Objectives

- Describe the current general approach to perioperative evaluation of patients undergoing a planned inpatient surgery
- Review the evidence of how to reduce the risk of cardiac complications during the perioperative period
- Highlight other chronic medical conditions that need to be addressed during the perioperative period to reduce the risk of complications

Perioperative Evaluation

- No surgery is without risk, so patients are risk stratified not “cleared”
- Avoid “routine” tests: cardiac stress tests, ABGs, CXRs because results rarely change the management plan
- Low risk surgery = no testing: outpatient surgery has a lower day of surgery mortality than mortality at 30 days; local/regional only anesthesia surgeries are also low risk
- Age correlates directly with complications
### Active Cardiac Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unstable coronary syndromes</td>
<td>Unstable or severe angina, Recent MI (7-30 days)</td>
</tr>
<tr>
<td>Decompensated Heart Failure</td>
<td>NYHA class IV; worsening or new onset CHF</td>
</tr>
<tr>
<td>Significant Arrhythmias</td>
<td>High-grade AV block, Symptomatic VT, SVT (including AFib) with V rate &gt;100 at rest, Symptomatic bradycardia, Newly recognized VT</td>
</tr>
<tr>
<td>Severe Valvular disease</td>
<td>Severe aortic stenosis (mean pressure gradient &gt;40 mmHg, AVA &lt;1 cm², or symptomatic), Symptomatic MS (progressive dyspnea on exertion, exertional presyncope, CHF)</td>
</tr>
</tbody>
</table>

Fleisher LA et al. JACC. 2007;50(17):159-241.

### Clinical Risk Factors

- CAD
  - History
  - Imaging evidence
  - ECG evidence (pathologic Q waves)
- CKD
- CHF
- CVD (stroke or TIA)
- Diabetes mellitus

Fleisher LA et al. JACC. 2007;50(17):159-241.

### Functional Capacity

**Good Functional Capacity (all without symptoms)**

1. Any exercising for > 15 min except: water aerobic (3.5 METs), weightlifting, golfing w/o carrying clubs
2. Walking up a flight of stairs without stopping
3. Walking on level ground at a pace of > 4mph (Walk a block in <2 minutes)
4. Climb up 2 flights of stairs or walk 4 blocks at any pace.

Functional Capacity

- Functional capacity is a key factor in preoperative cardiovascular risk assessment.
- For the majority of non-cardiac/non-vascular surgeries, the primary determinant of cardiac stress is anesthesia.
- Anesthesia exerts the equivalent of ~4 METs.
- If a patient regularly performs activities achieving >4 METs, there is no reason to suspect cardiac disease would be unmasked in the OR.

Does Surgical Approach Matter?

Robotic Assisted hysterectomy vs. laparoscopic vs. laparotomy approaches a review of 1591 endometrial cancer patients:
- Robotic has lower EBL.
- Robotic and laparoscopic approaches take longer but have shorter LOS.
- How long do want the patient to do 4 METS.
- Time also predicts post op pulmonary complications OR of 9.7 for >3 hrs vs. 4.9 for 2-3 hrs vs. 1 if surgery <2 hours.

(Obstet Gynecol 2010; 116:1422-31)
Canet J et al Anesthesiology 2010;113:1338-1550

Beta Blockers

65 y/o woman undergoes a total abdominal hysterectomy. Her PMH is significant for CAD with 2 drug eluting stents placed 18 months ago, HTN, DM and hyperlipidemia. Her medications include aspirin, atorvastatin, atenolol, amlodipine and metformin.

The morning of POD#2 she is vomiting due to a small bowel obstruction. Her vital signs are BP 130/72 and P 98.

Which is the best choice for management of her antihypertensive therapy?
A. Hold all BP medications
B. Give amlodipine and hold atenolol
C. Give atenolol, hold amlodipine
D. Give IV metoprolol
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Beta Blocker Withdrawal

75 y/o woman presents for to pre-op clinic for evaluation prior to hysterectomy for endometrial cancer planned in 3 weeks. Her PMH is also significant for CAD with 2 drug eluting stents placed 18 months ago, HTN, DM and hyperlipidemia. Her medications include aspirin, atorvastatin, amlodipine and metformin. Her exam is remarkable only for P 92 & BP 154/88.

Which is the best recommendation for perioperative beta-blocker management?

A. Start atenolol now and titrate to a pulse of ~60
B. Start atenolol 24 hours prior to surgery and titrate postoperatively to a pulse of ~60
C. Do not give beta blockers prior to surgery because of increased stroke risk
D. Start atenolol 24-48 hours after surgery
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Perioperative Beta-Blockade

- Beta blockers **should be continued** in patients undergoing surgery who are receiving beta blockers for treatment of conditions with ACCF/AHA Class I guideline indications for the drugs. *(Class I recommendation with Level of Evidence C)*
- POISE published in Lancet 2008 RCT of 8351 pts used metoprolol XL 200mg daily given unless HR<50 sys BP <100 lower MI 4.2% vs. 5.7 % but higher death 3.1% vs. 2.3% and stroke 1% vs. 0.5% compared to placebo arm


Beta blocker titration

Antiplatelet Agents in CAD Patients

62 y/o woman with a drug-eluting stent placed in the LAD 4 months ago presents to preop clinic before bladder prolapse surgery. She is able to swim for 20 minutes. Her medications include atenolol, clopidogrel, aspirin and simvastatin. ECG is unchanged, and lab studies are normal.

Which of the following is the best perioperative antiplatelet management plan?
A. Stop clopidogrel 5-7 days before surgery and continue aspirin perioperatively
B. Proceed to surgery continuing both aspirin and clopidogrel
C. Delay surgery for at least 2 months
D. Stop clopidogrel and aspirin and provide LMWH as bridging therapy

Statin Therapy

45 y/o woman presents for evaluation before vaginal subtotal hysterectomy. PMH significant for CAD with 2 drug eluting stents placed 18 months ago. HTN, DM & hyperlipidemia (LDL=150). Her medications include aspirin, atenolol and metformin.

Which of the following would you advise for perioperative management?
A. Start a statin today continue long term
B. Do not start a statin: may cause enhanced hepatotoxicity when combined with inhaled anesthetics
C. Start a statin on POD#1
D. Start niacin
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Cohort Studies: Perioperative Death

Pooled OR 0.58 (0.48-0.72)


Perioperative Statins: Take Home Points
- Statins probably reduce perioperative CV morbidity and mortality
- Effect may be due to anti-inflammatory effect but mechanism speculative
- Optimal dose, agent, and duration unknown
- Early d/c of statins after surgery increases risk
- Recommend:
  - All patients undergoing vascular surgery
  - Intermediate risk surgery and at least one clinical risk factor
  - Begin at least 30 days before surgery if possible
Obstructive Sleep Apnea

54 y/o obese woman presents for preop evaluation before total abdominal hysterectomy. She admits to waking her husband up with her snoring. Her BMI is 42 kg/m² and her measured neck circumference is 45 cm.

Which of the following is the best perioperative management plan for this patient?

A) Delay surgery and refer to a sleep medicine physician  
B) Proceed with surgery with no additional planning  
C) Proceed with surgery with plan for continuous postoperative oxygen therapy at 2 L/min  
D) Proceed with surgery with plan for postoperative auto-PAP and continuous pulse oximetry

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OSA & Increased Postoperative Complications

- Infections (respiratory and other)  
- Respiratory failure  
- Hypoxia  
- ICU use  
- Cardiac events  
- GI bleeding

OSA – When to Suspect

- Daytime somnolence
- Dyspnea or chest pain
- Crowded oropharynx
- Obesity
- Men > age 50

For consistency use OSA screening questionnaire


STOP-BANG Questionnaire

- Snoring: Do you snore loudly (louder than talking or loud enough to be heard through closed doors)?
- Tiredness: Do you often feel tired, fatigued, or sleepy during daytime?
- Observed apnea: Has anyone observed you stop breathing during your sleep?
- Pressure: Do you have or are you being treated for high BP?
- BMI >35 kg/m²
- Age >50 yrs
- Neck circumference > 40 cm
- Gender = male


STOP-BANG Questionnaire

- High risk of OSA: 3 or more questions answered yes
- Low risk of OSA: <3 questions answered yes

### Perioperative Management of OSA

| If patient is high risk & urgency of surgery does not preclude, pursue formal diagnosis & initiation of appropriate therapy |
| If no time for this, proceed with same precautions as patient with known OSA plus possible empiric PAP therapy |

| Intraoperative Management |
| --- | |
| - Consider regional anesthesia/peripheral nerve block |
| - Prepare for difficult airway management |
| - Consider invasive monitoring |
| - Extubate only after completely awake & reversed |


### Smoking and Surgery

38 y/o female is scheduled to undergo a subtotal hysterectomy for cervical cancer in 4 weeks. She smokes 1 ppd but does not drink alcohol. How would you counsel her regarding her smoking during the time between now and surgery?

- A) Do not stop smoking – cessation will increase her risk of complications
- B) Stop smoking – cessation will decrease her perioperative mortality
- C) Stop smoking – cessation will decrease her risk of pulmonary complications
- D) Say nothing, she is likely too stressed out about surgery to quit

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**Smoking & Surgical Complications**

<table>
<thead>
<tr>
<th>Postoperative Outcomes</th>
<th>Never Smoked (N=186,632)</th>
<th>Current Smoker (N=135,741)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical Site Infection</td>
<td>2.4%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>1.2%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Failure to wean &gt; 48 hours</td>
<td>0.8%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Reintubation</td>
<td>0.9%</td>
<td>1.6%</td>
</tr>
</tbody>
</table>

Smoking status significantly associated with all outcomes, \( \chi^2 \) test \( P < 0.001 \).

**Smoking Cessation and Perioperative Outcomes**

Preoperative smoking cessation decreases
- Overall postop complications (32% vs. 22%, RR 0.76)
- Pulmonary complications (20% vs 15%, RR 0.81)
- Wound healing (RR 0.73)
- No effect on mortality


**Duration of Preoperative Smoking Cessation**

- Contrary to incorrect interpretations of one cohort study\(^1\), smoking cessation <8 weeks before surgery does not increase the risk of pulmonary complications
- Patients who stop more than 4 weeks preop have less complications than those who stop for shorter durations\(^2\)
- Each week of smoking cessation decreases complications by an additional 19%\(^2\)
- Surgery has been associated with an increased likelihood of smoking cessation\(^3\)

\(^3\) Yen B and Warner DO. Anesthesiology. 2010;112(1):102-7.
Perioperative Smoking Take Home Points

- Smoking predicts postoperative morbidity and mortality
- Preoperative smoking cessation decreases pulmonary and non-pulmonary perioperative risks
- Preoperative evaluation is a teachable moment for smoking cessation

Postoperative Ileus

An 82 y/o F is undergoing laparotomy for ovarian cancer. She has no hx of abdominal surgeries, but does report constipation on ROS. She is a thin woman on exam 52 kg. CBC and BMP are wnl with a creatinine of 1.0

Of the following interventions that have been shown to decrease the risk of ileus, which one is inappropriate for this patient?

A. Early feeding  
B. Gum chewing  
C. Bowel stimulation  
D. Using ketorolac for pain control to decrease risk of opiate induced constipation
Recognizing Renal Dysfunction

Cockroft-Gault Equation

\[ \text{Cockroft-Gault Equation} = \frac{140 - \text{age} \times \text{wt in kgs}}{72} \times \text{multiplier for females} \]

Patient in case has a creatinine clearance of around 35 despite a “normal” creatinine lab value and would be at risk of nephrotoxicity if NSAIDS were used for postoperative pain control.

Last but not least: DVT Prophylaxis

A review of 738,150 women undergoing major gynecologic surgery between 2000 and 2010

- No prophylaxis 39.6%
- Mechanical prophylaxis 46.6%
- Pharmacologic prophylaxis 5.5%
- Combination prophylaxis 8.4%


Risk Factors for Venous Thromboembolism

- Surgery
- Immobility
- Malignancy
- Venous compression (pelvic lymph nodes, tumor)
- Prior episode of deep vein thrombosis
- Estrogen use or pregnancy/post partum
- Advanced Age
- Obesity
## Recommended Thromboprophylaxis


<table>
<thead>
<tr>
<th>Risk Level</th>
<th>Procedure Type</th>
<th>Heparin Dosing</th>
<th>Additional Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Risk</td>
<td>Laparoscopic procedures in patients with no risk factors</td>
<td>Low Molecular Weight Heparin 5000 u SQ q 12 hrs</td>
<td>Early frequent ambulation</td>
</tr>
<tr>
<td></td>
<td>Minor surgery &lt;30 min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate Risk</td>
<td>Minor or laparoscopic surgery in patients with risk factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Major surgery and no risk factors</td>
<td>Heparin 5000 u SQ q 12 hrs</td>
<td></td>
</tr>
<tr>
<td>High Risk</td>
<td>Major surgery in patients with risk factors</td>
<td>Low Molecular Weight Heparin 5000 u SQ q 8 hrs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intermitent pneumatic compression or combination</td>
<td></td>
</tr>
<tr>
<td>Highest Risk</td>
<td>Major surgery in patients older than 60 yrs of age, a hx of prior DVT, or malignancy</td>
<td>Low Molecular Weight Heparin 5000 u SQ q 8 hrs</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>with Intermitent pneumatic compression and graduated compression stockings</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>for 4 wks post discharge</td>
<td></td>
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</tbody>
</table>

### Questions?

- What are the different risk levels for thromboprophylaxis?
- How does the dosing of heparin vary based on the risk level?
- What additional measures are recommended for each risk level?