Perioperative Medicine

2016 UPDATE
TENNESSEE ACP
A 73 y.o. man with hypertension and diabetes presents with bilateral lower extremity claudications and a non-healing ulcer on his left ankle. He can ambulate only 50 feet without pain. Medications are lisinopril, glargine insulin, aspirin, and metoprolol. He smokes one pack cigarettes per day. Height is 6 feet and weight 230 pounds. Lab shows creatinine of 2.1. Further evaluation reveals the need for an aortofemoral bypass graft. What is his risk of death and major cardiac complication from the surgery? Should his surgery be delayed for CDV evaluation? Should ASA be held perioperatively?
Case One – Risk Stratification

A. 1.1%
B. 3.4%
C. 7%
D. 11%
E. 25%

"Nurse, has the staff been eating in pre-op again? There's mayonnaise on the scalpel."
Case One - Choices

A. 1.1%
B. 3.4% (based on ACS NSQIP calculator)
C. 7%
D. 11% (based on old revised cardiac risk index)
E. 25%

Answers the question: what is the combined risk of major CDV complications and death?
ACS – NSQIP Risk Calculator

- 1.4 million patients
- 393 hospitals
- Dataset from 2009-2012
- 1557 CPT codes
- 21 patient characteristics
- 8 complications
- Average length of stay

http://riskcalculator.facs.org/

Types of Procedures

- Anorectal
- Aortic
- Bariatric
- Brain
- Breast
- Cardiac
- ENT
- Foregut/hepatopancre-atobiliary
- GB/adrenals/appendix/spleen
- Hernia

- Intestinal
- Neck
- Nonesophageal thoracic
- Ob-gyn
- Orthopedic
- Other abdominal
- Peripheral vascular
- Skin
- Spinal
- Urologic
- Vein
### ACS NSQIP Patient Characteristics

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Diabetes</th>
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<tbody>
<tr>
<td>Age</td>
<td>Disseminated Cancer</td>
</tr>
<tr>
<td>Sex</td>
<td>Hypertension</td>
</tr>
<tr>
<td>Functional Status</td>
<td>Previous Cardiac Event</td>
</tr>
<tr>
<td>Emergency</td>
<td>CHF</td>
</tr>
<tr>
<td>ASA Class</td>
<td>Dyspnea</td>
</tr>
<tr>
<td>Wound Class</td>
<td>Current Smoker</td>
</tr>
<tr>
<td>Steroid Use</td>
<td>Severe COPD</td>
</tr>
<tr>
<td>Ascites Within 30 Days</td>
<td>Dialysis</td>
</tr>
<tr>
<td>Sepsis</td>
<td>Acute Renal Failure</td>
</tr>
<tr>
<td>Ventilator Dependent</td>
<td>BMI (Ht, Wt)</td>
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</tbody>
</table>
ACS NSQIP Complications

- Any complication 29%
- Serious complication 24.6%
- Pneumonia 2.3%
- Cardiac event 1.5%
- Death 1.9%
- Surgical Site Infection 9%
- UTI 1.5%
- DVT 0.4%
- Renal failure 2.6%
- Return to OR 14.1%
- Rehab or NH 27.7%

LOS – 7.5 days

I CAN'T SAY I'M ENTIRELY PLEASED WITH MY HIP REPLACEMENT.
## Comparison of ACS NSQIP and RCRI

<table>
<thead>
<tr>
<th></th>
<th><strong>ACS NSQIP</strong></th>
<th><strong>Lee</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year</strong></td>
<td>2013</td>
<td>1999</td>
</tr>
<tr>
<td><strong>Patient Numbers</strong></td>
<td>1,414,000 (NSQIP – 393 hospitals – 2007-2012 data)</td>
<td>4,315 (one hospital)</td>
</tr>
<tr>
<td><strong>Measurements</strong></td>
<td>21 variables</td>
<td>Presence of CHF, CAD, CKD, CVA/TIA, insulin-requiring DM, high risk surgery</td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
<td>8 outcomes – death, VTE, UTI, PNA, MI/arrest, morbidity, AKI, surgical infection</td>
<td>Major cardiac morbidity and mortality*</td>
</tr>
</tbody>
</table>

*Defined as MI, pulmonary edema, VF, cardiac arrest, complete heart block. MI with elevated CK-MB (>5%) or >3% with EKG ischemic changes.
10% of US hospitals and 30% of all surgeries comprised the database
CPT codes - 99% with 25+ cases and 94% with 200+ cases
Universal risk calculator was compared with earlier colectomy calculator - highly comparable
C-statistic – probability that outcome is better than chance. 0.8-0.94.
Hosmer-Lemeshow statistic – measures observed data vs data predicted by the model. Model performs well.
Brier score – compares predicted vs. observed outcomes. Zero is correct and one is wrong. 0.006 to 0.069.
# ASA Class Details

<table>
<thead>
<tr>
<th>ASA Class</th>
<th>Physical Status</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Healthy</td>
<td>DM, HTN, obesity, seizure disorder – all well controlled</td>
</tr>
<tr>
<td>2</td>
<td>Well-controlled mild systemic disease</td>
<td>Angina pectoris, hx. of MI or CVA. CHF &gt; 6 months ago, DM with vascular problems, poorly controlled HTN</td>
</tr>
<tr>
<td>3</td>
<td>Severe systemic disease with functional limitation</td>
<td>Unstable angina. MI or stroke &lt; 6 months, severe CHF or COPD, uncontrolled DM or HTN.</td>
</tr>
<tr>
<td>4</td>
<td>Severe systemic disease and a threat to life</td>
<td>Ruptured AAA, pulmonary embolus, CNS injury with ICP increase</td>
</tr>
<tr>
<td>5</td>
<td>Moribund and cannot survive without surgery</td>
<td></td>
</tr>
</tbody>
</table>
Activities of Daily Living (ADLs)

- Ambulation
- Toileting
- Bathing
- Transfers
- Eating
- Dressing
Limitations of the ACS NSQIP Calculator

- Transplants and trauma surgeries not included
- Indications for procedure not included
- Fudge factor included if surgeon (or internist) believes risk is higher
- No prospective external evaluation of the calculator – validated against a previously validated standard
A 73 y.o. man with hypertension and diabetes presents with bilateral lower extremity claudications and a non-healing ulcer on his left ankle. He can ambulate only 50 feet without pain. Medications are lisinopril, glargine insulin, aspirin, and metoprolol. He smokes one pack cigarettes per day. Height is 6 feet and weight 230 pounds. Lab shows creatinine of 2.1. Further evaluation reveals the need for an aortofemoral bypass graft. What is his risk of death and major cardiac complication from the surgery? Should his surgery be delayed for CDV evaluation? Should ASA be held perioperatively?
AHA Algorithm - 2014

- **Acute coronary syndrome**
  - Severe valvular disease, severe arrhythmia, decompensated CHF, Class III+ angina or recent MI – manage by guidelines

- **Low risk surgery** (vs. high risk with > 1% complications)
  - Endoscopic, superficial, ambulatory, cataract, breast

- **Functional capacity >/= 4 METS**
  - Washing dishes, dusting, 1 flight stairs, sexual activity, bicycling, singles tennis

- **Clinical risk factors**
  - CAD, CHF, insulin-requiring DM, CKD with creatinine >/= 2, cerebrovascular disease
Answers the question: should surgery be delayed?

POISE-2 Trial

- 10,010 patients undergoing non-cardiac surgery (78% major surgery)
- High risk for CDV complications – 33% with vascular disease, mean age 68.6, 37.5% on diabetic medication.
- Intervention – ASA at 100-200 mg/day vs. no ASA (if on ASA, none for 4-8 days preop and not resumed until 8 days postop)
- Death and fatal MI same (7%) at 30 days. Major bleeding 4.6% with ASA and 3.8% without ASA.

Answers the question: should ASA be held?

Conclusions from Case One

- Expect overall risk for death and major cardiac complications to be 3.4%.
- Consider pharmacologic cardiac imaging in view of high risk surgery and poor exercise tolerance. Do not expect to improve perioperative outcome, but possibly improve long term outcome.
- Hold aspirin for 4-8 days preoperatively and eight days postoperatively based upon POISE -2 trial.
A 67 y.o. woman is referred to you for medical management perioperatively for an elective cholecystectomy following an episode of acute pancreatitis five days ago. Abdominal US showed gallstones. She received a drug-eluting coronary stent seven months ago and is on aspirin, clopidogrel, metoprolol, and atorvastatin. She takes rivaroxaban for chronic atrial fibrillation. She is able to walk a half mile without symptoms. How should her medications be managed perioperatively?
Case 2 – Cardiac Medication Management

- A. Stop aspirin, clopidogrel, and rivaroxaban preoperatively and resume postoperatively.
- B. Stop all three above but bridge perioperatively with low molecular weight heparin.
- C. Stop clopidogrel and rivaroxaban, but leave on aspirin.
- D. Delay surgery for five months and then do C.
- E. Continue all medications except the rivaroxaban.
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Antiplatelet Therapy, Stents, and Surgery


Warning: do not stop the aspirin.
BRIDGE Study

- 1884 patients with atrial fibrillation undergoing surgical procedures
- 1-6 CHADS2 score with 38% at 3+
- Exclusions – mechanical heart valves, stroke, systemic embolism, recent TIA, cardiac/intracranial/intraspinal surgery.
- Warfarin stopped five days before and LMWH started three days before with last dose at 24 hours pre-procedure. Warfarin resumed within 24 hours and LMWH resumed 24-72 hours post-procedure
- No difference in mortality, no difference in arterial TE, but major bleeding in 3.2% of bridged (vs. 1.3%).

Holding Anticoagulation for Surgery

- Warfarin – 5 days. Resume within 24 hours postop.
- LMWH – 24 hours. Resume at 12-72 hours postop.
- Fondaparinux – 36-48 hours.
- Dabigatran – 1-2 days if CC > 50; 3-5 days if CC < 50
- Rivaroxaban – 1 day; 2 days if CC 60-90; 3 days if CC 30-59; 4 days if CC 15-29
- Apixaban – 1-2 days; 3 days if CC 50-59; 5 days if CC < 30-49.

Zheng Z et al. NEJM 2016;374:1744-57. — Rosuvastatin caused AKI and did not prevent MI or atrial fibrillation in cardiac surgery. Initiated 8 days preoperatively. 1922 patients.

Billings FT et al. JAMA 2016;315:877-888 — Atorvastatin did not prevent AKI in cardiac surgery patients. 617 patients.

Elgendy IY et al. AJC 2015;115:1523-28 — Atorvastatin reduced the risk of atrial fibrillation in CABS patients. 2980 patients. May need at least two weeks for effect.

Antoniou G et al. J Vasc Surg 2015;61:519-532 — Statins reduced all cause mortality, stroke, and MI. No difference in AKI. All types of non-cardiac vascular surgery — 23,536 patients, but only 675 from RCTs.
Base Statin Use on ACC/AHA Guidelines

- **L** – LDL > 190
- **A** – Atherosclerotic disease
- **R** – 10-year risk of > 7.5%
- **D** – diabetes present


http://tools.cardiosource.org/ASCVD-Risk-Estimator/
A 70 y.o. man is referred for preoperative evaluation prior to an elective total knee arthroplasty. He has hypertension controlled on HCTZ and amlodipine but no other medical illnesses. He takes ibuprofen to control his osteoarthritis symptoms and also omeprazole to prevent NSAID-induced bleeding. He feels fatigued and occasionally sleepy during the day. He denies any unusual bleeding or history of blood transfusions. On examination: T - 98.2 degrees, P-62, BP 145/95, R-16, height- 5 feet 9 inches, and weight - 252 pounds. SaO2 is 94%. CBC and BMP are normal. EKG shows a normal sinus rhythm. What additional evaluation should be done prior to surgery?
Case 3 – Preoperative Testing

A. Pro-time and APTT
B. Chest X-ray
C. Sleep study
D. Liver enzymes
E. No additional evaluation
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Case 3 – Sleep Apnea and Surgery

- 7-25% of patients undergoing surgery have sleep apnea
- Complications attributable to sleep apnea
  - Cardiac events
  - Acute respiratory failure
  - Postoperative oxygen desaturation
  - Postoperative ICU transfer
  - Overall 2-3X increased risk of postop complications
  - No definite decrease in surgical mortality, but decrease in mortality long-term with use of CPAP
Screening for Sleep Apnea

- **S** – Do you snore loudly
- **T** – Do you feel tired, fatigued, or sleepy during the day
- **O** – Has anyone observed you stop breathing during sleep
- **P** – Do you have high blood pressure
- **B** – BMI $\geq 35$ kg/m$^2$
- **A** – Age $> 50$
- **N** – Neck circumference $> 40$ cm
- **G** – Male?
Interpretation of Stop-Bang

- High risk for OSA $\geq 3$ points
- Sensitivity 84% and specificity 56%
- Critical care admission odds ratios
  - 4 points – 2.2
  - 5 points – 3.2
  - 6 points – 5.1
Screening and Then What?

- Consider sleep study. Unclear if treatment then improves outcomes.
- Consider mandibular device.
- Prepare for difficult intubation.
- Use local/regional anesthesia if possible.
- Use upright/lateral positioning.

- Continuous pulse ox even after recovery room.
- If moderate sedation, use capnography monitor.
- Extubate when awake.
- Avoid continuous opiates.
- Consider use of autotitrating CPAP postoperatively.

American Society of Anesthesiologists. Practice guidelines for the perioperative management of patients with OSA. Anesthesiology 2014;120:268-286.
1. Screen only patients with high probability of OSA plus uncontrolled systemic conditions such as hypoventilation syndromes, severe pulmonary hypertension, or resting hypoxemia. Also excepted: bariatric surgery, tonsillectomy.

2. Prepare to mitigate for complications related to OSA.

3. Notify primary care physician that evaluation for OSA is needed as an outpatient.

A 71 y.o. man receives a right total hip arthroplasty. The surgery was uneventful. The following morning he spikes a fever to 101.3 degrees. He denies headache, cough, dyspnea, chest or abdominal pain, or dysuria. Physical examination reveals a nonerythematous oropharynx, clear lungs, no cardiac murmur, and no abdominal tenderness. The wound per orthopedic surgery shows no unusual redness or drainage. What should be ordered at this time?
Case 4 – Postoperative Fever

- CBC with differential
- Blood cultures
- Chest X-ray
- Urinalysis and culture
- Ultrasound of right leg
- No further evaluation
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- CBC with differential
- Blood cultures
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- Urinalysis and culture
- Ultrasound of right leg
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The “Ws” of Postoperative Fever

- Wound
- Water
- Wonder Drug
- Walk
- Wind – PNA, not atelectasis
- Wire
- What Else – MI, gout, pancreatitis, sinusitis, benign postop fever

A 52 y.o. woman is scheduled for a hysterectomy due to uterine myomata with severe anemia. She has no medical problems other than menorrhagia and takes no medications other than oral ferrous sulfate. She has no history of DVT/PE and no family history of hypercoagulability. BMI is 31. Her hemoglobin is 8.1 following menses one week ago. In preparation for surgery should she be given PRBCs and what should be used for perioperative DVT prophylaxis?
Case Five – DVT Prophylaxis Choices

- A. No DVT prophylaxis indicated
- B. Mechanical prophylaxis only
- C. Prophylaxis with SQ heparin
- D. Prophylaxis with LMWH
- E. Prophylaxis with both mechanical and pharmacologic methods (e.g., LMWH)
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Use DVT risk scoring system such as Caprini

Caprini score is 4 – moderate risk (3-4 = MR, 5+ = HR)
- One point – age 41-60
- One point – BMI > 25
- Two points – major surgery (> 45 minutes)

Assess bleeding risk – low based upon HASBLED score

Use LMWH, LDUH, or mechanical prophylaxis


HAS-BLED Score

- Hypertension – SBP > 160 1 point
- Abnl renal function – Crt > 2 1 point
- Abnl liver function – crh, TB 2x, TA 3x 1 point
- Stroke 1 point
- Bleeding tendency – diathesis, previous 1 point
- Elderly - > 65 1 point
- Drugs – NSAIDs, antiplatelets 1 point
- Drugs – alcohol 1 point

> /= 3 is high risk; usually IPC only for DVT prevention

http://www.mdcalc.com/has-bled-score-for-major-bleeding-risk/
Case Five – DVT Prophylaxis

A 52 y.o. woman is scheduled for a hysterectomy due to uterine myomata with severe anemia. She has no medical problems other than menorrhagia and takes no medications other than oral ferrous sulfate. She has no history of DVT/PE and no family history of hypercoagulability. BMI is 31. Her hemoglobin is 8.1 following menses one week ago. In preparation for surgery should she be given PRBCs and what should be used for perioperative DVT prophylaxis?
**Case Five – Transfusion Choices**

- A. No PRBCs indicated
- B. Type and screen for two units PRBCs before surgery
- C. Type, cross match, and give two units of PRBCs before surgery
- D. Administer IV iron and operate when hemoglobin is 10 or above
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- A. No PRBCs indicated
- B. Type and screen for two units PRBCs before surgery
- C. Type, cross match, and give two units of PRBCs before surgery
- D. Administer IV iron and operate when hemoglobin is 10 or above
In general do not transfuse until Hg < 7-8.

Exception is in ACS and cardiac surgery where goal Hg may be >/= 9-10.

Single unit transfusions are associated with infection, MI, stroke, and malignant ventricular arrhythmias.

Transfusions already known to increase infection risk, increase overall mortality – or do they??


Case Five – When Transfusion is OK

- **Cardiac Surgery**
  - Murphy et al. NEJM 2015; 372:997-1008
  - 2000 patients. Threshold was 7.5 (restrictive) or 9 (liberal)
  - CABS 41% and valve surgery 31%
  - No difference in outcomes (infection, ischemic event)
  - Significant increase in mortality in restrictive group (4.2% vs. 2.6%)

- **Noncardiac Surgery**
  - Docherty et al. BMJ 2016;352:1351
  - Meta-analysis and systematic review of 11 trials
  - Restrictive (<8 Hg) with non-significant increase in mortality, increased risk of ACS (4.6% vs 2.7), but decreased risk of pulmonary edema. Liberal was 9-10 Hg.

- **Hip surgery**
  - 2016 patients with hip fracture. Median age was 81.6 years and 63% with CDV disease.
  - Restrictive with transfusion < 8 Hg. Liberal with transfusion < 10 Hg.
  - No increased death risk in 3 years in liberal and restrictive groups.
A 55 y.o. man undergoes a hemicolecotony for an adenocarcinoma detected by colonoscopy. He has hypertension and T2 diabetes controlled with lisinopril and amlodipine. Despite early enteral feedings, at four days after surgery he develops abdominal distension, vomits his feedings, and has no flatus or stool. His bowel sounds are hypoactive, and a KUB shows diffuse distension with air throughout the large and small intestines. CT abdomen confirms a nonobstructing ileus. CBC and electrolytes are checked and an NG tube placed.
Case Six - Ileus

What might have been done immediately postoperatively to prevent ileus?

- A. Gum-chewing
- B. Neostigmine
- C. Daikenchuto
- D. Total parenteral nutrition
- E. Coffee
Case Six - Ileus

What might have been done immediately postoperatively to prevent ileus?

- A. Gum-chewing
- B. Neostigmine
- C. Daikenchuto
- D. Total parenteral nutrition
- E. Coffee
Gum Chewing

- 120 patients with colon resections randomized to gum chewing or dermal patch (control)
- Three sticks gum per hour initiated preoperatively but patients could refuse.
- Postop ileus – 27% gum chewers vs 48% of controls.
- Stooling $<=$ 4 days in 85% vs. 57% controls. Flatus $<=$ 48 hours in 65% vs. 50% controls.
- Improved gastric emptying and reduction in IL-8 and TNF in gum chewers.

Heijkant TC et al. Randomized, clinical trial of the effect of gum chewing on POI and inflammation in colorectal surgery. BJS 2015;102:202-211.
Other Treatments

- Coffee – beneficial in 2012 BJS trial involving 80 colectomy patients. Coffee vs. water – 100 cc tid. First stool at 60 hours with coffee and 74 hours with water. Further studies in progress with caffeine.
- Avoid routine NG tube placement after GI surgery.

Cardinale D et al. Prevention of A-fib in high risk patients undergoing lung cancer surgery. Ann Surg. 2016;264:244-51. BB and ARB started postop within 12 hours based on elevated NT-proBNP levels. Dose was 25 bid increased to 100 bid metoprolol and 12.5 bid increased to 50/day losartan. Rates of A-fib of 6-12% on meds and 40% without.

Cheungpasitporn W et al. Preop ACEI, ARB use linked to reduced AKI: systematic review and meta-analysis. Nephrol Dial Transplant 2015;30:978-988. 102675 patients. CT and noncardiac surgeries. Better studies showed AKI risk of 0.52 if used > 2 weeks preop.

Munster AB et al. Temporal trends in safety of CEA in asymptomatic patients. Neurology 2015;85:365-372. Expected stroke and death risk is 1.2% at 30 days with 0.4% mortality. This suggests a role for CEA in asymptomatic stenosis.
Other Key Literature Changing Practice

- Sessler DI, Devereaux PJ. Perioperative troponin screening. Anesth Analg 2016;123:359-60. Suggests screening T on POD 1/2/3 in all patients over 45. NNT only 15. Mortality is 10% if MI with threshold of >/= 0.03 ng/ml.
Other Key Literature Changing Practice

- Sonny A et al. Lack of association between carotid artery stenosis and stroke or MI after noncardiac surgery in high-risk patients. Anesthesiology. 2014;121:922-9. Retrospective study of 2110 patients (HR- majority with CAD, half with PVD) who had carotid US/Doppler performed near time of surgery. No correlation between asymptomatic CAS and perioperative stroke or MI. Don’t look for it.
Perioperative Mnemonic

- Anesthesia and ADLs
- Bleeding
- Corticosteroid Use
- Drug Use
- Exercise
Preoperative Assessment - Summary

- Cardiovascular – ACS NSQIP risk calculator, AHA algorithm, postoperative MI surveillance
- Pulmonary – Gupta or Ariscat respiratory failure assessment, smoking cessation, DVT prophylaxis
- Endocrine – DM management, adrenal assessment and supplementation
- Hematology – platelets > 50,000, INR < 1.5, Hg > 7-8
- GI/Hepatology – MELD or Child-Pugh scales
  [https://itunes.apple.com/us/app/model-for-end-stage-liver/id955166907?mt=8]
  [http://www.mdcalc.com/child-pugh-score-for-cirrhosis-mortality/]
Preoperative Assessment - Summary

- Rheumatology – C-spine stability, cricoarytenoid dysfunction, Raynaud’s management
- Nephrology – dialysis timing, electrolyte and fluid corrections
- Infectious Diseases – endocarditis prophylaxis (high risk cardiac lesion and high risk procedure)
- Neurology – AED level, delirium prevention, specific disease management
- Pharmacology – medication management in setting of NPO status
The End Is In Sight

They hold elections in November because it's the best time for picking out a turkey.

POLITICS NEWS:
Unemployment rose by 535 as Congress gets back to work.