Learning Objectives

1. Screen patients for risk factors before they undergo surgical procedures and report subsequent risks to the patient’s surgical care team.
2. Evaluate patients for preoperative cardiac risk according to the American College of Cardiology/American Heart Association’s 2007 clinical guidelines.
3. Distinguish the necessary components of a preoperative cardiac risk assessment.

Preoperative Evaluation/Consult

- Medical history (thorough)
  - is the most valuable tool
A comprehensive evaluation also includes
- Assessment of perioperative risk factors
- Ancillary tests to consider
  - Diagnostics
    - Lab
    - EKG
    - X-ray
- Interventions recommended to mitigate risks identified
- Physical exam

Preoperative Evaluation/Consult

Pre-op Evaluations should also include:

- Functional Assessment
  - What is the patient capable of doing at home
  - What assistive devices may they need
- Determine Social Support
  - Lives alone or is the primary care giver
  - Need for home health nurse or PCA?
  - Possible need for short-term rehab?

Medical History

- Indication for surgical procedure
- Allergies and intolerances to medications, anesthesia, or other agents (specify reaction type)
- Known medical problems (particularly heart and lung)
- Surgical history
- Trauma (major)
- Current medications (prescription, over-the-counter medications, herbal and dietary supplements, and illicit drugs)
- Focused review of issues pertinent to anesthesia and the proposed procedure
- Evaluate: current status of pertinent knowns
  - Medical problems
  - Cardiac status
  - Pulmonary status
  - Hemostasis status (personal or family history of abnormal bleeding)
  - Possibility for severe (symptomatic) anemia

Physical Exam

- Weight and height
- Vital signs – BP, pulse (rate and regularity), RR, O₂ saturation
- Cardiac
- Pulmonary
- Other pertinent exam

© American Academy of Family Physicians. All Rights Reserved.
1. A 60-year-old male is referred to the office for preoperative evaluation for an elective cholecystectomy in 12 days.
PMHx: Type II DM x 20 years.
Medication: metformin, lisinopril and ASA.
Vitals signs: BP=130/80, P=75, RR= 16, afebrile
At this point you should?

A. Obtain an EKG, CBC, PT/PTT, HgA1C
B. Obtain an EKG, CBC, Glucose
C. Obtain an EKG, no labs required
D. Obtain an EKG, CXR, no labs required

Diagnostic Studies

Mass testing
• Multiple tests drawn prior to a procedure regardless of procedure or patient
• Increases risk of “falsely” abnormal tests
• Most studies show that 30-95% of unexpected lab abnormalities are not addressed preoperatively – Poses an increased medico-legal risk
• >$30 billion annually on preop exams, 60% of which are unnecessary

Selective Testing
• EKG: obtain in men >40, women >50, or if there is a cardiac hx
• Hgb: baseline for pts at risk for severe anemia or prior to procedures with potential for significant blood loss.
• Fasting glucose: in all patients age > 45
• Urine HCG: in all women of child-bearing age

Selective Testing
• PT/PTT, platelets: h/o bleeding disorder or on anticoagulants
• Renal and liver function: not routine, based on hx
• CXR: based on history, >65, CVD, COPD, previous malignancy, current smoker with >20 pack yr history

ICSI Recommendations

• EKG: age 55 (SOR: A)
• Coag studies: no routine testing (SOR: B)
• Hgb: based on planned procedure and medical condition (SOR: C)
• Smoking cessation: no evidence to recommend prior to surgery (SOR: C)
2. Surgical procedures associated with a high risk of perioperative cardiac complications include which one of the following?

A. Peripheral vascular surgery
B. Breast surgery
C. Orthopedic surgery
D. Prostate surgery

Preoperative Evaluation/Consult

The vast majority of perioperative problems fall into 5 categories

- Cardiac
- Pulmonary
- Renal
- Infectious
- Hematologic

Cardiac Status

Generally the primary concern, and has the most formal guidelines

- American College of Cardiology and American Heart Association (ACC/AHA)
  - Increasingly evidence-based now
  - Address noncardiac, non-emergent procedures

Diagnostic Studies

Studies should be done based on:

- Surgery-Related Predictors
- Patient-Related Predictors

These are most often used to assess risks for perioperative cardiac complications, which are the most common type that threatens a pt’s life or prolongs hospital stays

Surgery-Related Predictors for Risk of Perioperative Cardiac Complications

<table>
<thead>
<tr>
<th>Risk Stratification</th>
<th>Type of Surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Emergency, Anticipated increased blood loss, Aortic or Peripheral vascular</td>
</tr>
<tr>
<td>Intermediate</td>
<td>Abdominal or thoracic, Head/Neck, Carotid endarterectomy, Orthopedic, Prostate</td>
</tr>
<tr>
<td>Low</td>
<td>Breast, Cataract, Superficial, Endoscopy, Ambulatory procedure</td>
</tr>
</tbody>
</table>

© American Academy of Family Physicians. All Rights Reserved.
Patient-Related Predictors for Risk of Perioperative Cardiac Complications

<table>
<thead>
<tr>
<th>Major Clinical Predictors</th>
<th>Intermediate Clinical Predictors</th>
<th>Minor Clinical Predictors</th>
</tr>
</thead>
<tbody>
<tr>
<td>MI &lt;6 wks previously</td>
<td>MI &lt;6 wks &lt;5 yrs ago</td>
<td>Advanced age</td>
</tr>
<tr>
<td>Unstable angina</td>
<td>Antiviral EKG (LVH, LBBB, ST-T wave abnormalities)</td>
<td>Non-sinus rhythm</td>
</tr>
<tr>
<td>Decompensated CHF</td>
<td>Compensated CHF</td>
<td>Low functional capacity</td>
</tr>
<tr>
<td>Significant arrhythmias</td>
<td>Diabetes mellitus</td>
<td>No a previous stroke or CHF</td>
</tr>
<tr>
<td>(hemodynamic instability)</td>
<td></td>
<td>Uncontrolled HTN</td>
</tr>
<tr>
<td>Severe valvular dz (AS or MS valve area&lt;1.0cm²)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cardiac Assessment

Cardiac testing is NOT indicated if H/O:
- Normal cardiac stress testing within 2 yrs
- CABG and no Sxs within 5 yrs
- Angioplasty and no Sxs 6mo-5yrs previously

Cardiac re-evaluation or testing IS indicated if:
- Symptomatic
- Angioplasty within past 6 months or >5 yrs ago

Stepwise Approach to Cardiac Assessment

<table>
<thead>
<tr>
<th>Step</th>
<th>Situation or Medical Condition</th>
<th>Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Need for emergent noncardiac surgery?</td>
<td>Proceed to surgery, role of medical consultant is to assist with perioperative monitoring, postoperative medical management, and eventual cardiac risk stratification</td>
</tr>
<tr>
<td>2</td>
<td>Active cardiac condition?</td>
<td>Evaluate and manage prior to surgery, often need angiography and cardiology consultation</td>
</tr>
<tr>
<td>3</td>
<td>Low risk surgery?</td>
<td>Proceed to surgery, further assessment not indicated</td>
</tr>
</tbody>
</table>

Stepwise Approach to Cardiac Assessment

<table>
<thead>
<tr>
<th>Step</th>
<th>Situation or Clinical Risk Factors</th>
<th>Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Good functional capacity (&gt;4 METS) without symptoms?</td>
<td>Proceed to surgery: further assessment not indicated</td>
</tr>
<tr>
<td>5</td>
<td>Clinical and surgery-specific risk factors</td>
<td></td>
</tr>
<tr>
<td>1. If no risk factors</td>
<td>1. Proceed to surgery</td>
<td></td>
</tr>
<tr>
<td>2. If &gt;3 risk factors + vascular surgery</td>
<td>2. Noninvasive testing if management will change consider B-blockade in appropriate pts</td>
<td></td>
</tr>
<tr>
<td>3. If &gt;3 risk factors + intermediate risk surgery or 1-2 risk factors + vascular surgery</td>
<td>3. Proceed to surgery with B-blockade, or consider testing if management will change</td>
<td></td>
</tr>
</tbody>
</table>

Identifying and Minimizing Perioperative Risk: Cardiac

<table>
<thead>
<tr>
<th>Patient-specific Risk Factors</th>
<th>Procedure-specific Risk Factors</th>
<th>Risk-reduction Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major risks</td>
<td>Vascular surgery</td>
<td>Optimize treatment of underlying conditions Consider beta blockers perioperatively Consider adjunctive testing if results could alter patient management</td>
</tr>
<tr>
<td>- Decompensated HF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Severe valve disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Significant arrhythmias</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Unstable coronary syndrome</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other cardiovascular risks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Cardiovascular disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- CKF or AKI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Compensated/prior HF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Diabetes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Functional capacity &lt;4 METS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Ischemic heart disease</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Preoperative Cardiac Assessment

- Evidence from a randomized trial suggests that preoperative stress testing is of no value in patients with only one or two cardiac risk factors
  - The PPV in this population is only 20-40%
  - Consistent with the findings that optimal medical therapy (minimal reversible LV myocardial ischemia on stress imaging) have no greater incidence of perioperative cardiac events than those with no ischemia
Coronary Artery Revascularization Prophylaxis (CARP) Trial

- Median follow up of 2.7 years
- No difference in all-cause mortality was observed
- No difference in the incidence of postoperative MI
  *criticism was that this excluded too many high-risk patients

Dutch Echocardiographic Cardiac Risk Evaluation Applying Stress Echocardiography (DECREASE-V)

- Based on the composite endpoint of all-cause mortality and nonfatal MI,
  - Preoperative revascularization conferred NO benefit
- Findings c/w a study that showed no incremental benefit from prophylactic percutaneous coronary intervention (PCI)

Coronary Revascularization

- Accomplished by PCI or CABG
- In most studies pts have undergone PCI
- Thrombosis prevention with stents
  - Dual antiplatelet therapy with
    - Clopidogrel (Plavix)
    - Drug eluding require 12 months
  - Drug eluding require 12 months
- Aspirin is recommended life-long
- Lack of adherence poses a substantial hazard to these pts in the perioperative period

3. A 67-yr-old female with a h/o DM, HTN and Rheumatoid Arthritis presents with 6 hrs of sudden severe diffuse abdominal pain.
  Meds: hydrochlorothiazide, metformin, prednisone (x 8yrs), celecoxib, and ASA.
  Vitals: BP 140/90, P 105, RR 30, AF. Cushingoid appearance.
  PE: Diffusely tender abdomen; guarding and rebound. IV in place, labs drawn, and X-ray shows free air under the diaphragm.
  What preoperative medication would you recommend?
  - A. Hydrocortisone 100 mg IV
  - B. Hydrocortisone 50 mg IV
  - C. Furosemide 10 mg IV
  - D. Vitamin K 10 mg IM

Preoperative Medications

<table>
<thead>
<tr>
<th>Medication</th>
<th>Timing of Medication</th>
<th>Reasoning for Stopping or Giving</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASA</td>
<td>Stop 5-7 days prior</td>
<td>Irreversibly inhibits cyclooxygenase and platelet aggregation</td>
</tr>
<tr>
<td>Clopidogrel/Ticlopidine</td>
<td>Stop 5-7 days prior</td>
<td>Irreversibly affects ADP-induced platelet aggregation</td>
</tr>
<tr>
<td>NSAIDs</td>
<td>1-3 days prior</td>
<td>Reversibly inhibits cyclooxygenase</td>
</tr>
<tr>
<td>Gliptins</td>
<td>2-3 days prior</td>
<td>No effect on platelets, but affects renal function</td>
</tr>
<tr>
<td>Parenteral antibiotics</td>
<td>30 min prior</td>
<td>Decreases same-site infection rates</td>
</tr>
<tr>
<td>Long and intermediate insulins</td>
<td>Morning of</td>
<td>½ the dose morning of surgery. (hold oral hypoglycemics)</td>
</tr>
</tbody>
</table>

© American Academy of Family Physicians. All Rights Reserved.
Preoperative Medications

<table>
<thead>
<tr>
<th>Medication</th>
<th>Hypothalamic Pituitary Axis Affected?</th>
<th>Recommended Dosing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steroids</td>
<td>No signs of HPA suppression</td>
<td>Usual daily dose perioperatively</td>
</tr>
<tr>
<td></td>
<td>(+) signs of HPA suppression or &gt;20 mg x 3 wks</td>
<td>Low risk surgery: 50 mg IV hydrocortisone, then 25 mg q 8 hr x 24-48 hrs. High risk surgery: 100 mg IV, then 50 mg q 8 hr x 24-48 hrs.</td>
</tr>
</tbody>
</table>

Am J Health Syst Pharm. 2004 May 1; 61: 899-912

Preoperative Medications

Warfarin Management

**Low thromboembolic risk**
- Stop 5 days pre-op
- Restart post-op as soon as taking po

**High thromboembolic risk**
- Stop 4 days pre-op and start LMWH (outpt) or UFH (inpt)
- Stop LMWH 12-18 hrs, UFH 6 hrs pre-op
- Restart LMWH 6 hrs post-op (assuming hemostasis achieved)
- Restart warfarin when tolerating po
- Stop LMWH when INR = 2.0

Preoperative Medications

Warfarin Management

**Low thromboembolic risk**
- AF with no CVA or systemic embolism within past 12 months
- Biological heart valves >3 months out
- Vascular grafts
- H/o venous thrombosis >3 mo out with NO confirmed hypercoagulable state
- Systemic arterial embolism not current

**High thromboembolic risk**
- Mechanical Heart valve
- H/o DVT/PE with documented hypercoagulable state
- H/o DVT/PE < 3 months ago

Preoperative Medications

Herbal Medications

"While there is a considerable amount of debate in the literature, it is prudent to discontinue these agents for at least two weeks before surgery."

*Herbal medications may have an effect on bleeding, sedation, blood pressure and heart rate.

Pass et al Am J Health Syst Pharm 2004;61;909.

Preoperative Medications

Aspirin Therapy
- Irreversible inactivation of cyclooxygenase 1 and 2
  - Reduces prostaglandin and thromboxane production
  - Resulting in antiplatelet and anti-inflammatory effects.

Preoperative Medications

Aspirin
- Meta-analysis of pts receiving ASA for secondary prevention
  - Discontinuation resulted in a 3-fold increase in the risk of adverse cardiac events
- Patients with coronary stents
  - Cessation of ASA Rx resulted in a 90-fold increase in complications
- ASA withdrawal has been implicated as a causal factor in up to 10% of adverse perioperative CV events occurring an average of 10 days after cessation

© American Academy of Family Physicians. All Rights Reserved.
Aspirin

- Increases surgical bleeding by approx 20%
- Concern about hemorrhagic complications is not supported by evidence from clinical trials
  - Meta-analysis of studies comparing surgical bleeding in pts on low-dose ASA with those not, found no difference in severity of bleeding events (with exception of intracranial surgery and possibly transurethral prostatectomy) or mortality
- Therefore, in most cases, ASA should be continued in the perioperative period
  - Communication between the PP and surgeon is essential in weighing the CV risks vs the bleeding risks

Preoperative Medications

- Statin Therapy
  - Has pleiotropic effects
    - Lipid-lowering ability
    - Reduce vascular inflammation
    - Improve endothelial function
    - Stabilize atherosclerotic plaques
  - Strong evidence that perioperative statin therapy reduces CV risk in pts undergoing vascular surgery

Statins

- Rebound effect with abrupt cessation
  - Risk of CV events sharply increases
  - Extended release formulations are recommended
    - Lovastatin
    - Fluvastatin
- Ideally initiated several weeks prior to surgery
- Benefits are seen when initiated immediately preoperatively

DECREASE-III Trial

- Fluvastatin (Lescol) reduced the incidence of
  - Perioperative MI
  - 30-day non-fatal MI and cardiac death
- NNT was
  - 13 to prevent one occurrence of myocardial ischemia
  - 36 to prevent one nonfatal MI
  - 42 to prevent one cardiac death

4. A 65-year-old nonsmoker is scheduled to undergo right knee replacement. His cardiac history is negative, and he takes aspirin, 81 mg/day, to prevent cardiovascular problems. He also takes simvastatin, 20 mg/day, for hypercholesterolemia, and metoprolol, 25 mg twice daily, for hypertension. His body mass index (BMI) is 26 kg/m², his heart rate is 60 BPM, and his blood pressure is controlled.

Which one of the following is the best recommendation regarding metoprolol?

A. Withhold 12 hours before and after surgery
B. Withhold 24 hours before and after surgery
C. Withhold 48 hours before and after surgery
D. Withhold the day of surgery and restart it in the morning
E. Continue the drug on his regular schedule when he has surgery

4. A 65-year-old nonsmoker is scheduled to undergo right knee replacement. His cardiac history is negative, and he takes aspirin, 81 mg/day, to prevent cardiovascular problems. He also takes simvastatin, 20 mg/day, for hypercholesterolemia, and metoprolol, 25 mg twice daily, for hypertension. His body mass index (BMI) is 26 kg/m², his heart rate is 60 BPM, and his blood pressure is controlled.

Which one of the following is the best recommendation regarding metoprolol?

1% A. Withhold 12 hours before and after surgery
2% B. Withhold 24 hours before and after surgery
1% C. Withhold 48 hours before and after surgery
15% D. Withhold the day of surgery and restart it in the morning
82% E. Continue the drug on his regular schedule when he has surgery
Preoperative Medications

Beta Blockers: reduce mortality in high-risk patients scheduled for
- Elective or emergent surgery
- During hospitalization and for as long as two years after surgery

Mangano DT, et al. NEJM 1996; 335:1713
Poldermans D, et al. NEJM 1999; 341:1789
ACC/AHA Guidelines 2007

Perioperative Ischemic Evaluation (POISE) Trial (2008)
- 8000 pts Tx with fixed dose extended-release metoprolol or placebo initiated immediately before surgery
  - Reduced risk of nonfatal MI and cardiac death
  - Overall mortality and stroke risk increased
  - Possibly because of drug-induced hypotension

Beta Blockers
- Recent Cohort study
  - Acute preop beta blockade in a naïve population resulted in worse cardiac outcomes compared with chronic use
  - Not related to increased stroke, but increased occurrence of MI and cardiac death

Beta Blockers
- Probably related to the anti-inflammatory properties that contribute to plaque stabilization
- Onset is delayed so the therapeutic benefit is not seen until they are started at least two weeks prior to surgery
- Early preop initiation also allows time for gradual titration and management of adverse effects

Revised Cardiac Risk Index (RCRI)
Calculating a Patient's Score:
- 1 point each for
  - High-risk surgery
  - Ischemic heart disease
  - Cerebrovascular disease
  - Renal insufficiency
  - Diabetes mellitus
Functional Capacity

- Expressed in Metabolic equivalents (METS)
- Perioperative cardiac risk is increased in pts who are unable to exercise at 4 METs
- In contrast, pts with excellent functional tolerance are unlikely to have postoperative CV complications even if cardiac risk factors are present
  - Thus ACA/AHA guidelines advise that further cardiac evaluation is NOT needed before surgery in pts with good functional capacity

Perioperative Beta Blocker

NNT (number of patients treated to prevent 1 in-hospital death)

- RCRI = 0, NNT = 2349*
- RCRI = 1, NNT = 864
- RCRI = 2, NNT = 227
- RCRI = 3, NNT = 62
- RCRI ≥ 4, NNT = 33

* pts with HTN only


Perioperative Beta Blocker

NNH (number of patients treated for 1 in-hospital death to occur)

- RCRI = 0, NNH = 208
- RCRI = 1, NNH = 504
  - if patient had
    - DM, NNH = 209
    - ischemic heart disease, NNH = 408
    - cerebrovascular disease, NNH = 410
    - renal insufficiency, NNH = 1505


ACC/AHA Guidelines 2007

Use of Beta Blockers in Noncardiac Surgery

<table>
<thead>
<tr>
<th>Class</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Continue beta blockers in noncardiac-surgery patients currently taking them for any ACC/AHA class I indication (e.g., heart failure), rather than just for angina, symptomatic arrhythmias, or hypertension. Remains a class I indication for beta blockers in patients undergoing vascular surgery whose preoperative testing documents ischemia.</td>
</tr>
<tr>
<td>IIA*</td>
<td>Conflicting evidence, currently weighted in favor of efficacy, perioperative beta blockers may be recommended.</td>
</tr>
<tr>
<td>IIB*</td>
<td>Conflicting evidence, unless well-established, perioperative beta blockers may be considered in patients undergoing intermediate- or high-risk procedures who have a single risk factor and also in vascular surgery patients who have low cardiac risk.</td>
</tr>
<tr>
<td>III</td>
<td>The recommendation against using beta blockers in patients with absolute contraindications still stands (class III).</td>
</tr>
</tbody>
</table>

*The new class II indications for perioperative beta blockade in noncardiac surgery reflect growing evidence of the benefits of beta blockers in patients with coronary heart disease or risk factors for it, especially when undergoing vascular surgery. Class I and III indications have changed little.

Tools for Cardiac Risk Assessment

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>Program</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC/AHA1 2007</td>
<td>STAT Cardiac Clearance</td>
<td><a href="http://www.statcoder.com">http://www.statcoder.com</a></td>
</tr>
<tr>
<td>Detsky6</td>
<td>InfoRetriever</td>
<td><a href="http://www.infopoems.com">http://www.infopoems.com</a></td>
</tr>
</tbody>
</table>
5. The risk of pulmonary complications is increased in the perioperative period by which of the following risk factors?

A. Obesity
B. Surgery distant to the diaphragm
C. Quitting smoking 4 months prior to the procedure
D. Regional anesthesia

5. The risk of pulmonary complications is increased in the perioperative period by which of the following risk factors?

- A. Obesity
- B. Surgery distant to the diaphragm
- C. Quitting smoking 4 months prior to the procedure
- D. Regional anesthesia

Pulmonary Status

- Postoperative pulmonary complications
  - Are as prevalent as cardiac and contribute equally to morbidity, mortality, and LOS
  - Better predictors of long-term mortality after surgery
  - Risk factors
    - HF, COPD, advanced age, need for assist with ADLs
  - American College of Physicians (ACP) guideline (2006) is a good resource
    - http://www.annals.org/content/144/8/575

- Major complications in the perioperative period
  - Atelectasis, bronchitis, and pneumonia
- Predisposing factors
  - Cough, dyspnea, smoking, COPD, obesity, and abdominal or thoracic surgery
  - Greatest risk is how close surgery is to the diaphragm
  - Need to “quit” smoking 8 wks prior to surgery to make a difference

Pulmonary Status

- What tests to consider?
  - CXR
  - Spirometry
  - Both may be appropriate for pts with a previous dx of COPD or asthma
    - Routine use is of little value
  - Laboratory
    - Serum albumin level <35 g/dL
    - BUN >21 mg/dL
    - Both are strongly associated with post/op complications

Consider Delaying Surgery in Pediatric Patients with URI

- General rule of thumb
  - If surgery involves “General” anesthesia and 1 or more of the following risk factors is present,
    - Asthma
    - H/o prematurity
    - Copious secretions
    - A parent who smokes
    - Planned use of an endotracheal tube
    - Procedure involving the airway
Identifying and Minimizing Perioperative Risk: Pulmonary

**Patient-specific Risk Factors**
- Acute URI
- Requiring assistance with ADLs
- Age >60 years
- Elevated BUN (>21 mg/dL)
- COPD
- Hypoalbuminemia (<35 g/dL)
- Presence of any systemic disease

**Procedure-specific Risk Factors**
- Emergency surgery
- General anesthesia
- Surgery >3 h
- Abdominal, head, or neck, thoracic, or vascular surgery
- Neurosurgery

**Risk-reduction Recommendations**
- Postop incentive spirometry
- Postop nasogastric tube
- Consider intraoperative use of LMA
- Smoking cessation (30-60 days preoperatively)

Renal Status

- Scoring system helps evaluate renal risk
  - See “Cardiovascular surgery and acute kidney injury: Scoring the risk” at www.jfponline.com click “Before surgery: Have you done enough to mitigate risk?”
- Pts with CRF are at increased risk, but if the GFR >25 mL/min, surgery is generally well tolerated
- As GFR drops to 10-15 mL/min, rate of surgical complications rises rapidly, 55-60%
  - For such pts, preoperative dialysis is worth considering
- Postoperative acute kidney injury (AKI) has a 58% mortality rate
  - Develops in only 1% of surgical pts

End-Stage Renal Disease

- Very high perioperative morbidity
- Increased risk for
  - Hyperkalemia
  - Infection
  - Hyper/hypotension
  - Bleeding
  - Arrhythmias
  - Clotted fistulas
- Preoperative planning including possible preoperative dialysis may be necessary

Infection Status

- Postoperative infections both at the surgical and remote sites are a significant cause of morbidity and mortality
- Pneumonia is the most prominent remote infection
  - Early ambulation, Incentive Spirometry, tight glycemic control greatly decrease the risk
- SSI (surgical site infections) occur in 37% of cases

Identifying and Minimizing Perioperative Risk: Renal

**Patient-specific Risk Factors**
- Age >60 years
- CRF (especially with creatinine >2.1 mg/dL)
- Diabetes (especially insulin-dependent)
- HF
- Jaundice

**Procedure-specific Risk Factors**
- Heart or cardiovascular surgery
- Liver transplantation

**Risk-reduction Recommendations**
- Ensure preoperative acidemia and good (normal status)
- Minimize exposure to nephrotoxins
- Avoid periparative hypotension (maintain MAP >65 mmHg)
- Consider preoperative dialysis if GFR <15 mL/min

End-Stage Renal Disease

- Very high perioperative morbidity
- Increased risk for
  - Hyperkalemia
  - Infection
  - Hyper/hypotension
  - Bleeding
  - Arrhythmias
  - Clotted fistulas
- Preoperative planning including possible preoperative dialysis may be necessary

Identifying and Minimizing Perioperative Risk: Infectious

**Patient-specific Risk Factors**
- Advanced age
- Corticosteroid use
- Hyperglycemia
- Hypoalbuminemia
- Immunosuppressed
- Malnutrition/obesity
- Peripheral vascular disease
- Postoperative infection
- Pneumonia
- Prior radiation therapy
- Smoking

**Procedure-specific Risk Factors**
- Blood transfusion
- Surgery >3 h
- Preoperative hypothermia
- Preoperative hypoxia
- Preoperative shaving
- Promote hospital stay

**Risk-reduction Recommendations**
- Optimize diabetes management (HbA1c<7) tight perioperative glycemic control
- Treat preexisting infections
- Provide nutritional supplementation (1-14 days preoperatively)
- Smoking cessation (30 days preoperatively)
Hematologic Status

- Bleeding risk
  - Routine testing of surgical patients without synthetic liver dysfunction or history of oral anticoagulant use is of little benefit to assess bleeding risk
  - Obtaining a detailed medical history is much more important to assess bleeding risks
  - Look for physical findings suggestive of increased bleeding risk
- Anemia risk
- Thromboembolism risk

Identifying and Minimizing Perioperative Risk – Hematologic: Perioperative Bleeding

<table>
<thead>
<tr>
<th>Patient-specific Risk Factors</th>
<th>Procedure-specific Risk Factors</th>
<th>Risk-reduction Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collagen vascular disease</td>
<td>Minimally invasive liver surgery</td>
<td>Optimise treatment of pre-existing conditions</td>
</tr>
<tr>
<td>Gl or underranial blood loss</td>
<td>Minimally invasive kidney surgery</td>
<td>Discontinue antithrombotic medications, if medically feasible</td>
</tr>
<tr>
<td>Heavy or prolonged menses</td>
<td>Major vascular surgery</td>
<td>Continue antithrombotic medication use</td>
</tr>
<tr>
<td>Hemorrhagic disease</td>
<td>General surgery</td>
<td>Continue antithrombotic medication use</td>
</tr>
<tr>
<td>Hemophilia or other inherited disorder</td>
<td>Laparoscopic surgery</td>
<td>Continue antithrombotic medication use</td>
</tr>
<tr>
<td>History of excessive bruising or bleeding</td>
<td>Miscellaneous surgery</td>
<td>Continue antithrombotic medication use</td>
</tr>
<tr>
<td>Liver or renal disease</td>
<td>Non-malignant gynecologic surgery</td>
<td>Continue antithrombotic medication use</td>
</tr>
<tr>
<td>Severe bleeding after dental extraction, other surgery, or childbirth</td>
<td>Miscellaneous surgery</td>
<td>Continue antithrombotic medication use</td>
</tr>
<tr>
<td>Physical findings suggestive of purpura, hematoma, jaundice, or cirrhosis</td>
<td>Miscellaneous surgery</td>
<td>Continue antithrombotic medication use</td>
</tr>
<tr>
<td>Use of medications that affect hemostasis</td>
<td>Miscellaneous surgery</td>
<td>Continue antithrombotic medication use</td>
</tr>
</tbody>
</table>

Huntington M, J Fam Pract, April 2010, 59, 202-211

Identifying and Minimizing Perioperative Risk – Hematologic: Perioperative Anemia

<table>
<thead>
<tr>
<th>Patient-specific Risk Factors</th>
<th>Procedure-specific Risk Factors</th>
<th>Risk-reduction Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemoglobinopathies</td>
<td>Correct anemia prior to surgery</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Preexisting iron deficiency anemia</td>
<td>Consider preoperative erythropoiesis</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Preexisting pernicious anemia</td>
<td>Avoid preoperative transfusion</td>
<td>Early mobilization</td>
</tr>
</tbody>
</table>

Identifying and Minimizing Perioperative Risk – Hematologic: Venous thromboembolism

<table>
<thead>
<tr>
<th>Patient-specific Risk Factors</th>
<th>Procedure-specific Risk Factors</th>
<th>Risk-reduction Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute medical illness</td>
<td>Cardiothoracic surgery</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Age (older)</td>
<td>Central versus catheterization</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Cancer (active or occult)</td>
<td>Major surgery (general, gynecologic, orthopedic, peripheral vascular, or urologic)</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Cancer therapy</td>
<td>Neurosurgery</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Erythropoiesis-stimulating agents</td>
<td>Thrombosis</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Immobility</td>
<td>Venous compression</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>IBD</td>
<td>Thrombophilia</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Lower-extremity paresis</td>
<td>Venous compression</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Malignancy or other hematologic disorders</td>
<td>Miscellaneous surgery</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Myeloproliferative disorders</td>
<td>Miscellaneous surgery</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Nephrotic syndrome</td>
<td>Miscellaneous surgery</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Obesity</td>
<td>Miscellaneous surgery</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Paroxysmal nocturnal hemoglobinuria</td>
<td>Miscellaneous surgery</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Pregnancy/postpartum</td>
<td>Miscellaneous surgery</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Previous VTE</td>
<td>Miscellaneous surgery</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Smoking</td>
<td>Miscellaneous surgery</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Thrombophilia</td>
<td>Miscellaneous surgery</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Venous compression</td>
<td>Miscellaneous surgery</td>
<td>Early mobilization</td>
</tr>
</tbody>
</table>

Cardiothoracic surgery: Early mobilization, mechanical prophylaxis, low molecular weight heparin (LMWH, LDUH, Fpx), prophylaxis-guided pharmaceutical prophylaxis, LMWH, Fpx, VKA

Central versus catheterization: Early mobilization, mechanical prophylaxis, LMWH, Fpx, VKA

Major surgery (general, gynecologic, orthopedic, peripheral vascular, or urologic): Early mobilization, mechanical prophylaxis, LMWH, Fpx, VKA

Neurosurgery: Early mobilization, mechanical prophylaxis, LMWH, Fpx, VKA

Thrombosis: Early mobilization, mechanical prophylaxis, LMWH, Fpx, VKA

Venous compression: Early mobilization, mechanical prophylaxis, LMWH, Fpx, VKA

Perioperative Thromboembolism: Risk and Prophylaxis

<table>
<thead>
<tr>
<th>DVT/VTE Risk</th>
<th>Prophylaxis Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (&lt;10%)</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Mobile patients</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Minimal patient-specific risk factors</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Surgery &lt;30 min</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Prolonged menses</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Moderate-risk procedure with high risk of bleeding</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Moderate-risk procedure with high risk of bleeding</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>High (40% - 80%)</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Trauma, major surgery</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Either patient or procedure is at high risk for VTE and patient is at high risk of bleeding</td>
<td>Early mobilization</td>
</tr>
<tr>
<td>Coagulation studies</td>
<td>Do not order routinely</td>
</tr>
<tr>
<td>CBC, platelets</td>
<td>Do not order routinely</td>
</tr>
<tr>
<td>Chest x-ray</td>
<td>It depends. It is not used routinely for predicting risk but may be appropriate for patients with previous exposure to VTE or COPD or asthma.</td>
</tr>
<tr>
<td>Blood urea nitrogen, creatinine, electrolytes</td>
<td>Order for at-risk subpopulations.</td>
</tr>
</tbody>
</table>

When Should You Order These Ancillary Tests?

- Albumin: Order for at-risk populations.
- CBC, platelets: Do not order routinely; check hemoglobin if procedure increases risk for bleeding.
- Coagulation studies: Do not order routinely.
- Chest x-ray: It depends. It is not used routinely for predicting risk but may be appropriate for patients with previous exposure to VTE or COPD or asthma.
- Blood urea nitrogen, creatinine, electrolytes: Order for at-risk subpopulations.

Huntington M, J Fam Pract, April 2010, 59, 202-211
When Should You Order These Ancillary Tests? cont.

Echocardiogram
It is reasonable to order for patients with dyspnea of unknown origin, history of HF and worsening dyspnea, or other change in clinical status and may be considered for patients with previously documented cardiomyopathy.

EKG
Vascular surgery: Order for patients with ≥1 clinical risk; it is also reasonable for patients with no clinical risk factors.

Intermediate-risk procedure:
Order for patients with CHD, PAD, or CVD and consider for patients with ≥1 clinical risk factors.

Exercise stress-testing
Order for patients with active cardiac conditions; it is reasonable for vascular surgery candidates with ≥3 clinical risk factors and poor functional capacity and may be considered for patients undergoing vascular or intermediate-risk procedure who have 1-2 clinical risk factors and poor functional capacity.

Huntington M, J of Fam Pract, April 2010, 59, 202-211

Practice Recommendations

• Identify cardiac, pulmonary, renal, infectious, and hematologic risk factors, and steps that can be taken to minimize risk (SOR:C)

• Check serum albumin levels of all patients at risk for hypoalbuminemia; levels <35 gm/L are strongly associated with postoperative pulmonary complications (SOR:B)

• Help patients with diabetes achieve optimal glycemic control prior to surgery to minimize the risk of infection (SOR:B)

• Avoid routine use of ancillary testing; evidence supports the use of such tests in only a small minority of surgical candidates (SOR:C)

Huntington M, J of Fam Pract, April 2010, 59, 202-211

A 65-year-old ex-smoker is in for a preop evaluation for an elective AAA repair. He is in his normal state of health without any sx of ischemia or DOE at the time of evaluation.

PMH: MI 2 yrs ago, s/p angioplasty and stent placement x 2, HTN, COPD, diet controlled DM

Meds: ASA 81 mg/d, metoprolol 25 mg bid, lisinopril 5 mg/d, simvastatin 20 mg/d, atrovent 2 puffs bid.

VS: BP 100/60, HR 60, RR 14, BMI 26kg/m².

What testing should be considered and what recommendations made for medications prior to surgery?

6. What is the surgery-related risk for this patient?
   A. High
   B. Intermediate
   C. Low

6. What is the surgery-related risk for this patient?
   ✔ A. High
   24% B. Intermediate
   4% C. Low
7. What is the patient-related risk?
   A. Major
   B. Intermediate
   C. Minor

8. What is the RCRI score?
   A. 1
   B. 2
   C. 3
   D. 4
   E. 5

9. What labs should be considered?
   A. Hgb, plts, UA
   B. Hgb, plts, INR/PTT
   C. Serum albumin, BUN, UA
   D. B and C
   E. None
10. What other ancillary tests should be considered?
   A. CXR only  
   B. Spirometry and ECG  
   C. ECG, CXR and Spirometry  
   D. Cardiac stress test and CXR  
   E. None

11. What other recommendations postoperatively would you suggest?
   A. Use of an incentive spirometer (IS)  
   B. Tight glycemic control  
   C. Consider graduated compression stockings (GCSs) or intermittent pneumatic device (IPD)  
   D. All of the above

Preop Evaluation Case Summary
- Surgery-related risk: High-risk procedure
- Patient-related risk: Intermediate and minor clinical predictors; MI >6 wks prior and DM >60 yrs of age
- RCRI score = 3, so perioperative B-blockade is indicated (NNT=62)
- Labs: Hgb, coags, serum albumin, BUN, and a UA should be considered. Increased risk for blood loss, high-risk procedure with COPD and advanced age, so at increased risk for pulmonary complications
- ECG, due to pt age and h/o ischemic disease
- Stress testing not indicated since it is >6 wks since his MI and stenting and is asymptomatic
- CXR and spirometry should be considered due to h/o COPD and ex-smoker
- Recommend post-op IS and tight glycemic control to decrease risk of pulmonary infection and SSI
- Consider GCS or IPD to decrease risk for DVT
General Surgery-Part I: Preoperative Care

Answers

1. B
2. A
3. A
4. E
5. A
6. A
7. B
8. C
9. D
10. C
11. D