PRE Operative Care of the High Risk Surgical Patient

Dr A T Dewhurst
Consultant Anaesthetist
St George’s Hospital
London
Perioperative Optimization

Shoemaker

oxygen delivery

goal directed therapy

ITS NOT JUST ALL ABOUT

Maximising

DO2
Guidelines for pre-operative cardiac risk assessment and perioperative cardiac management in non-cardiac surgery

The Task Force for Preoperative Cardiac Risk Assessment and Perioperative Cardiac Management in Non-cardiac Surgery of the European Society of Cardiology (ESC) and endorsed by the European Society of Anaesthesiology (ESA)

Authors/Task Force Members: Don Poldermans; (Chairperson) (The Netherlands)*; Jeroen J. Bax (The Netherlands); Eric Boersma (The Netherlands); Stefan De Hert (The Netherlands); Erik Eeckhout (Switzerland); Gerry Fowkes (UK); Bulent Gorenek (Turkey); Michael G. Hennerici (Germany); Bernard lung (France); Malte Kelm (Germany); Keld Per Kjeldsen (Denmark); Steen Dalby Kristensen (Denmark); Jose Lopez-Sendon (Spain); Paolo Pelosi (Italy); François Philippe (France); Luc Pierard (Belgium); Piotr Ponikowski (Poland); Jean-Paul Schmid (Switzerland); Olav F.M. Sellevold (Norway); Rosa Sicari (Italy); Greet Van den Berghe (Belgium); Frank Vermassen (Belgium)
Incidence in Europe of complication following major non-cardiac surgery

- Cardiac death 0.5-1.5%
- Major cardiac complication 2-3.5%
- EU population 490 million, 7 million high risk procedures per annum
- 150,000 to 250,000 life threatening cardiac complications in EU per annum
High Risk Case

- Condition of patient
- Co-morbidities
- Magnitude and Duration of surgery
- Non cardiac complications
- Cardiac complication
  - Chronic mismatch myocardial supply/demand
  - Acute plaque rupture
  - LV failure
Surgical factors

Body cavity surgery/vascular surgery

- Changes core temperature
- Blood loss
- Fluid shifts
- Stress response
  - Hypertension
  - Tachycardiac
- Prothrombotic
Surgical Mortality

Mortality (%)

IHD COPD CCF

Farrow, BJA, 82
Patient Selection

Shoemaker in a series of observational studies demonstrated a group of patients that he called “High Risk” and who had a 28 day mortality of 30-40%.
Shoemaker Used Simple Clinical Criteria to Identify These Patients

- Previous severe cardio-respiratory illness
- Late stage vascular disease
- Age > 70 with limited physiological reserve
- Acute abdominal catastrophe
- Septicaemia
- Respiratory failure
- Acute renal failure
- Massive blood loss > 8 units
- Extensive surgery for carcinoma
Risk Indices for Cardiac Events


Lee Index

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<th>Index</th>
<th>Risk</th>
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<tr>
<td>1.</td>
<td>IHD</td>
<td></td>
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<tr>
<td>2.</td>
<td>Heart failure</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Stroke or Transient ischaemic attack</td>
<td>&gt; 3</td>
</tr>
<tr>
<td>4.</td>
<td>Diabetes requiring insulin</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Renal dysfunction</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>High Risk surgery</td>
<td></td>
</tr>
</tbody>
</table>
Type and Timing of Surgery

Routine
Day
Damage Control surgery
CEPOD list

Urgent
Night

Emergency
HELP EMERGENCY
CEPOD list
• Mella BJS 98
• Colorectal surgery audit
• Operations carried out urgently have a higher mortality rate
## Type of Operation

<table>
<thead>
<tr>
<th>Low-risk &lt;1%</th>
<th>Intermediate-risk 1–5%</th>
<th>High-risk &gt;5%</th>
</tr>
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<tr>
<td>Breast</td>
<td>Abdominal</td>
<td>Aortic and major vascular surgery</td>
</tr>
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<td>Dental</td>
<td>Carotid</td>
<td>Peripheral vascular surgery</td>
</tr>
<tr>
<td>Endocrine</td>
<td>Peripheral arterial angioplasty</td>
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<tr>
<td>Eye</td>
<td>Endovascular aneurysm repair</td>
<td></td>
</tr>
<tr>
<td>Gynaecology</td>
<td>Head and neck surgery</td>
<td></td>
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<tr>
<td>Reconstructive</td>
<td>Neurological/orthopaedic—major (hip and spine surgery)</td>
<td></td>
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<tr>
<td>Orthopaedic—minor (knee surgery)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urologic—minor</td>
<td>Pulmonary renal/liver transplant</td>
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</tr>
</tbody>
</table>

*Risk of MI and cardiac death within 30 days after surgery.*
Preoperative assessment

- High risk patients are clinical priority
- Good communication between surgical and anaesthetic teams required
- Limited time available
- Balance between optimising medical conditions and need for surgery
Base Line Investigations

- Full blood count
- Urea and Electrolytes
- Coagulation screen
- Blood Glucose
- ECG
- Chest X-ray
Other Investigations

- Echocardiography in patients with heart failure or murmur
- Significant valvular lesions and impaired LV consider invasive monitoring + HDU
Non-invasive testing IHD

- Is there time available?
- Exercise tolerance test (ETT)
- Myocardial Perfusion Imaging (MPI)
- Stress Echocardiography
- CT or MRI
- Angiography
- CPET
ETT

- Sensitivity 74%, Specificity 69%
- Not suitable for patients who cannot reach ischaemic threshold
Radioisotopes scan

- Dobutamine
- Dipyridamole, Adenosine
- Look for
  - Reversible defects
  - Fixed defects
Meta-analysis MPI (1)

9 studies vascular surgery, end points cardiac death or MI, n 1179, 7% event rate

<table>
<thead>
<tr>
<th>% LV reversible ischaemia</th>
<th>Likelihood ratio of ischaemic event</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20%</td>
<td>No difference</td>
</tr>
<tr>
<td>20-29%</td>
<td>1.6</td>
</tr>
<tr>
<td>30-49%</td>
<td>2.9</td>
</tr>
<tr>
<td>&gt;50%</td>
<td>11</td>
</tr>
</tbody>
</table>

Stress Echocardiography

- Sensitivity 85%, Specificity 70% for cardiac death and MI
- **Negative predictive value 90-100%** (-ve test means safe)
- **Positive predictive value 25-45%** (+ve test does not predict post op cardiac event)
Angiography

- Rarely indicated to assess risk and may cause delay
- However is indicated in STEMI/NSTEMI and unstable angina if surgery can be delayed
Respiratory Assessment

- COPD increases risk x 3 of pulmonary complications
- Arterial Blood Gas
- Pulmonary Function Test
  - FEV1 < 70%
  - FEV1/FVC < 0.65
Optimisation

- Identify factors that can be optimised in time frame available
- Specialist input
- Pharmacological optimisation
- Medical optimisation
- Physiological optimisation
Pharmacological optimisation

- **B-blockers** – continue established therapy, complex guidelines, POISE
- **Statins** – continue (7.5-fold increased risk of death if stopped)
- **Aspirin** – consider continuing
- **ACE inhibitors** – consider continuing
- **Diuretics** – for hypertension hold, for LVF continue
## Recommendations on β-blockers

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>β-Blockers are recommended in patients who have known IHD or myocardial ischaemia according to pre-operative stress testing&lt;sup&gt;a&lt;/sup&gt;</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>β-Blockers are recommended in patients scheduled for high-risk surgery&lt;sup&gt;a&lt;/sup&gt;</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>Continuation of β-blockers is recommended in patients previously treated with β-blockers because of IHD, arrhythmias, or hypertension</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>β-Blockers should be considered for patients scheduled for intermediate-risk surgery&lt;sup&gt;a&lt;/sup&gt;</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>Continuation in patients previously treated with β-blockers because of chronic heart failure with systolic dysfunction should be considered</td>
<td>IIa</td>
<td>C</td>
</tr>
<tr>
<td>β-Blockers may be considered in patients scheduled for low-risk surgery with risk factor(s)</td>
<td>IIb</td>
<td>B</td>
</tr>
<tr>
<td>Perioperative high-dose β-blockers without titration are not recommended</td>
<td>III</td>
<td>A</td>
</tr>
<tr>
<td>β-Blockers are not recommended in patients scheduled for low-risk surgery without risk factors</td>
<td>III</td>
<td>B</td>
</tr>
</tbody>
</table>
Active Cardiac Conditions

- Unstable coronary syndromes
  - MI within 30d
  - Angina class III or IV
- Decompensated heart failure
- Severe valve disease
- Significant arrhythmias
Surgery following PCI

Previous PCI

Balloon angioplasty
- < 14 days: Postpone non-urgent surgery
- ≥ 14 days: Proceed to surgery with aspirin

Bare-metal stent
- Minimum ≥ 6 weeks Optimally ≥ 3 months: Proceed to surgery with aspirin
- < 6 weeks: Postpone non-urgent surgery

Drug-eluting stent
- < 12 months: Postpone non-urgent surgery
- ≥ 12 months: Proceed to surgery with aspirin
Atrial Fibrillation

- Rate control 80-100
- Consider TOE to exclude thrombus and cardioversion if acute onset
Other Arrhythmias

- SVT/AF
- VPB/non-sustained VT
- SMVT
- SPVT
- Torsades-de-Pointes
Aortic Stenosis

- Severe AS < 1cm² risk of MI and death
- Urgent surgery performed with invasive monitoring
- Non urgent surgery delay consider Tx AS

Other Valve Disease

- **MS** symptomatic patients with PHT > 50mmHg high risk
- **AR/MR** symptomatic patients with LV EF < 30% high risk
- Prosthetic valves antibiotics and anticoagulants
Renal Disease

- eGFR < 60mls/min at risk
- Oral intake
- IVI fluids 1ml/kg/hr
- Vasopressor
- Diuretics
- Dopamine
- N-acetylcysteine (contrast nephropathy)
Other issues

- Diabetes
- Pulmonary disease
- Metabolic derangement
- Pain
- Monitoring
- Anaesthetic
Preoperative Haemodynamic Optimisation or EGDT

• Multiple studies of varying quality
• Seem to make a difference in outcome in sick patients undergoing high risk surgery if started early
• Use flow monitoring to direct fluids and inotropes

I will discuss this topic in more depth at workshop on friday
## Meta-analysis

### Comparison: 01 All Studies

**Outcome:** 01 Mortality

<table>
<thead>
<tr>
<th>Study</th>
<th>Treatment</th>
<th>Control</th>
<th>Peto OR (95%CI Fixed)</th>
<th>Weight %</th>
<th>Peto OR (95%CI Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoemaker 1988</td>
<td>1 / 28</td>
<td>18 / 60</td>
<td>0.21[0.07,0.63]</td>
<td>17.5</td>
<td>0.21[0.07,0.63]</td>
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<tr>
<td>Berlauk 1991</td>
<td>1 / 68</td>
<td>2 / 21</td>
<td>0.09[0.01,1.29]</td>
<td>2.8</td>
<td>0.09[0.01,1.29]</td>
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<tr>
<td>Boyd 1993</td>
<td>3 / 53</td>
<td>12 / 54</td>
<td>0.26[0.09,0.76]</td>
<td>17.5</td>
<td>0.26[0.09,0.76]</td>
</tr>
<tr>
<td>Mythen 1995</td>
<td>0 / 30</td>
<td>1 / 30</td>
<td>0.14[0.00,6.82]</td>
<td>1.3</td>
<td>0.14[0.00,6.82]</td>
</tr>
<tr>
<td>Sinclair 1997</td>
<td>1 / 20</td>
<td>2 / 20</td>
<td>0.50[0.05,5.06]</td>
<td>3.8</td>
<td>0.50[0.05,5.06]</td>
</tr>
<tr>
<td>Ziegler 1997</td>
<td>3 / 32</td>
<td>2 / 40</td>
<td>1.95[0.32,11.98]</td>
<td>6.3</td>
<td>1.95[0.32,11.98]</td>
</tr>
<tr>
<td>Bender 1997</td>
<td>1 / 51</td>
<td>1 / 53</td>
<td>1.04[0.06,16.86]</td>
<td>2.7</td>
<td>1.04[0.06,16.86]</td>
</tr>
<tr>
<td>Valentine 1998</td>
<td>3 / 60</td>
<td>1 / 60</td>
<td>2.79[0.38,20.31]</td>
<td>5.2</td>
<td>2.79[0.38,20.31]</td>
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<tr>
<td>Ueno 1998</td>
<td>0 / 16</td>
<td>2 / 18</td>
<td>0.14[0.01,2.39]</td>
<td>2.6</td>
<td>0.14[0.01,2.39]</td>
</tr>
<tr>
<td>Wilson 1999</td>
<td>3 / 92</td>
<td>8 / 46</td>
<td>0.15[0.04,0.54]</td>
<td>12.2</td>
<td>0.15[0.04,0.54]</td>
</tr>
<tr>
<td>Lobo 2000</td>
<td>3 / 19</td>
<td>9 / 18</td>
<td>0.22[0.06,0.85]</td>
<td>11.2</td>
<td>0.22[0.06,0.85]</td>
</tr>
<tr>
<td>Polonen 2000</td>
<td>4 / 196</td>
<td>9 / 197</td>
<td>0.45[0.15,1.37]</td>
<td>16.9</td>
<td>0.45[0.15,1.37]</td>
</tr>
</tbody>
</table>

**Total (95%CI):** 23 / 665 | 67 / 617 | 0.33[0.21,0.51]       |

Chi-square 13.33 (df=11) P: 0.35 Z=-4.84 P: <0.00001

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### All studies

<table>
<thead>
<tr>
<th>Mortality</th>
<th>Treatment</th>
<th>Control</th>
<th>Peto OR</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Mortality</td>
<td>23/665</td>
<td>67/617</td>
<td>0.33</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>3.5%</td>
<td>10.9%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Grocott M. et al. 2003
**Step 1**  
Urgent surgery  
Yes / No

**Step 2**  
One of active or unstable cardiac conditions (table 12)  
Yes / No

**Step 3**  
Determine the risk of the surgical procedure (table 4)  
Low  
Intermediate or high

**Step 4**  
Consider the functional capacity of the patient  
> 4 METs / ≤ 4 METs

**Step 5**  
In patients with poor functional capacity consider the risk of the surgical procedure  
Intermediate risk surgery  
High-risk surgery

**Step 6**  
Cardiac risk factors (table 13)  
≥ 3 / < 2

**Step 7**  
Consider non-invasive testing. Non-invasive testing can also be considered prior to any surgical procedure for patients counseling change of perioperative management in relation to type of surgery and anesthetics technique.  
No/Minimal stress-induced ischemia  
Extensive stress-induced ischemia

If applicable, discuss the continuation of chronic aspirin therapy. Discontinuation of aspirin therapy should be considered only in those patients in which haemostasis is difficult to control during surgery.