Preoperative Management

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Perioperative Care
Consideration

• Medical care provided to prepare a patient for surgery and to hasten post-op recovery

• Peri-op care is as integral to the outcome of the patient as the operation itself

• The simplicity of these statements belies the complexity of the issues because numerous fundamental questions must be addressed before considering the specifics involved
Perioperative Care

• May be more important to the achievement of a good outcome than the operation itself
  - When a major complication occurs after minor surgery or when a patient with complex medical problems must be managed for a straightforward operation
Perioperative Period

- The concept that the peri-op period can be defined temporally is arbitrary but necessary.
- The necessity has derived from the impetus to describe the incidence of post-op complications.
- Surgical literature relating to the pre-op period is scant compared to that relating to intra-op management and post-op care.
Perioperative Period

• The definition of the pre-op period is nebulous

• Much of the care in the pre-hospital setting is provided by non-surgeons

• Regardless, it is crucial for surgeons to be involved in *ALL PHASES* of perioperative care because many stand ready to provide care if surgeons are not involved
Perioperative Period

- The pre-op period begins when it is decided that a patient needs surgery
  - This period may extend for the few minutes that it takes to get a trauma patient to the OR or for several weeks if comorbid factors must be addressed in preparation

- The post-op period = 30 days after surgery
  - Operative mortality and complication rates are generally reported using that criterion
CV Risk

- > 3 million patients with CAD undergo surgery each year in the US
- 50K patients sustain a peri-op MI
- The incidence may be increasing because of an aging population
- Overall mortality for perioperative MI remains nearly 40%
CV Risk

- Aortic, peripheral vascular and, orthopedic surgery, and major intra-thoracic and IP procedures are more frequently associated with perioperative cardiac mortality
- Men are at increased risk > 35 years of age, women after age 40
- Cardiac mortality risk increases markedly in patients over age 70
- Cigarette smoking - increased risk
Identification

- Crucial to the task of risk-benefit analysis is the prospective identification of the patient at risk for a peri-op cardiac complication.
- Unfortunately, although the presence of CAD is not difficult to demonstrate by screening techniques, there is little evidence that prophylactic coronary revascularization, whether by open surgery or angioplasty, can reduce risk before non-cardiac surgery.
Identification

- Routine noninvasive testing is expensive, and clinical criteria may be nearly as good.
- Until recently, it has been unclear whether medical management in preparation for surgery accomplishes much unless the patient has decompensated disease.
- New evidence indicates that peri-op β-blockade can reduce CV mortality even when started immediately pre-op.
Risk

- H&P must ascertain the presence of valvular heart disease (particularly asymptomatic aortic stenosis, CHF or arrhythmias)
- CHF is strongly predictive of perioperative pulmonary edema and other complications
Risk

- PS of 254 predominantly hypertensive diabetic patients who underwent elective general surgery operations revealed a 17% incidence of peri-op CHF among patients with cardiac disease.

- Patients with both diabetes and heart disease were at especially high risk.

- CHF developed in fewer than 1% of patients without prior cardiac disease.
AS

- Severe AS must be detected preoperatively - risk of perioperative mortality = 13%
- Increased mortality results from a limited capacity to increase CO in response to stress, vasodilation, or hypovolemia
- Left ventricular hypertrophy decreases ventricular compliance and leads to decreased diastolic filling
- Elective AVR before non-cardiac surgery may be indicated in severe AS
Chest Pain

• Atypical or unstable chest pain requires careful evaluation

• Stable chest pain does not increase peri-op risk, but unstable disease (new-onset or crescendo angina, a recent MI, or recent or current CHF) certainly warrants both evaluation and stabilization

• Pre-op evaluation of a patient with angina should determine whether the patient's disease and symptoms are truly stable
Chest Pain

- If stable, surgery may proceed with the maintenance of an effective anti-anginal regimen during and after operation.

- Similarly, asymptomatic or only minimally symptomatic patients who have previously undergone coronary bypass grafting tolerate surgery well.
A recent MI is the single most important risk factor for perioperative infarction.

The risk is greatest within the first 30 days.

Estimates of the risk of anesthesia following an MI range as high as a 27% re-infarction rate within 3 months, 11% between 3 and 6 months, and 5% after 6 months.
Patients who suffer non-transmural (non-Q-wave) infarctions appear to be at identical risk.

With intraoperative hemodynamic monitoring, the risk may be reduced to as low as 6% within 3 months of the first MI and only 2% incidence within 3 to 6 months.

Elective surgery should be postponed for 6 months following an acute MI.
• Major emergency surgery should be performed with intraoperative hemodynamic monitoring

• Urgent surgery (a potentially resectable malignant tumor) can be undertaken from 4 to 6 weeks after infarction if the patient has had an uncomplicated recent course and the results of noninvasive stress testing are favorable
Cardiac Risk Index System

- Developed from a cohort of patients ≥ 40 years who underwent non-cardiac surgery
- Risk classes (I-IV) are assigned on the basis of accumulated points
- Any elective operation is contraindicated if the patient falls within class IV
- One benefit of CRIS is that > one-half of the total points are potentially controllable
TABLE 17.2. Cardiac Risk Index System (CRIS).

<table>
<thead>
<tr>
<th>Factors</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>History</strong></td>
<td></td>
</tr>
<tr>
<td>Age &gt;70 years</td>
<td>5</td>
</tr>
<tr>
<td>Myocardial infarction ≤6months ago</td>
<td>10</td>
</tr>
<tr>
<td>Aortic stenosis</td>
<td>3</td>
</tr>
<tr>
<td><strong>Physical examination</strong></td>
<td></td>
</tr>
<tr>
<td>S₃ gallop, jugular venous distension or congestive heart failure</td>
<td>11</td>
</tr>
<tr>
<td>Bedridden</td>
<td>3</td>
</tr>
<tr>
<td><strong>Laboratory</strong></td>
<td></td>
</tr>
<tr>
<td>PO₂ &lt;60mmHg</td>
<td>3</td>
</tr>
<tr>
<td>PCCO₂ &gt;50mmHg</td>
<td>3</td>
</tr>
<tr>
<td>Potassium &lt;3mEq/dl</td>
<td>3</td>
</tr>
<tr>
<td>Blood urine nitrogen &gt;50mg/dl</td>
<td>3</td>
</tr>
<tr>
<td>Creatinine &gt;3mg/dl</td>
<td>3</td>
</tr>
<tr>
<td><strong>Operation</strong></td>
<td></td>
</tr>
<tr>
<td>Emergency</td>
<td>4</td>
</tr>
<tr>
<td>Intrathoracic</td>
<td>3</td>
</tr>
<tr>
<td>Intraabdominal</td>
<td>3</td>
</tr>
<tr>
<td>Aortic</td>
<td>3</td>
</tr>
</tbody>
</table>

**Approximate cardiac risk (percentage incidence of major complications)**

<table>
<thead>
<tr>
<th>Class(a) baseline</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor surgery</td>
<td>1</td>
<td>0.3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Major noncardiac surgery, age &gt;40 years</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>Abdominal aortic surgery or age &gt;40 with other characteristics</td>
<td>10</td>
<td>3</td>
<td>10</td>
<td>30</td>
</tr>
</tbody>
</table>

aCRIS class I, 0-5 points; class II, 6-12 points; class III, 13-25 points; class IV, ≥26 points.
<table>
<thead>
<tr>
<th>Step 1.</th>
<th>What is the urgency of the proposed surgery? If emergent, detailed risk assessment must be deferred to the postoperative period.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2.</td>
<td>Has the patient had myocardial revascularization within the past 5 years? If so, further testing is generally unnecessary if the patient is stable/asymptomatic.</td>
</tr>
<tr>
<td>Step 3.</td>
<td>Has the patient had a cardiologic evaluation within the past 2 years? If so, further testing is generally unnecessary if the patient is stable/asymptomatic.</td>
</tr>
<tr>
<td>Step 4.</td>
<td>Does the patient have unstable symptoms or a major predictor of risk? Unstable chest pain, decompensated congestive heart failure, symptomatic arrhythmias, and severe valvular heart disease require evaluation and treatment before elective surgery.</td>
</tr>
<tr>
<td>Step 5.</td>
<td>Does the patient have intermediate clinical predictors of risk, such as prior myocardial infarction, angina pectoris, prior or compensated heart failure, or diabetes? Consideration of the patient's capacity to function and the level of risk inherent in the proposed surgery can help identify patients who will benefit most from perioperative noninvasive testing.</td>
</tr>
<tr>
<td>Step 6.</td>
<td>Patients with intermediate risk and good-to-excellent functional capacity can undergo intermediate-risk surgery with very little risk. Consider additional testing for patients with multiple predictors about to undergo higher-risk surgery.</td>
</tr>
<tr>
<td>Step 7.</td>
<td>Further testing can be performed on patients with poor functional capacity in the absence of clinical predictors of risk, especially if vascular surgery is planned.</td>
</tr>
<tr>
<td>Step 8.</td>
<td>For high-risk patients about to go to high-risk surgery, coronary angiography or even cardiac surgery may be less risky than the noncardiac operation. Clinical, surgery-specific, and functional parameters are taken into account to make the decision. Indications for coronary revascularization are identical whether or not considered in preparation for noncardiac surgery.</td>
</tr>
</tbody>
</table>
Screening

- Resting ECG remains the primary screening modality for virtually all patients > age 40
- It is undeniably cost-effective but may be normal in many patients with CAD
- Evidence of a prior MI is nearly indisputable evidence of CAD
- Noninvasive tests are sufficiently sensitive to identify most patients at increased risk
Screening

- A wide array of other tests have been employed for the preoperative assessment of cardiac risk
  - Ambulatory ECG, exercise ECG, stress echocardiography, radionuclide imaging, and coronary angiography
Screening

- Exercise ECG is the historical standard to unmask myocardial ischemia
- Sensitivity for detection of CAD ranges up to 81%, whereas specificity varies up to 96%
- False-negative studies are problematic
- The test has limited value as a screening procedure for healthy, asymptomatic individuals
Thallium Scan

- Radionuclide cardiac imaging for preoperative evaluation of cardiac disease
- Can be performed at rest, during exercise, or during a pharmacological exercise equivalent (e.g., dipyridamole) for patients who cannot exercise (e.g., those with peripheral vascular disease, lower-extremity orthopedic problems)
Thallium Scan

- Utilizes intravenous $^{201}$Th to analyze the extent and location of CAD, the reversibility of the lesions, and the stress response of $^{201}$Th in the coronary circulation
- The isotope is taken up by myocytes in a manner analogous to potassium
- Rapid uptake allows visualization of ischemic or unperfused myocardium
Thallium Scan

- Normal coronary blood flow is relatively homogeneous, such that perfusion deficits cannot be detected in the resting state unless severe (90% or greater) coronary artery stenosis is present.
- Heterogeneity can therefore be enhanced by superimposed myocardial stress, which reflects ischemia.
Thallium Scan

- Because myocardial clearance of $^{201}$Th is rapid, redistribution during reperfusion of ischemic myocardium can also be observed.

- Although the NPV is high (90%), the presence of redistribution during reperfusion is identified so often, particularly in vascular surgical patients, that its PPV is low (30%).
Echo

- Stress echocardiography (usually with infusion of dobutamine) may be even more accurate than $^{201}$Th scanning
- Less expensive and has the advantage of additional imaging possibilities
- Valvular function can be assessed, wall motion and thickening can be quantified, and an estimate of LVEF can be made
Dobutamine echocardiography should probably be considered the provocative test of choice for moderate- to high-risk patients.

Echocardiographic estimates of ventricular function correlate well with angiographic and radionuclide data.
Echo

- Such information can be of great value as reduced LVEF (<35%) correlates strongly with perioperative myocardial events.
- Some patients may be evaluated more safely at rest than under pharmacological stress.
- An equivocal or positive result from noninvasive testing is an indication for cardiac catheterization.
Pre-operative Optimization
To minimize risk, the patient must be in optimal medical condition. Ultimately, the responsibility of the surgeon but may often be undertaken by the referring physician or a consultant. CHF, poorly controlled HTN (DBP >110 mmHg), and DM must be stabilized before an elective procedure is undertaken.
In general, CV meds should be continued through the peri-op period.

Discontinuation of antihypertensive therapy does pose potential hazards.

Rebound HTN may be precipitated.

CHF may recur.
There is widespread agreement that β-adrenergic blockade should not be discontinued abruptly. Abrupt discontinuation may be associated with a hyperadrenergic withdrawal syndrome characterized by unstable angina, tachyarrhythmias, MI, or sudden death.
β-blockers

- Several studies suggested that both short- and long-term survival can be improved.
- PRS with 200 patients with CAD and at least two risk factors.
- No difference in in-hospital MI or death rate.
- Overall mortality and deaths from CVD were reduced significantly at 6 mos and 2 yrs - RR for death was 48%, and there was a 15% increase in event-free survival.
β-blockers

• In another study, conducted in high-risk patients (clinical indicators and the results of dobutamine echocardiography) not already taking β-blockers and about to undergo major vascular surgery, patients who received β-blockers had statistically lower rates of perioperative (30-day) MI and death.
Post-op MI

• Dx can be elusive because most are silent clinically, many are non-transmural (non-Q-wave) and therefore have minimal accompanying ECG changes

• Current ACC/AHA recommendations are to screen for MI in patients without evidence of CAD only if signs of CV dysfunction develop
Post-op MI

- For patients with CAD undergoing high-risk operations, an ECG at baseline, immediately post-op, and daily for the first 2 post-op days should be obtained.
- Measurements of cardiac enzymes are best reserved for patients at high risk or those who demonstrate ECG or hemodynamic evidence of myocardial dysfunction.
Pulmonary Assessment
Pulmonary Evaluation

- Patients with a history of lung disease or those for whom a pulmonary resection is planned may benefit from preoperative assessment and optimization of pulmonary function.

- Late post-op pulmonary complications are leading causes of morbidity and mortality - second only to cardiac complications.
Post-op Risk

- Prolonged post-op decreases in FRC and FVC are associated with atelectasis, decreased pulmonary compliance, increased WOB and tachypnea at low TV
- Poor cough effort and impaired airway reflexes increase susceptibility to retained secretions, bacterial invasion, and PN
Pulmonary Morbidity

- Older age, upper abdominal and thoracic incisions, neurosurgical procedures, emergency operations, prolonged operative time, increased severity of underlying pulmonary disease, alcohol abuse, cigarette smoking, poor preoperative nutrition, and preoperative blood transfusion are independent risk factors for major pulmonary morbidity.
Pre-op Assessment

- Before non-thoracic surgery should focus on identification of chronic airway obstruction, possible pre-op intervention to minimize risk, and the choice of surgical incision.

- Few data suggest that outcome is improved by optimization of pulmonary function before elective procedures.
Screening

- Most laboratory studies are of little benefit for prediction of pulmonary morbidity
- Elevated serum bicarbonate concentration suggests chronic respiratory acidosis, whereas polycythemia may suggest chronic hypoxemia
- RA PaO$_2$ < 60 correlates with pulmonary HTN, whereas a PaCO$_2$ > 45 is associated with increased peri-op morbidity
Spirometry

• Before and after bronchodilators is simple and safe to obtain
• Analysis of FEV$_1$ and FVC usually provides sufficient information for clinical decisions
• Dyspnea = FEV$_1$ < 2L
• Exertional dyspnea = FEV$_1$ < 50% of the predicted value
• In COPD, the FVC decreases < the FEV$_1$, resulting in an FEV$_1$/FVC ratio < 0.8
Spirometry

- Spirometry correlates with development of post-op atelectasis and PN
- If spirometric parameters improve by 15% or more after bronchodilator therapy, then such therapy should be continued
- For abdominal surgery, there is no indication for evaluation beyond spirometry and arterial blood gas analysis
Smoking

- Cessation has been advocated for those who smoke > 10 cigarettes/day, but the benefit is uncertain.
- Short-term abstinence (48h) decreases the cHgb concentration to that of a nonsmoker, abolishes the effects of nicotine on the CVS and improves mucosal ciliary function.
- Sputum volume decreases after 1-2 weeks and spirometry improves after 6 weeks.