has not had an echocardiogram in the past year

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Chest Radiograph (x-ray)

*Unlikely to change management or outcome*

*Meta-analysis (1993)* – 14,395 patients with preoperative chest x-rays
  * 10% (1,439) ‘abnormal’ result but only 1.3% (187) were unexpected from H&P
  * Only 0.1% (14) led to a change in management
*Note: chest radiograph abnormalities increase with age*

*ACP Guidelines (2006)* – some limited evidence for:
  * patients with ‘cardiopulmonary disease’
  * older than 50 years undergoing upper abdominal/thoracic or abdominal aortic aneurysm surgery

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Spirometry (PFTs)

*ACP Guidelines (2006): “...spirometry should be reserved for patients who are thought to have undiagnosed chronic obstructive pulmonary disease”*

*H&P usually sufficient to determine degree of airflow obstruction that may lead to complications*

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Obstructive Sleep Apnea (OSA)

*OSA is associated with increased post-operative cardiac and pulmonary complications (1.5 to 3x risk)*

*Undiagnosed* OSA patients have a higher risk of cardiovascular complications compared to *diagnosed* OSA patients treated with CPAP and controls. This risk increases with OSA severity.

*Risk of pulmonary complications appears to be high whether or not the OSA is diagnosed*

*It is not clear if CPAP treatment actually decreases pulmonary risk in surgical patients. However, it is reasonable to continue CPAP treatment while hospitalized. Also patients with OSA may benefit from closer cardiopulmonary monitoring.*

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Case 2: Mrs. Cano, continued

• Testing:
  • CBC: +/- due to possible blood loss
  • Chemistry panel: NO, done within 3 months
  • INR: NO
  • LFTs, albumin: NO
  • ECG: reasonable if not done within 3 months (atrial fibrillation, CAD)
  • CXR: NO
  • PFTs: NO
  • Echocardiogram: NO
  • Sleep Apnea screening: NO (no symptoms, BMI low)

Pause Procedure

• Please take 1-2 minutes to pair share about:
  • 1 or 2 things you have learned so far about pre-operative testing
  • How what you have learned may change your clinical practice

Case 2: Mrs. Cano, continued

• How should we manage her medications?
  • Aspirin:
  • Metoprolol:
  • Lisinopril:
  • Atorvastatin:
  • Insulin glargine:
  • Furosemide:
  • ‘Stress-dose’ steroid?
  • Clonidine?

Antiplatelet Medications

• Aspirin for primary / secondary prevention (excluding recent stents):
  • Aspirin in the perioperative period did not decrease death or non-fatal MI but increased major hemorrhage (HR 1.23 95% CI 1.01 to 1.49).
    – Caveats: low rate of PCI, low rate of vascular surgery
    – These may not be your patients: mod- to high risk patients received 200mg ASA just before surgery and 100mg for 30 days afterward
  • For procedures with higher risk of hemorrhage and patient without recent stents it is probably safe to stop aspirin 5-10 days prior to procedure. Restart 8-10 days afterward

Antiplatelet Medications, continued

- Aspirin in patients with stents:
  - Highest thrombosis risk is within 4-6 weeks after stent placement.
  - Optimally, delay elective procedure at least 14 days after balloon angioplasty, 30 days after bare metal stent and 1 year after drug-eluting stent.
  - Continue dual antiplatelet medications perioperatively if possible.
  - If surgery needs to be performed and risk of hemorrhage deems dual antiplatelet therapy unacceptable: Continue aspirin, discontinue P2Y12 inhibitor (i.e. clopidogrel – 5 days) and resume as soon as possible.

Beta-Blockers

- In NON-cardiac surgery, beta-blockers reduce cardiac events perioperatively but NOT death. They are associated with higher risk of death and stroke [Cochrane Review 2014].
- CONTINUE beta blockers perioperatively if a patient is already on one. DO NOT withdraw beta-blockers abruptly if at all possible.
- DO NOT initiate a beta blocker solely for surgery (note: ACC/AHA guidelines say consider if RCRI 3+)
- IF you are starting a beta blocker perioperatively try to start it 2 – 7 days prior to the procedure

Angiotensin-Converting Enzyme Inhibitors (ACEI) and Angiotensin Receptor Blockers (ARB)

- Continuing ACEI/ARB associated with intraoperative hypotension but not with poorer cardiovascular outcomes. Possible decrease in perioperative hypertension
- Anesthesia practice has been to hold ACEI / ARBs on day of surgery
- AHA/ACC Guidelines: “Continuation of angiotensin-converting enzyme (ACE) inhibitors or angiotensin-receptor blockers (ARBs) perioperatively is reasonable”
- Recent study: withholding ACEI/ARB safe in ambulatory surgery
- Recommend: if patient on ACEI/ARB for heart failure or difficult to control hypertension would probably continue.

Statins

- Continue statins if patient already taking one
- Reasonable to initiate a statin if patient is to undergo vascular surgery
- Reasonable to initiate a statin as indicated by current guidelines for higher risk surgeries
Anticoagulants

- **Recent Updates:**
  - It is becoming more common to perform procedures while continuing anticoagulation.
  - There are fewer indications for bridging anticoagulation.
  - Use of Direct Oral Anticoagulants (DOACs) is becoming more common.

- **General Framework:**
  - Evaluate procedural bleeding risk.
  - Evaluate perioperative thromboembolic risk.
  - Consult with your surgeon and anticoagulation clinic and adhere to local practice guidelines.

Steroids

**Objective:** determine if the patient's Hypothalamic-Pituitary-Adrenal (HPA) axis is suppressed or not. **Goal:** Avoid adrenal crisis and perioperative hypotension.

<table>
<thead>
<tr>
<th>HPA Axis</th>
<th>Glucocorticoid Exposure</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Suppressed</td>
<td>≤ 5 weeks/year or ≤ 5 mg oral prednisone equivalent</td>
<td>Continue taking usual glucocorticoid.</td>
</tr>
<tr>
<td>Possibly Suppressed</td>
<td>5–20 mg/day prednisone equivalent or other significant use</td>
<td>Use of inhaled steroid, topical glucocorticoid use (Class I), &gt;3 steroid injections in 3 months. Check 8am cortisol; if suppressed give supplemental steroids vs. ACTH stimulation test vs. empiric supplementation.</td>
</tr>
<tr>
<td>Suppressed</td>
<td>&gt;20 mg/day prednisone equivalent for &gt;3 weeks</td>
<td>Stress supplementation.</td>
</tr>
</tbody>
</table>


Alpha-2 Agonists (clonidine)

- **NOT RECOMMENDED** perioperatively for cardiac prophylaxis.

- Prior studies showed reduced mortality and ischemia.

- However, POISE-2 (2014) was a larger trial (~10,000 patients):
  - No decrease in perioperative death or MI.
  - Increase in non-fatal cardiac arrest (PEA) and clinically significant hypotension.

Case 2: Mrs. Cano, continued

- How should we manage her medications?
  - Aspirin: +/- continue (DES 5 yrs ago, intermediate risk of hemorrhage, ACC/AHA recommends continuation, increased risk of hemorrhage with questionable benefit).
  - Insulin: decrease basal insulin by ~20%, stop prandial.
  - Furosemide: reasonable to discontinue.
  - Lisinopril: controversial, would prefer to continue.
  - Atorvastatin: continue.
  - Metoprolol: continue.
  - ‘Stress-dose’ steroid: NO.
Case 3: What about anticoagulation? Mrs. Lee

Mrs. Lee is seeing you in clinic prior to left knee arthroplasty surgery. Her orthopaedic surgeon has contacted you and has asked you to determine what testing and management is needed prior to her procedure.

Mrs. Cano is a 68 year old woman with a history of:

• **Heart failure with reduced ejection fraction (EF 45%)** (Rx: furosemide, metoprolol, lisinopril),
• **Diabetes** (HgbA1c 7.5%) (Rx: insulin glargine PM)
• **CAD (DES to RCA 5 years ago)** (Rx: atorvastatin, metoprolol, no ASA – on warfarin**)
• **Hypertension** (Rx: metoprolol)
• **And atrial fibrillation [CHA2DS2-VASc = 4 (age, HF, HTN, female)]** (Rx: warfarin, metoprolol)

**Anticoagulants: warfarin**

<table>
<thead>
<tr>
<th>Procedure Bleeding Risk</th>
<th>Low (&lt; 2%)</th>
<th>Moderate (2-10%)</th>
<th>High (&gt; 10%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridging anticoagulation</td>
<td>NOT indicated</td>
<td>bridging anticoagulation NO LONGER recommended</td>
<td>Strongly consider bridging anticoagulation: consult with anticoagulation service and surgeon</td>
</tr>
</tbody>
</table>

**Ver y Low**
- Cataract, ICD/pacemaker
  - Probably do not need to interrupt anticoagulation

**Low**
- Some procedures may be performed on warfarin
  - Stop warfarin 5 days prior to procedure
  - No bridging
  - Check INR day of surgery
  - Restart warfarin POD #0 or when deemed safe by surgeon

**High**
- Vascular, CABG, knee/hip replacement, kidney biopsy, neurosurgical procedures
  - Stop warfarin 5 days prior to procedure
  - No bridging
  - Check INR day of surgery

**Anticoagulants: DOACs**

**Warfarin** with moderate perioperative thromboembolic risk (CHA2DS2-VASc = 4) bridging anticoagulation is NO LONGER recommended. Procedure bleeding risk is ‘high’ so warfarin should be HELD.

Plan: hold warfarin 5 days prior to procedure. No bridging. Resume warfarin POD0 or when deemed safe. For orthopaedic procedures administer prophylactic enoxaparin until INR therapeutic.

**Apixaban** – bridging anticoagulation generally not recommended. Procedure bleeding risk is ‘high’ so apixaban should be HELD.

Plan: hold apixaban 48 hours prior to procedure. No bridging. Resume apixaban no sooner than 5 – 7 days post-procedure. For orthopaedic procedures administer prophylactic enoxaparin (or prophylactic dose apixaban) post-operatively.
Case 3: Mrs. Lee – Anticoagulation Learning Points

- Bridging anticoagulation is NO LONGER recommended for patients on warfarin and low-moderate perioperative thromboembolic risk. Consult your anticoagulation service/pharmacist for patients at high risk for thromboembolism.
- Pharmacokinetics of DOACs are variable, depending on agent and renal function. Consult your anticoagulation service or pharmacist regarding specific hold times prior to procedures.
- More procedures with low risk of hemorrhage are being performed while on anticoagulation (i.e. cataract, dental, endoscopic procedures without biopsy). Discuss with person performing procedure, your anticoagulation service, and adhere to local guidelines.

Pause Procedure

- Please take 1-2 minutes to pair share about:
  - 1 or 2 things you have learned so far about pre-operative medication management
  - How what you have learned may change your clinical practice

Additional Optimization

- Smoking Cessation
  - Stop smoking as far out from surgery as possible
  - Earlier data that showed worse outcomes with smoking cessation < 4 weeks not borne out by later meta-analysis

- Nutrition
  - Low albumin is predictor of poor pulmonary outcomes
  - Patients with severe malnutrition may benefit from enteral nutritional supplementation

- Pulmonary
  - Preoperative inspiratory muscle training decreases pulmonary complications, especially in cardiothoracic and abdominal surgery

Select Populations…
Women

- Pregnancy Testing - rate of incidental pregnancies found pre-operatively: 0.3 to 2.4%
  - American Society of Anesthesiologists: “...the literature is inadequate to inform patients or physicians on whether anesthesia causes harmful effects on early pregnancy. Pregnancy testing may be offered to female patients of childbearing age and for whom the result would alter the patient’s management”
  - However, general practice is to obtain urine pregnancy testing in women of childbearing age (time of initial reported menses and one year after last reported menses, without exclusion criteria i.e. hysterectomy)

- Genital tract infection – routine screening NOT indicated. Evaluate based on symptoms.

Women, continued

- Oral Contraceptives / Hormone Therapy – increased risk of thromboembolic events
  - Low-risk procedures / early ambulation: CONTINUE
  - Moderate- to High-Risk procedures / relative immobility: DISCONTINUE 4-6 weeks prior to procedure after DISCUSSION with patient.
    - Risk of unintended pregnancy (use backup method)
    - Post-operative prophylaxis: defer to surgeon

Johnson B, Porter J, Obstetrics & Gynecology, 2008; 111:1183-1194

Older Patients

- Risk of mortality in elective surgery increases slightly with age but probably due to co-morbidities rather than age alone
- No Care Without Goals of Care
  - Discuss risks and benefits of procedure given life expectancy, expected outcome
  - Advance Directive / Code Status
  - Surrogate Decision-Maker

Older Patients, Pre-Operative Evaluation

- Evaluate Cognitive Status and decision-making capacity. Cognitive impairment increases risk of perioperative delirium and mortality. Advise patient to bring assistive devices (hearing aids, glasses) to hospital
- Evaluate Functional Status – older patients are at risk for loss of functional status simply due to hospitalization. Decreased functional status is a risk for increased morbidity.
- Evaluate Nutrition – poor nutrition may be risk for mortality (studies variable)
- Consider pre-operative rehabilitation program to improve functional status and nutrition and ensure post-operative rehabilitation plan is in place.

Postoperative Care

- Postoperative troponin elevation is associated with increased 30-day mortality
- However, unclear how to manage this risk – many were asymptomatic and mechanism is likely supply/demand mismatch
- ACC/AHA recommends against routine post-operative troponin screening
- Bottom line: more studies needed. If your patient is found to have an elevated troponin post operatively it would be prudent to further evaluate and manage her cardiac risk.

Summary of Recent Updates

- NO testing is required prior to cataract surgery
- Determining need for cardiac testing has been simplified:
  - determine risk of MACE: if < 1%, proceed with surgery, if ≥ 1% and good functional status, proceed with surgery
  - if not, consider cardiac testing if management would change.
- Screening and treating for OSA can decrease cardiovascular events
- Okay to HOLD Aspirin in the perioperative period unless patient has recent coronary stent
- DO NOT use bridging anticoagulation in patients on warfarin and low-moderate thromboembolic risk
- BE AWARE that post-op troponin elevation leads to increased mortality

Questions?

Thank you!

Henry Crevensten, MD
Contact: Henry.Crevensten@ucsf.edu
References – Good Places to Start

- ACC/AHA Guideline 2014

- University of Washington Medicine Consult Service

- American College of Obstetrics and Gynecology
  (note: an older reference)

- Cataract Surgery Guidelines

References – Additional Reading

General


Cardiac


- Clinical Summary: Coronary Heart Disease: Screening with Electrocardiography. U.S. Preventive Services Task Force. October 2014


Pulmonary


Geriatrics