The Cardiac Patient for Non-Cardiac Surgery

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Basic Ideas

• What type of heart disease?
• What is the risk to the patient?
  • From surgery?
  • From me?
• With what self-risk does the patient present?
• What can I do to minimize these risks?

National Vital Statistics

• Diseases of the heart
  • Leading cause of death in the United States
  • Over 598,000 deaths in 2009¹
  • Estimated direct and indirect costs of $450 billion²
• Coronary Artery Disease
  • Responsible for about half of CVD deaths
• Other mortality statistics¹
  • All cancers: 568K, accidents: 117K, Sepsis: 35K

Morbidity and Mortality

• Incidence of CAD in surgical patients: 5 to 10%
• Cardiovascular complications are responsible for 25-50% of deaths following non-cardiac surgery
• Perioperative findings
  • Myocardial infarction, ischemia, arrhythmias
  • CHF, pulmonary edema

Major Risk Factors for Development of CAD

• Male
• Increasing Age
• High cholesterol
• Hypertension
• Smoking
• Diabetes
• Obesity
• Family History
• Postmenopausal
• Contraceptives
  • High estrogen content
• Sedentary lifestyle
Atherosclerosis

- Primary pathway to CAD
  - Lipid deposits, fibrous cap, hemodynamic stress, etc.
  - How does it begin?

Pathophysiology of CAD

- CAD is almost exclusively a disease of epicardial coronary arteries
- Arterioles regulate intramyocardial vascular resistance to maintain a basal flow
- Arterioles compensate for increasing epicardial stenosis by dilating to a limit to meet O₂ needs.
- Reserve is typically 3 to 5 times basal flow.
- Since the heart maximizes O₂ extraction even at rest, increased coronary flow is the only way to meet increased demands.

Determinants of Cardiac Demand

- Heart rate is the primary determinant of myocardial oxygen demand
  - Causes a rise in O₂ demand and a fall in O₂ supply
  - MVO₂:HR ratio is not linear, O₂ demand increases at a greater rate than HR
- Afterload
- Contractility
- Chamber pressure

Management Goals

- Maximize coronary flow and perfusion to the coronary myocytes
  - Myocardial O₂ Consumption= 8 – 10 cc/100gm/min
- Coronary perfusion pressure of > 70 mm Hg
  - CPP = DBP – LVEDP
- Control of blood pressure and heart rate
  - Summary: control of autonomic nervous system
Other Cardiac Disease Processes
• Valve Disorders: Aortic or Mitral Stenosis or Regurgitation
• Cardiomyopathy
  • Idiopathic, Non-ischemic, Ischemic
• Aneurysms
  • Ventricular, Thoracic and Abdominal
• Dysrhythmias
  • Atrial fibrillation, Heart Blocks
• Congenital Issues
  • Bicuspid aortic valve, Anatomical variants
• History of surgery for any of these conditions

Risk Stratification:
American College of Cardiology (ACC)
and the American Heart Association (AHA)
• History of CABG, and if so, how recent?
• History of favorable cardiac evaluation, and if so, how recent?
  • If CABG was within the last five years or a favorable cardiac eval was within the last two years without a change in symptoms, then no further eval necessary
• Lacking these, consider comorbidities, surgical risk and functional status

Risk Management: Comorbidities
• Major
  • Unstable coronary syndromes
  • Acute or recent MI (1 week vs. 1 month)
  • Decompensated CHF, severe dysrhythmias or valve diseases
• Intermediate
  • Stable angina, MI > 1 month ago
  • History of CHF
  • Insulin dependent diabetes
  • Creatinine > 2.0 (renal insufficiency)
• Minor
  • Advanced age, hypertension, history of stroke
  • Do not figure into triage decision

Risk Management: Surgery
• High risk:
  • Greater than 5% rate of CHF, MI or death
  • Peripheral vascular bypasses, aortic surgery
• Intermediate risk:
  • 1% to 5% rate of cardiac event
  • CEA, abdominal or thoracic surgery, orthopedic, head/neck, and prostate surgery
• Low risk:
  • less than 1% rate of cardiac event

Preoperative Evaluation
• Exercise Tolerance or Functional Status
  • Expressed in metabolic equivalents, METs
  • One MET is the energy consumed by the body at rest: 3.5 cc oxygen/kg/min
    • <4 METS = Indoor, level walking, light housework
    • 4-10 METS = Climb a flight of stairs, run a short distance, heavy housework, golf, bowling, dancing.
    • 10 METS = Swimming, skiing, singles tennis, running
  • > 4 METs demonstrates acceptable functional status

Cardiac Diagnostics
• Chest X-ray
• Electrocardiogram
• Stress Testing
  • Treadmill
  • Pharmacologic
• Radionuclide myocardial perfusion imaging
  • SPECT or planar images
• Exercise (Stress) Echocardiography
• Pharmacologic
• Viability Studies
  • Hibernating myocardium
• MRI
  • Precise means of assessing viability
Cardiac Diagnostics

- Cardiac Cath
- Remains Gold Standard
- Echocardiography
  - TEE and TTE
- Noninvasive Angiography
  - Approaching resolution and imaging of invasive techniques
  - MDCT or MSCT
  - Cardiac MRI

Drugs of Interest

- Aspirin (ASA)
  - Inhibits cyclooxygenase
  - Effective 7-10 days
  - Hold 3-5 days preop
- Clopidogrel (Plavix)
  - Modifies platelet's ADP P2Y12 receptor
  - Effective 75 mg dose
  - Paired with ASA
  - Hold 5-7 days preop
- Heparin
  - UFH, hold 4 hrs
  - LMWH, hold 18-24 hrs
- Warfarin
  - Hold 4-5 days
- Eptifibatide
  - GP IIb/IIIa inhibitor
- Fish oil, flaxseed oil, garlic, vitamin E, gingko