

# The Cardiac Patient for Non-Cardiac Surgery

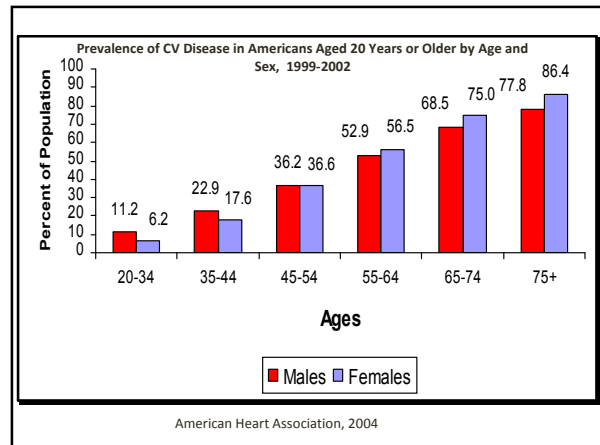
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## Basic Ideas

- 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 2009<sup>1</sup>
  - Estimated direct and indirect costs of \$450 billion<sup>2</sup>
- Coronary Artery Disease
  - Responsible for about half of CVD deaths
- Other mortality statistics<sup>1</sup>
  - All cancers: 568K, accidents: 117K, Sepsis: 35K



## 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

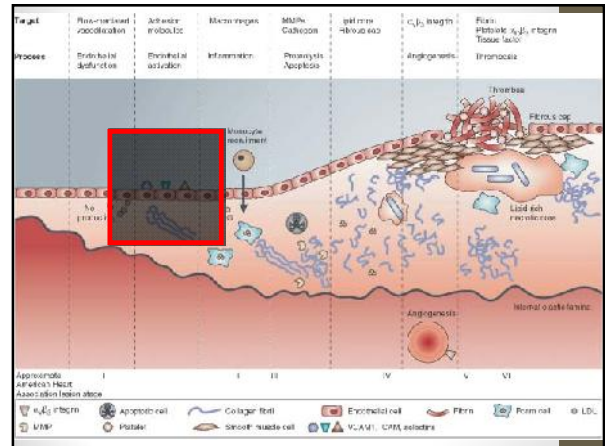
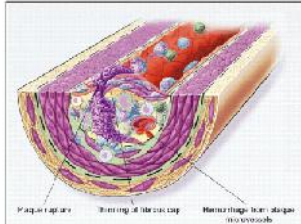


## Morbidity and Mortality

- 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

# Atherosclerosis

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

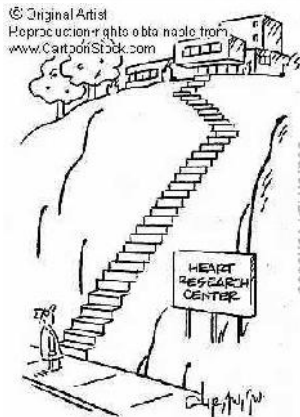


# Pathophysiology of CAD

- 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  $O_2$  needs.
  - Reserve is typically 3 to 5 times basal flow.
  - Since the heart maximizes  $O_2$  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  $O_2$  demand and a fall in  $O_2$  supply
  - $MVO_2:HR$  ratio is not linear,  $O_2$  demand increases at a greater rate than HR
- Afterload
- Contractility
- Chamber pressure



# Management Goals

- Maximize coronary flow and perfusion to the coronary myocytes
  - Myocardial  $O_2$  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)
  - (-) Cyclooxygenase
  - Effective 7-10 days
  - Hold 3-5 days preop
- Clopidogrel (Plavix)
  - Modifies platelet's ADP P2Y<sub>12</sub> receptor
  - 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
- Eptifibatid
  - GP IIb/IIIa inhibitor
- Fish oil, flaxseed oil, garlic, vitamin E, ginkgo