Pearls of Perioperative Medicine

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Objectives

- Medical management
  - Anticoagulation
  - Chronic steroid use
  - Hyperglycemia
- Medical “Clearance”
  - Do not express opinion on whether or not to proceed with surgery
  - Express risk of surgery

Perioperative Medicine

- Pre-operative Medication Management
- Post-operative Medication Management
- Risk Stratification (“pre-op” evaluation)

Pre-operative Medications

- Anticoagulation
- Glucocorticoids
- Hyperglycemia
- β-Blockers

Pre-operative Medications

- Anticoagulation
  - Aspirin (stop 7-10 days before surgery)
  - NSAIDs (stop 7 days before surgery)
  - Plavix (stop 5 days before surgery)
  - Coumadin (stop 4 days before surgery)
  - Bridging

Pre-operative Medications

- Bridging
  - Low risk for thromboembolism
    - a fib
  - No coumadin for 4 days before surgery
  - No heparin or LMWH

Pre-operative Medications

- Bridging
  - Intermediate risk for thromboembolism
    - a fib with $CHADS_2$ score ≥ 4
  - No coumadin for 4 days before surgery
  - Heparin 5000 units/day or LMWH ½ mg/kg/day for 2 days before surgery

$CHADS_2$ Score

C	Congestive Heart Failure	1
H	Hypertension	1
A	Age > 75 years	1
D	Diabetes	1
S_2	Stroke or TIA	2

$CHADS_2$ Score

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Annual Stroke Risk

$CHADS_2$ Score	Stroke Risk %
0	1.9
1	2.8
2	4.0
3	5.9
4	8.5
5	12.5
6	18.2

Pre-operative Medications

- Bridging
  - Intermediate risk for thromboembolism
    - A fib with $CHADS_2$ score ≥ 4
  - No coumadin for 4 days before surgery
  - Heparin 5000 units/day or LMWH ½ mg/kg/day for 2 days before surgery

Pre-operative Medications

- Bridging
  - High Risk of thromboembolism
    - DVT/PE within 3 months
    - cardiac thrombus within 1 month
    - recurrent VTE
    - cancer
    - coagulopathy (antiphospholipid syndrome, AT III deficiency, Protein C or S deficiency)
    - mechanical valves or ball-cage valves
  - No coumadin 4 days before surgery
  - Full dose heparin or LMWH for 2 days before surgery

Pre-operative Medications

- Anticoagulation
- Glucocorticoids
- Hyperglycemia
- β-Blockers

Pre-operative Medications

- Glucocorticoids
  - Basal rate: 8-10 mg/day cortisol secretion
  - Minor surgery: 50 mg/day cortisol secretion
  - Major surgery: 75-100 mg/day cortisol secretion

Pre-operative Medications

- Glucocorticoids
  - NOT suppressed if:
    - Prednisone < 5 mg/day (or equivalent)
    - Any dose glucocorticoid < 3 weeks
    - Alternate day therapy

Pre-operative Medications

- Glucocorticoids
  - SUPPRESSED if:
    - Prednisone > 20 mg/day or equivalent if used > 3 weeks:
      - 16 mg/day methylprednisolone
      - 2 mg/day dexamethasone
      - 80 mg/day hydrocortisone
    - Clinical Cushing's

Pre-operative Medications

- Anticoagulation
- Glucocorticoids
- Hyperglycemia
- β-Blockers

Glycemic Control

- Surgery and Anesthesia affect:
  - Epinephrine
  - Glucagon
  - Cortisol
  - Growth hormone
  - Cytokines (IL-6,TNF-α)

Glycemic Control

- Surgery and Anesthesia:
  - ↑ insulin resistance
  - ↓ peripheral glucose utilization
  - ↓ insulin secretion
  - ↑ lipolysis
  - ↑ protein catabolism

  - ↑ glycemia, ketosis

Glycemic Control

- HbA1c > 7.0 increases post-operative infection
- BG > 200 increases post-operative wound infection

Glycemic Control

- Goals:
  - Maintain fluid and electrolyte balance
  - Prevent ketoacidosis
  - Avoid marked hyperglycemia
  - Avoid hypoglycemia

Glycemic Control

- Morning of surgery:
  - Oral hypoglycemic drugs
    - Do NOT take
  - Insulin
    - Take 1/2-2/3 dose of basal insulin
    - Omit short-acting insulin

Pre-operative Medications

- Anticoagulation
- Glucocorticoids
- Hyperglycemia
- β-Blockers

Pre-operative Medications

- β-Blockers
  - Meta-analysis of 33 studies
  - 12,036 patients
  - 51% beta-blocker
  - 49% control

Pre-operative Medications

- β-Blockers
  - did NOT:
    - ↓ risk of all cause mortality
    - ↓ risk of cardiovascular mortality
    - ↓ risk of heart failure

Pre-operative Medications

- β-Blockers
  - did NOT:
    - ↓ risk of all cause mortality
    - ↓ risk of cardiovascular mortality
    - ↓ risk of heart failure
  - DID:
    - ↓nonfatal MI 35%
    - ↓ myocardial ischemia 64%
    - ↑ nonfatal CVA 116%
    - ↑ risk of bradycardia requiring treatment
    - ↑ risk of hypotension requiring treatment

Pre-operative Medications

- β-Blockers
  - "In view of the increased risk for stroke, bradycardia, and hypotension, beta-blockers should not be used for perioperative treatment of patients undergoing noncardiac surgery unless patients are already taking them for clinically indicated reasons."

Pearls of Perioperative Medicine

- Pre-operative Medications
- Post-operative Medications
- Risk Stratification

Post-operative Medications

- Anticoagulation
- Glucocorticoids
- Hyperglycemia
- β–Blockers

Post-operative Medications

- Anticoagulation
  - Low risk (a fib)
    - Resume coumadin post-op day 0
    - No heparin or LMWH

Post-operative Medications

- Anticoagulation
  - Low risk (a fib)
    - Resume coumadin post-op day 0
    - No heparin or LMWH
  - Intermediate risk (a fib with $CHADS_2$ score ≥ 4)
    - Resume coumadin post-op day 0
    - Hold heparin or LMWH for 24-48 hours post-op

Post-operative Medications

- Anticoagulation
  - Low risk (a fib)
    - Resume coumadin post-op day 0
    - No heparin or LMWH
  - Intermediate risk (a fib with $CHADS_2$ score ≥ 4)
    - Resume coumadin post-op day 0
    - Hold heparin or LMWH for 24-48 hours post-op
  - High risk (VTE, mechanical valves, coagulopathy, etc.)
    - Resume coumadin post-op day 0
    - Begin heparin or LMWH post-op day 0

Post-operative Medications

- Glucocorticoids
  - Minor surgery
    - Take morning dose of steroid
    - No stress dose

Post-operative Medications

- Glucocorticoids
  - Minor surgery
    - Take morning dose of steroid
    - No stress dose
  - Moderate surgery (total joint, PVD)
    - Take morning dose
    - Hydrocortisone 50 mg before surgery
    - Hydrocortisone 25 mg every 8 hrs x 3 after surgery

Post-operative Medications

- Glucocorticoids
  - Major surgery (cardiac)
    - Take morning dose of steroid
    - Hydrocortisone 100 mg before surgery
    - Hydrocortisone 50 mg every 8 hrs x 3 after surgery
    - Taper hydrocortisone dose by ½ every day until daily maintenance dose

Post-operative Medications

- Glycemic Control

Glycemic Control

- Hospitalized patients:
  - ADA endorsed:
    - fasting glucose < 140
    - random glucose < 180

Post-operative Medications

- β-Blockers
  - Continue pre-op β-Blockers

Pearls of Perioperative Medicine

- Pre-operative Medications
- Post-operative Medications
- Risk Stratification

Risk Stratification

- Surgical Risk

Risk Stratification

- Surgical Risk
  - Low (< 1% cardiac risk – death or nonfatal MI)
    - Ambulatory
    - Endoscopy
    - Cataract
    - Breast

Risk Stratification

- Surgical Risk
  - Intermediate (1-5% cardiac risk – death or nonfatal MI)
    - CEA
    - Head/neck
    - Orthopedic
    - Prostate

Risk Stratification

- Surgical Risk
  - High (> 5% cardiac risk – death or nonfatal MI)
    - Emergency
    - Cardiac
    - Vascular

Risk Stratification

- Surgical Risk
  - Low (ambulatory, endoscopy, cataract, breast)
  - Intermediate (CEA, head/neck, orthopedic, prostate)
  - High (cardiac, vascular)

- Patient Risk

Risk Stratification

- Surgical Risk
  - Low (ambulatory, endoscopy, cataract, breast)
  - Intermediate (CEA, head/neck, orthopedic, prostate)
  - High (cardiac, vascular)

- Patient Risk
  - Low (healthy)
  - Intermediate
  - High (unstable angina, decompensated HF)

Risk Stratification

- Pre-operative evaluation
  - History
  - Physical Examination
  - Labs
  - Studies
  - Cardiac evaluation (not “clearance”)

Pre-operative Evaluation

- History
  - Cardiac Risk Factors (Framingham Heart Study)
    - Diabetes
    - Hypertension
    - Hyperlipidemia
    - Tobacco use
    - Family history of premature coronary disease
      - 1st degree male relative < 55 yrs old
      - 1st degree female relative < 65 yrs old

Pre-operative Evaluation

- History
  - Clinical Predictors of perioperative risk
    - Minor Risk Factors
      - Age > 70
      - Abnormal ECG (LVH, LBBB, ST segment changes)
      - Non-sinus rhythm
      - Uncontrolled HTN (SBP > 180 mm Hg or DBP > 110 mm Hg)

Pre-operative Evaluation

- History
  - Clinical Predictors of perioperative risk
    - Intermediate Risk Factors (Clinical Risk factors)
      - CAD
      - CVD
      - CHF
      - CKD (Cr > 2.0 mg/dL)
      - Diabetes

Pre-operative Evaluation

- History
  - Clinical Predictors of perioperative risk
    - Major Risk Factors (active cardiac conditions)
      - Unstable angina
      - Decompensated heart failure (high AV block – Mobitz II, 3rd degree AV block)
      - Significant aortic stenosis
      - Significant arrhythmias (a fib > 100 bpm, VT, bradycardia)
      - Recent MI
        - » ACC defines "recent" as MI > 7 days but ≤ 30 days

Pre-operative Evaluation

- History
  - Functional Capacity
  - METS (metabolic equivalents)
    - 1 MET = 3.5 mL O_2 uptake/kg/min
      - Caring for self (eating, dressing, toileting) = 1 MET
      - Walk up 1 flight of stairs = 4 METS
      - Heavy housework (lifting, scrubbing, moving furniture) = 4-10 METS
      - Activities (tennis, football, basketball, skiing) = > 10 METS

Pre-operative Evaluation

- History
  - Functional Capacity
    - Simple assessment:
      - "Can you walk 4 blocks without stopping because of limiting symptoms?
      - "Can you climb 2 flights of stairs without stopping because of limiting symptoms?"
    - Good functional capacity if "yes" to either question
    - Poor functional capacity "no" to both questions
    - Inability to achieve 4 METS increases cardiac risk

Pre-operative Evaluation

- Pre-operative evaluation
  - History
  - Physical Examination
  - Labs
  - Studies
  - Cardiac evaluation (not “clearance”)

Pre-operative Evaluation

- Physical Examination
  - Increased Cardiac risk
    - Poorly controlled CHF
    - Significant Aortic Stenosis

Pre-operative Evaluation

- Pre-operative evaluation
  - History
  - Physical Examination
  - Labs
  - Studies
  - Cardiac evaluation (not “clearance”)

Pre-operative Evaluation

- Labs
  - 2000 patients
  - 60% “pre-op” labs would not be ordered if ordered for only recognizable conditions
  - 0.22% of tests revealed abnormalities which may have influenced perioperative management

Pre-operative Evaluation

- Labs
  - 991 patients undergoing noncardiac surgery
  - At least one lab abnormality in 52.5% patients
  - In no instance was management changed because of abnormal lab

Pre-operative Evaluation

- Labs
  - Routine screening lab panels of 20 independent tests in healthy patients will have ≥ 1 abnormal result in 64% cases
  - Reference ranges are 2 standard deviations from the mean which will yield abnormal results in 5% of patients by definition

Pre-operative Evaluation

- Labs
  - Hemostasis (PT, PTT, platelets, hematocrit)
  - Electrolytes
  - Renal function
  - Glucose
  - Urinanalysis

Pre-operative Labs

- Hemostasis
  - PT, PTT not recommended
    - 480/611 patients had labs checked
      - 13 were abnormal
        - » 4 were rechecked and normal
        - » 9 abnormals proceeded to surgery without complications
    - 3866 patients
      - No PT, PTT, platelet count in 76%, 75%, 92% respectively
      - No adverse events

Pre-operative Labs

- Hematocrit
  - Anemia in 1% asymptomatic patients
  - 1958 patients refused transfusion
    - 30-day mortality
      - 1.3% for patients with hemoglobin > 12 g/dL
      - 33.3% for patients with hemoglobin < 6 g/dL
  - 310,311 Veterans ≥ 65 yrs old
    - Mortality ↑ 1.6% for 1 point above or below normal (39-53.9%)
  - Recommendation:
    - Check Hct if expected major blood loss or age > 65 yrs old

Pre-operative Labs

- Labs
  - Electrolytes
    - Unexpected electrolyte abnormalities = 0.6 %
    - Recommendations:
      - Do NOT check for healthy patients

Pre-operative Labs

- Labs
  - Renal Function
    - Prevalence of ↑ Cr in asymptomatic patients without renal disease = 0.2%
    - Prevalence increases with age: 9.8% for age 46-60 yrs old
    - Recommendation:
      - Check Cr for age > 50

Pre-operative Labs

- Labs
  - Glucose
    - Recommendation:
      - Do NOT check for healthy patients

Pre-operative Labs

- Labs
  - Urinalysis
    - Not indicated for asymptomatic renal disease if Cr is checked
    - No difference in wound infection with abnormal pre-op UA vs. normal pre-op UA for nonprosthetic knees
    - Cost analysis
      - 4.58 infections per nonprosthetic knee surgery prevented annually
      - $1.5 million/infection prevented
  - Recommendation:
    - UA NOT recommended for most surgical procedures

Risk Stratification

- Pre-operative evaluation
  - History
  - Physical Examination
  - Labs
  - Studies
  - Cardiac evaluation (not “clearance”)

Pre-operative Evaluation

- Studies
  - ECG
  - Chest X-ray
  - Pulmonary Function Studies

ECG

- Recent MI greatly increases perioperative morbidity and mortality
- Framingham Study:
  - MI in 708 of 5127
    - 25% were silent
- Arrhythmias ↑ perioperative risk
  - PACs, PVCs (> 5/minute)
- RBBB, LBBB did not affect risk

ECG

- Increased perioperative risk
  - Q waves
  - ST elevation/depression
  - Arrhythmia

ECG

- Recommendation:
  - Male > 45 yrs old
  - Female > 55 yrs old
  - CAD
  - HTN
  - Diabetes
  - Evaluation suggestive of CAD
  - Major surgery
  - Risk of electrolyte abnormalities (ie diuretics)

ECG

- Recommendations
  - ECG if vascular surgery and ≥ 1 risk factor (Class I)
  - ECG if intermediate risk surgery and CAD, PVD, CVD (Class I)
  - ECG if vascular surgery and no risk factors (Class IIa)
  - ECG if intermediate risk surgery and ≥ 1 risk factor (Class IIb)
  - ECG if asymptomatic and low risk surgery (Class III)

Pre-operative Evaluation

- Chest X-ray
  - 14,390 x-rays
  - 1444 abnormals
  - 140 unexpected
  - 14 (0.1%) influenced management

  - Recommendation:
    - X-ray if > 50 yrs old and major surgery
    - X-ray if CAD
    - X-ray if Pulmonary Disease
    - No X-ray if previous one < 6 months ago

Pre-operative Evaluation

- Pulmonary Function Tests
  - Recommendation:
    - NOT recommended for routine evaluation

Risk Stratification

- Pre-operative evaluation
  - History
  - Physical Examination
  - Labs
  - Studies
  - Cardiac evaluation (not “clearance”)

Risk Stratification

- Pre-operative evaluation
  - History
  - Physical Examination
  - Labs
  - Studies
  - Cardiac evaluation (not “clearance”)
    - 40-70% mortality rate for perioperative MI

Risk Stratification

- Cardiac Risk Indices
  - Goldman Index
  - Revised Goldman Index
  - Detsky Index
  - Detsky Modified Index
  - Eagle
  - ACC/AHA clinical guidelines – 1996, 2002, 2007

Risk Stratification

- 3 major parameters for risk determination
  - Clinical characteristics of the patient
  - Inherent cardiac risk of planned surgical procedure
  - Patient's functional capacity

Risk Stratification

- Cardiac Stress Testing
  - Exercise ECG
  - Exercise echocardiography
  - Dobutamine echocardiography
  - Myocardial perfusion imaging

Risk Stratification

- Cardiac Stress Testing
  - Sestamibi
    - 89-90% sensitivity
  - Dypiridamole echo
    - Specificity (93%)
  - Dobutamine echo
    - Best combination of sensitivity/specificity (80%/84%)
  - Dipyridamole rMPI
    - Negative predictive value = 98%

Risk Stratification

- Post-operative complication risk factors
  - Creatinine > 2.0 mg/dL
  - Coronary Artery Disease
  - Cerebrovascular Disease
  - Diabetes
  - Congestive Heart Failure
  - High-risk surgery

Risk Stratification

- Cardiac Stress Testing Recommendations
  - Test if vascular surgery, ≥ 3 risk factors, and poor functional capacity (< 4 METS) (Class IIa)
  - Test if intermediate risk surgery, ≥ 1 risk factor, and poor functional capacity (< 4 METS) (Class IIb)
  - Test if vascular surgery, ≥ 1 risk factor, and good functional capacity (Class IIb)
  - Test if intermediate risk surgery and no risk factors (Class III)

Summary

- Perioperative Medical Consultation
  - Pre-operative medication management
  - Post-operative medication management
  - “Medical Clearance” – RISK STRATIFICATION!!

Summary

- Take Home Points
  - If able to achieve 4 METS, no further cardiac assessment
  - If no Clinical Risk Factors, no further cardiac assessment
  - If on β-Blockers pre-operatively, continue them post-operatively

Thank you !

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