PREOPERATIVE TESTING FOR NON-CARDIOTHORACIC SURGERY- ONE SIZE DOES NOT FIT ALL

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Disclaimer

- I have no conflict of interests
- Information pertains to non-cardiothoracic surgery
Objectives

Review best evidence/recommendations for preoperative testing. Looking specifically at:

- ECG/Cardiac Evaluation
- CXR
- Electrolytes and Creatinine
- Glucose and A1C
- Urinalysis
- H/H
- Coagulation Studies
- Cataract Surgery
Dear Dr. Jones:
Your patient will be having cataract surgery and requires preoperative clearance. Please send a recent history and physical and copies of the following tests: EKG, CXR, CBC, BMP, and INR. Thanks for your rapid attention.
What testing should you perform?

1. All the tests asked for
2. EKG and CXR
3. Not sure - need more information
4. EKG only
5. No testing required
Clinical Scenario 2

A 62 year old male with HTN and dyslipidemia reports for an annual wellness visit. He currently has no complaints. He plays tennis 3 days a week with his wife. His medications include HCTZ and simvastatin. No personal or family history of abnormal bleeding. Vitals are stable and exam is unremarkable. He agrees to have a colonoscopy for colo-rectal cancer screening.
What testing should be done before the procedure?

1. ECG, CBC, BMP, and coags
2. ECG
3. CBC and BMP
4. BMP
5. No testing is required
Clinical Scenario 3

A 65 y/o male reports for a preoperative evaluation. He has cholelithiasis and will be having an elective cholecystectomy. He has a history of CABG 5 years ago. His medications include Aspirin, Atorvastatin, and Carvedilol. He golfs twice a week and walks the course without a cart. He has no chest pain or sob when golfing. He has no personal or family history of bleeding problems. Vitals are stable and exam is unremarkable.
What preoperative tests should you order?

1. Stress test, CBC, BMP, and INR
2. ECG only
3. ECG and Stress test
4. ECG, CBC, and BMP
Clinical Scenario 4

A 70 y/o female with a history of a myocardial infarction 2 years ago, CHF, and insulin requiring diabetes reports for preoperative evaluation. She will be having a L carotid endarterectomy. She gets short of breath with walking up one flight of stairs—which is her baseline. No personal or family history of abnormal bleeding. Vitals are stable and exam is unremarkable.
What preoperative testing should be ordered?

1. EKG
2. CBC and BMP
3. CXR
4. Nuclear stress test
5. All of the above
“An extensive systematic review concluded that there was no evidence to support routine preoperative testing.” Level A evidence. AAFP- Preoperative Testing Before Noncardiac Surgery: Guidelines and Recommendations.

“Preoperative tests should not be ordered routinely.” Practice Advisory for Preanesthesia Evaluation An Updated Report by the American Society of Anesthesiologists Task Force on Preanesthesia Evaluation

(Feely et al., 2013; Apfelbaum et al. 2012)
What should testing be based on?

- History and physical exam findings
- Preoperative risk assessment
- Clinical judgment

(Feely et al., 2013)
Why is this important?

- Implications of false positive tests
  - Additional work up required
  - Unnecessary worry
  - Delay in surgery
- Unnecessary cost
- ECG/Cardiac Evaluation
- CXR
- Electrolytes and Creatinine
- Glucose and A1C
- Urinalysis
- H/H
- Coagulation Studies
ECG

- Multiple recommendations from different societies—all are based on low level evidence and expert opinion. Most widely accepted is ACC.

- You need to know the following before you can decide:
  - Current symptoms
  - Type of procedure
  - Cardiac risk factors

(Feely et al., 2013)
Cardiac Risk factors

- Cerebrovascular disease
- Congestive heart failure
- Creatinine level > 2.0 mg per dL
- Diabetes mellitus requiring insulin
- Ischemic cardiac disease

(Feely et al., 2013; Fleischmann et al., 2009)
Stress testing

- Based on similar factors to ECG
  - Presence or Absence of Active Cardiac Conditions
  - Inherent Surgical Risk
  - Functional Capacity
  - Cardiac Risk Factors
ACC/AHA Preoperative Guidelines algorithm for cardiac evaluation prior to non-cardiac surgery

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

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

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

Step 4: Functional capacity greater than or equal to 4 METs without symptoms.‡ (Class I, LOE B)
- Yes: Proceed with planned surgery†
- No

Step 5: No or unknown
- 3 or more clinical risk factors‖: Intermediate risk surgery
- 1-2 clinical risk factors‖: Vascular surgery
- No clinical risk factors‖: Proceed with planned surgery†

Vascular surgery
- Class IIa, LOE B
- Consider testing if it will change management¶

Intermediate risk surgery
- Proceed with planned surgery with HR control ‡ (Class IIa, LOE B)
- or consider noninvasive testing (Class IIb, LOE B) if it will change management

Intermediate risk surgery
- Vascular surgery
- Proceed with planned surgery†
Active Cardiac Conditions for Which the Patient Should Undergo Evaluation and Treatment Before Noncardiac Surgery (Class 1, LOE: B)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unstable coronary syndromes</td>
<td>- Unstable or severe angina* (CCS class III or IV)†</td>
</tr>
<tr>
<td></td>
<td>- Recent MI‡</td>
</tr>
<tr>
<td>Decompensated HF (NYHA functional class IV; worsening or new-onset HF)</td>
<td></td>
</tr>
<tr>
<td>Significant arrhythmias</td>
<td>- High-grade atrioventricular block</td>
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<tr>
<td></td>
<td>- Mobitz II atrioventricular block</td>
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<tr>
<td></td>
<td>- Third-degree atrioventricular heart block</td>
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<tr>
<td></td>
<td>- Symptomatic ventricular arrhythmias</td>
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<tr>
<td></td>
<td>- Supraventricular arrhythmias (including atrial fibrillation) with uncontrolled ventricular rate (HR &gt; 100 bpm at rest)</td>
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<tr>
<td></td>
<td>- Symptomatic bradycardia</td>
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<tr>
<td></td>
<td>- Newly recognized ventricular tachycardia</td>
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<tr>
<td>Severe valvular disease</td>
<td>- Severe aortic stenosis (mean pressure gradient &gt; 40 mm Hg, aortic valve area &lt; 1.0 cm², or symptomatic)</td>
</tr>
<tr>
<td></td>
<td>- Symptomatic mitral stenosis (progressive dyspnea on exertion, exertional presyncope, or HF) or MVA&lt;1.5 cm²</td>
</tr>
</tbody>
</table>

CCS indicates Canadian Cardiovascular Society; HF, heart failure; HR, heart rate; MI, myocardial infarction; NYHA, New York Heart Association. *According to Campeau. †May include stable angina in patients who are unusually sedentary. ‡The ACC National Database Library defines recent MI as more than 7 days but within 30 days. (Fleischmann et al., 2009)
# Cardiac Risk Stratification for Noncardiac Surgical Procedures

<table>
<thead>
<tr>
<th>Risk Stratification</th>
<th>Procedure Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vascular (reported cardiac risk often &gt; 5%)</td>
<td>Aortic and other major vascular surgery</td>
</tr>
<tr>
<td></td>
<td>Peripheral vascular surgery</td>
</tr>
<tr>
<td>Intermediate (reported cardiac risk generally 1%-5%)</td>
<td>Intraperitoneal and intrathoracic surgery</td>
</tr>
<tr>
<td></td>
<td>Carotid endarterectomy</td>
</tr>
<tr>
<td></td>
<td>Head and neck surgery Orthopedic surgery</td>
</tr>
<tr>
<td></td>
<td>Prostate surgery</td>
</tr>
<tr>
<td>Low† (reported cardiac risk generally &lt;1%)</td>
<td>Endoscopic procedures</td>
</tr>
<tr>
<td></td>
<td>Superficial procedure /Breast surgery</td>
</tr>
<tr>
<td></td>
<td>Cataract surgery</td>
</tr>
<tr>
<td></td>
<td>Ambulatory surgery</td>
</tr>
</tbody>
</table>

(Fleischmann et al., 2009)
## Estimated Energy Requirements for Various Activities

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

MET indicates metabolic equivalent; mph, miles per hour; kph, kilometers per hour. *Modified from Hlatky et al, copyright 1989, with permission from Elsevier, and adapted from Fletcher et al.
Cardiac Risk Factors

- Cerebrovascular disease
- Congestive heart failure
- Creatinine level > 2.0 mg per dL
- Diabetes mellitus requiring insulin
- Ischemic cardiac disease
ACC/AHA Preoperative Guidelines algorithm for cardiac evaluation prior to non-cardiac 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

Step 2: Active cardiac conditions?
- Yes (Class I, LOE B) → Evaluate and treat per ACC/AHA guidelines → Consider operating room
- No → Step 3

Step 3: Low risk surgery
- Yes (Class I, LOE B) → Proceed with planned surgery†
- No → Step 4

Step 4: Functional capacity greater than or equal to 4 METs without symptoms.
- Yes (Class IIa, LOE B) → Proceed with planned surgery†
- No → Step 5

Step 5: No or unknown
- Vascular surgery
  - Class IIa, LOE B → Consider testing if it will change management
- Intermediate risk surgery
  - 3 or more clinical risk factors
    - Proceed with planned surgery with HR control† (Class IIa, LOE B) or consider noninvasive testing (Class IIb LOE B) if it will change management
  - 1-2 clinical risk factors
    - Vascular surgery
    - Intermediate risk surgery
  - No clinical risk factors
    - Class I, LOE B → Proceed with planned surgery†
Take home point- Preoperative cardiac testing is not indicated for asymptomatic patients undergoing a low risk procedure or patients with good functional capacity undergoing higher risk procedures.
- ECG/Cardiac Evaluation
- **CXR**
- Electrolytes and Creatinine
- Glucose and A1C
- Urinalysis
- H/H
- Coagulation Studies
General consensus that routine CXR is not indicated.

- False positive findings in asymptomatic patient
- Findings on routine preoperative CXR rarely affect preoperative management
- Abnormal findings on screening CXR can be predicted by history and physical
- Even in patients at risk for pulmonary complications- no evidence that CXR alters outcomes more than findings on history and physical exam

(Feely et al., 2013; Apfelbaum et al., 2012; Qaseem, et al., 2006)
Decision to order CXR should be based on clinical findings

- Should be ordered for new or unstable cardiopulmonary disease.
- Consider if the findings will change the course of perioperative management

(Feely et al., 2013; Apfelbaum et al., 2012; Qaseem, et al., 2006)
ECG/Cardiac Evaluation
CXR
*Electrolytes and Creatinine*
Glucose and A1C
Urinalysis
H/H
Coagulation Studies
Electrolytes and Creatinine

- Routine measurement is not recommended.
  - No data shows changes in outcomes with routine screening.
- Screening should be based on history and physical findings that increase likelihood of abnormalities
  - Consider specific conditions- renal disease, liver disease, heart failure, complicated diabetes, hypertension, etc.
  - Consider medications- ACE inhibitors, ARBs, diuretics, etc.

(Feely et al., 2013; Apfelbaum et al., 2012)
- ECG/Cardiac Evaluation
- CXR
- Electrolytes and Creatinine
- *Glucose and A1C*
- Urinalysis
- H/H
- Coagulation Studies
Glucose and A1C

- In patients without diabetes testing should be performed on patients with clinical symptoms of diabetes.
- In patients with diabetes the testing should be performed if the results would alter perioperative management. Example: delay surgery until blood glucose is under better control.

(Feely et al., 2013)
- ECG/Cardiac Evaluation
- CXR
- Electrolytes and Creatinine
- Glucose and A1C
- Urinalysis
- H/H
- Coagulation Studies
Urinalysis

- Should be based on results from history and physical- in other words asymptomatic patients should not be tested

- Two exceptions
  - Should be performed in all patients that will have foreign material implanted- joints, heart valve, etc.
  - Should be performed in all patients having an invasive urologic procedure

(Feely et al., 2013)
- ECG/Cardiac Evaluation
- CXR
- Electrolytes and Creatinine
- Glucose and A1C
- Urinalysis
- \textit{H/H}
- Coagulation Studies
Hemoglobin/Hematocrit

- Association with poor outcome for abnormal hematocrit/hemoglobin- however incidence is low- question is who to test
- Test those that have increased risk for anemia based on history and physical- chronic inflammatory disease, chronic renal disease, chronic liver disease, clinical signs or symptoms of anemia
- Also test those that are having surgery were significant blood loss is expected.

(Wu et al., 2007; Feely et al., 2013)
- ECG/Cardiac Evaluation
- CXR
- Electrolytes and Creatinine
- Glucose and A1C
- Urinalysis
- CBC
- Coagulation Studies
Coagulation Studies

- Routine testing not recommended
  - Low prevalence of inherited coagulopathies
  - Often times the most common disorder (von Wilebrand disease) shows normal routine coagulation tests

- Testing should be based on clinical findings
  - Medical conditions with increased risk of abnormalities- liver disease, disease of hematopoiesis, etc.
  - Use of anticoagulants
  - Abnormal bleeding history- excessive bruising, excessive surgical bleeding, family history of bleeding problems

(Feely et al., 2013)
Preoperative testing is not required for patients in their usual state of health

- A randomized controlled trial with more than 19,000 patients showed no difference between no preoperative testing and usual care.
- Cochrane review in 2012 looked at three randomized controlled trials with 21,531 and showed no difference in outcome with preoperative testing opposed to no testing. Costs were 2.55 times higher in the preoperative testing group.

(Feely et al. 2013; Keay et al. 2012)
Back to the Cases
Your patient reports to your office with the following note:

Dear Dr. Jones:
Your patient will be having cataract surgery and requires preoperative clearance. Please send a recent history and physical and copies of the following tests: EKG, CXR, CBC, BMP, and INR. Thanks for your rapid attention.
What testing should you perform?

1. All the tests asked for
2. EKG and CXR
3. Not sure- need more information
4. EKG only
5. No testing required
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<th>Test Requested</th>
<th>All the tests asked for</th>
<th>EKG and CXR</th>
<th>Not sure - need more information</th>
<th>EKG only</th>
<th>No testing required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integer Value</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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A 62 year old male with HTN and dyslipidemia reports for an annual wellness visit. He currently has no complaints. He plays tennis 3 days a week with his wife. His medications include HCTZ and simvastatin. No personal or family history of abnormal bleeding. Vitals are stable and exam is unremarkable. He agrees to have a colonoscopy for colo-rectal cancer screening.
What testing should be done before the procedure?

1. ECG, CBC, BMP, and coags
2. ECG
3. CBC and BMP
4. BMP
5. No testing is required
ECG, CBC, BMP, and coags

No testing is required
A 65 y/o male reports for a preoperative evaluation. He has cholelithiasis and will be having an elective cholecystectomy. He has a history of CABG 5 years ago. His medications include Aspirin, Atorvastatin, and Carvedilol. He golfs twice a week and walks the course without a cart. He has no chest pain or sob when golfing. He has no personal or family history of bleeding problems. Vitals are stable and exam is unremarkable.
What preoperative tests should you order?

1. Stress test, CBC, BMP, and INR
2. ECG only
3. ECG and Stress test
4. ECG, CBC, and BMP
Stress test, CBC, BMP, and INR

ECG only

ECG and Stress test

ECG, CBC, and BMP
Clinical Scenario 4

A 70 y/o female with a history of a myocardial infarction 2 years ago, CHF, and insulin requiring diabetes reports for preoperative evaluation. She will be having a L carotid endarterectomy. She gets short of breath with walking up one flight of stairs—which is here baseline. No personal or family history of abnormal bleeding. Vitals are stable and exam is unremarkable. What preoperative testing should be ordered?
What preoperative testing should be ordered?

1. EKG
2. CBC and BMP
3. CXR
4. Nuclear stress test
5. All of the above
EKG
CBC and BMP
CXR
Nuclear stress test
All of the above
Evidence does not support routine preoperative testing.

Preoperative testing should be based on clinical findings and operative risk.

Patients undergoing low risk surgery in their usual state of health require minimal if any testing.

Patients with good functional capacity in their usual state of health do not require extensive preoperative testing irrespective of the type of surgery they will undergo.
Sources

THE END