Contraindications to Time Critical Surgery; when not to proceed

The Anaesthetic perspective
Time Critical Surgery

Emergency; arising unexpectedly and requires immediate action

Urgent; quick but not immediate action within 24 hours

Emergent; Beginning to arise (Few hours)

Elective.

Indicated Surgery where delay will act as a negative predictor on patient outcome

L King. The Rubric Theme. Jan 2013
Time Critical Surgery

Emergency; arising unexpectedly and requires immediate action

Urgent; quick but not immediate action within 24 hours
Emergent; Beginning to arise (Few hours)

Elective.

Indicated Surgery where delay will act as a negative predictor on patient outcome

L King, The Rubric Theme. Jan 2013
Life threatening

Major Risk

Emergency

Surgery

Time Critical

Anaesthetic

AAA
Cardiac Tamponade
Aortic Dissection Type I
Haemorrhage

Ischaemic leg
Septic Abdomen
Ruptured Viscus
Subdural

Palliative Care

vs

‘Heroic’ Surgery

Hypoxia
Inability to Ventilate - Asthma
Shock
Ingested Toxin
Metabolic - Ketoacidosis
Life threatening
Major Risk

Emergency
Surgery
Time Critical

Anaesthetic

AAA
Cardiac Tamponade
Aortic Dissection Type I
Haemorrhage

Valvular heart Disease
Pulmonary Hypertension
Left main Disease
Left ventricular failure
Lactic Acidosis
Myasthenia

Ischaemic leg
Septic Abdomen
Ruptured Viscus
Subdural

Proceed
Maximal Anaesthetic Intervention
Life threatening
Major Risk

Emergency
Surgery
Time Critical

Anaesthetic

Carcinoma
Aneurysms
Intracranial tumors
Unstable fractures
Infections requiring drainage

Hypoxia
Inability to Ventilate - Asthma
Shock
Ingested Toxin
Metabolic - Ketoacidosis
Endocrine - thyrotoxicosis
-phaeochromocytoma

Cancel
Clinically Based. ICU emergency.

Supply Oxygen:
- ARDS maximal ventilator settings. FiO₂ 100%, High PEEP, Desaturations, Difficult transportation.
- Bronchopneumonia.
- Severe Asthma. Accessory muscle use, tiring, sitting up.

Deliver Oxygen
- Shock.

Utilize Oxygen - CN
- Metabolic. Ketoacidosis, Ingested Toxin
Life threatening
Major Risk
Emergency
Surgery
Time Critical

Anaesthetic

Valvular heart Disease
Pulmonary Hypertension
Coronary Artery/Left main Disease
Left ventricular failure
Myasthenia
Hepatic Failure
Respiratory Failure

Carcinoma
Anneurysms
Intracranial tumors
Unstable fractures
Infections requiring drainage

Cancel
Resolve
Delay
Proceed
Risk

Clinician Experience
Risk Indices
Biochemical Markers

Benefit
Cardiac Risk Indices

- Goldman Risk Index 1970
- Detsky’s (AS, VE’s, Surgery) 1986
- Eagles (Vascular, Thallium imaging) 1989
- Lee’s Revised Risk Index (RCI) 1999
- ACA/AHA Cardiac Risk Classif. 2007
- STS, Frailty, Major organ system dysfunction, procedure-specific impediments for Valve Surgery. 2014
Cardiac Risk Indices

- Goldman Risk Index
- Eagles
- Detsky’s
- Lee’s Revised Risk Index (RCI)
- ACA/AHA Cardiac Risk Classification

RCI CATEGORIES
- High-risk surgery (intrathoracic, intra-abdominal, or suprainguinal vascular)
- Ischemic heart disease (defined as a history of MI, pathologic Q waves on the ECG, use of nitrates, abnormal stress test, or chest pain secondary to ischemic causes)
- Congestive heart failure
- History of cerebrovascular disease
- Diabetes requiring insulin therapy
- Preoperative serum creatinine level higher than 2Â mg/dL

<table>
<thead>
<tr>
<th>Number of Factors</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.4%</td>
</tr>
<tr>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>3</td>
<td>7%</td>
</tr>
<tr>
<td>4</td>
<td>11%</td>
</tr>
</tbody>
</table>
Risk Assessment Valve Surgery  
2014 AHA/ACC Guidelines

STS, STS database Online Calculator
Frailty Index
Major Organ System Dysfunction
Procedure Specific Impediments

Seven Frailty indices:
1. Katz Activities of Daily living. (ADL) 6 = Full Function, <2 Severe impairment
   Feeding, Bathing, Dressing,
   Transferring, Toileting,
   Urinary continence.
2. Independence in ambulation;
   Walking aid, or not, 5 meter walk in < 6seconds

2014 AHA/ACC guideline for the management of patients with valvular heart disease.  
Patient Risk Factors for Postoperative Pulmonary Complications

Table 1. Patient-Related Risk Factors for Postoperative Pulmonary Complications*

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Studies, n</th>
<th>Pooled Estimate Odds Ratio (95% CI)†</th>
<th>P, %‡</th>
<th>Trim-and-Fill Estimate Odds Ratio (95% CI)§</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50–59 y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60–69 y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70–79 y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥80 y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASA class</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥II§</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥III§</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abnormal chest radiograph</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arrhythmia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functional dependence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partial</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COPD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight loss</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical comorbid condition</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cigarette use</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impaired sensorium</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corticosteroid use</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol use</td>
<td>2</td>
<td>1.21 (1.11–1.32)</td>
<td>0.0</td>
<td></td>
</tr>
</tbody>
</table>

- Recent cessation of Smoking             OR 6.7
- ASA 2+ Status                           OR 4.8
- Surgical Site - thoracic                OR 4.24
- Increasing age                          OR 3
- CCF                                      OR 2.93
- Surgical length                         OR 2.26
- Emergency Surgery                       OR 2.21
- Impaired Sensorium - delerium           OR 1.39
- Anaesthesia                             OR 1.83

* ASA = American Society of Anesthesiologists; CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease.
† For \( I^2 \) definition and values, see the Appendix, available at www.annals.org.
‡ Estimates derived from meta-analysis of adjusted odds ratios from multivariable studies.
§ Estimates derived from meta-analysis of adjusted odds ratios from multivariable studies.
§ When compared with patients with lower ASA class values.
## Predictors of Postoperative ARDS

### Preoperative Predictor

<table>
<thead>
<tr>
<th>Predictor</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASA 3-5</td>
<td>18.96</td>
</tr>
<tr>
<td>Emergent Surgery</td>
<td>9.34</td>
</tr>
<tr>
<td>Renal Failure</td>
<td>2.19</td>
</tr>
<tr>
<td>COAD</td>
<td>2.16</td>
</tr>
<tr>
<td>Number of Anaesthetics/admission</td>
<td>1.37</td>
</tr>
<tr>
<td>Male</td>
<td>1.65</td>
</tr>
</tbody>
</table>

### Intraoperative

<table>
<thead>
<tr>
<th>Predictor</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBC transfusion</td>
<td>5.36</td>
</tr>
<tr>
<td>Crystalloid transfusion</td>
<td>1.43</td>
</tr>
<tr>
<td>Ventilator drive pressure</td>
<td>1.17</td>
</tr>
</tbody>
</table>

Liver Disease

1. Pugh Classification  Grps B, C  - 12% mortality in Abdominal Surgery

2. MELD Classification >15 Cancel ‘Elective’

\[
3.78 \times \ln[\text{serum bilirubin (mg/dL)}] + 11.2 \times \ln[\text{INR}] + 9.57 \times \ln[\text{serum creatinine (mg/dL)}] + 6.43 \times \text{aetiology(0: cholestatic or alcoholic, 1: otherwise)}
\]

Se Bllirubin  
Se Creatinine  
INR  
Aetiology of Liver disease

In Hospital 3mth Mortality

<table>
<thead>
<tr>
<th>Meld</th>
<th>Mortality %</th>
</tr>
</thead>
<tbody>
<tr>
<td>40+</td>
<td>71.3</td>
</tr>
<tr>
<td>30-39</td>
<td>52.6</td>
</tr>
<tr>
<td>20-29</td>
<td>19.6</td>
</tr>
<tr>
<td>10-19</td>
<td>6</td>
</tr>
<tr>
<td>&lt;9</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Monitoring and managing hepatic disease in anaesthesia

3. MELD plus Na

Wiesner et al. Model for end-stage liver disease (MELD) and allocation of donor livers. Gastroenterology (2003) vol. 124 (1) pp. 91-6
Hepatic Failure

MELD liver disease

Heart score

RCI cardiac risk

STS

Intensive Care admission

Modified Early warning Score (MEWS)

Respiratory assessment

Pneumonia Severity Index. PSI

CURB-65 severity score for community acquired pneumonia; confusion, age > 65, BUN, RR. Need for intubation
Biochemical Marker Risk Assessment

BNP levels in predicting Major Adverse Cardiac Event (MACE) at 30D

<table>
<thead>
<tr>
<th>pg/ml</th>
<th>MACE %</th>
<th>Death %</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-29</td>
<td>1.2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>30-115</td>
<td>6.5</td>
<td>2.8</td>
<td>5.6</td>
</tr>
<tr>
<td>116-372</td>
<td>20.9</td>
<td>5.5</td>
<td>21</td>
</tr>
<tr>
<td>&gt;372</td>
<td>36.7</td>
<td>12.2</td>
<td>45.5</td>
</tr>
</tbody>
</table>

J Am Coll Cardiol, 2011; 58:522-529,
Postoperative B-type Natriuretic Peptide for Prediction of Major Cardiac Events in Patients Undergoing Noncardiac Surgery

Systematic Review and Individual Patient Meta-analysis

Reitze N. Rodseth M.B.Ch.B., F.C.A., M.Med.,* Bruce M. Biccard, M.B.Ch.B., F.C.A., Ph.D.,†
Rong Chu, M.Sc., Ph.D.,‡ Giovana A. Lurati Buse, M.D.,§ Lehana Thabane, Ph.D.,||
Ameet Bakhai, M.B.B.S., M.D., F.R.C.P., M.E.S.H., F.E.S.C.,# Daniel Bolliger, M.D.,**
Lucio Cagini, M.D.,+++ Thomas J. Cahill, M.A., M.B.B.S., M.R.C.P.,++
Daniela Cardinale, M.D., Ph.D., F.E.S.C., §§ Carol P. W. Chong, M.B.B.S., F.R.A.C.P., M.D.,||||
Miłosław Cnotliwy, M.D., Ph.D.,## Salvatore Di Somma, M.D., Ph.D.,*** René Fahrner, M.D.,+++
Wen K. Lim, M.D., M.B.B.S., F.R.A.C.P.,+++ Elisabeth Mahla, M.D., §§§
Yannick Le Manach, M.D., Ph.D.,||| Ramaswamy Manikandan, M.D.,### Wook B. Pyun, M.D.,****
Sriram Rajagopalan, M.D., F.R.C.S.,+++ Milan Radović, M.D., Ph.D.,++++
Robert C. Schutt, M.D., §§§§ Daniel I. Sessler, M.D.,|||||
Stuart Suttle, M.B.Ch.B., M.D., F.R.C.S.Ed.,#### Thuvaraha Vanniyasingam, B.Sc.,*****
Marek Waliszek, M.D., Ph.D.,++++++ P. J. Devereaux, M.D., Ph.D.,+++++++
The Prognostic Value of Pre-Operative and Post-Operative B-Type Natriuretic Peptides in Patients Undergoing Noncardiac Surgery: B-Type Natriuretic Peptide and N-Terminal Fragment of Pro-B-Type Natriuretic Peptide: A Systematic Review and Individual Patient Data Meta-Analysis

### Table 5. Postoperative NT-proBNP Thresholds and the Incidence of Mortality or Nonfatal MI at 30 Days after Surgery

<table>
<thead>
<tr>
<th>NT-proBNP Value, pg/ml</th>
<th>Mortality or MI for All Types of Surgery n/N*</th>
<th>% (95% CI)</th>
<th>Adjusted Odds Ratio, 95% CI</th>
<th>Multilevel Likelihood Ratios</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–300</td>
<td>11/605</td>
<td>1.8 (0.8–2.9)</td>
<td>1</td>
<td>0.16</td>
</tr>
<tr>
<td>&gt;300–900</td>
<td>31/356</td>
<td>8.7 (5.8–11.7)</td>
<td>1.8 (0.57–5.61)</td>
<td>0.75</td>
</tr>
<tr>
<td>&gt;900–3,000</td>
<td>63/301</td>
<td>20.9 (16.3–22.5)</td>
<td>4.7 (1.62–13.37)</td>
<td>1.79</td>
</tr>
<tr>
<td>&gt;3,000</td>
<td>61/159</td>
<td>38.4 (30.7–46)</td>
<td>12.5 (2.85–54.89)</td>
<td>3.28</td>
</tr>
<tr>
<td>Total</td>
<td>166/1,421</td>
<td>11.7 (10.0–13.4)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* n/N = number of patients who died in subgroup/total number of patients in subgroup. MI = myocardial infarction; NT-proBNP = N-terminal B-type natriuretic peptide.

### Table 6. Postoperative BNP Thresholds and the Incidence of Mortality or Nonfatal MI at 30 Days after Surgery

<table>
<thead>
<tr>
<th>BNP Value, pg/ml</th>
<th>Mortality or MI for All Types of Surgery n/N*</th>
<th>% (95% CI)</th>
<th>Adjusted Odds Ratio, 95% CI</th>
<th>Multilevel Likelihood Ratios</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–250</td>
<td>31/467</td>
<td>6.6 (4.7–9.2)</td>
<td>1</td>
<td>0.58</td>
</tr>
<tr>
<td>&gt;250–400</td>
<td>8/51</td>
<td>15.7 (6.4–26.1)</td>
<td>2.5 (1.39–4.49)</td>
<td>1.37</td>
</tr>
<tr>
<td>&gt;400</td>
<td>33/112</td>
<td>29.5 (20.7–37.8)</td>
<td>5.9 (3.71–9.26)</td>
<td>2.58</td>
</tr>
<tr>
<td>Total</td>
<td>72/630</td>
<td>11.4 (8.9–13.9)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* n/N = number of patients who died in subgroup/total number of patients in subgroup. BNP = B-type natriuretic peptide; MI = myocardial infarction.
ROC calculation

Postoperative point was

- **BNP**: 245 pg/ml  (ROC 0.71 95% CI 0.64-0.78)
- **NT-proBNP**: 718 pg/ml  (95% CI 656-995 pg/ml)

**Merged**: 0.76 95% CI 0.73-0.80.

*Anaesthesiaology* 2013;119:270-83
Life threatening
Major Risk
Emergency
Time Critical
Anaesthetic
Surgery

Valvular heart Disease
Pulmonary Hypertension
Coronary Artery/Left main Disease
Left ventricular failure
Myasthenia
Hepatic Failure
Respiratory Failure

Carcinoma
Aneurysms
Intracranial tumors
Unstable fractures
Infections requiring drainage

Cancel
Delay
Resolve
Proceed
Coronary Artery Disease
Coronary Artery Disease
## Non Cardiac Surgery following Cardiac intervention

<table>
<thead>
<tr>
<th></th>
<th>3-4 weeks</th>
<th>2-3 months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PCI</td>
<td>CABG</td>
</tr>
<tr>
<td><strong>Mortality</strong></td>
<td>26%&lt;sup&gt;1-4&lt;/sup&gt;</td>
<td>21%&lt;sup&gt;5&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>MI</strong></td>
<td>35%</td>
<td></td>
</tr>
</tbody>
</table>

Coronary Revascularisation

• Revascularisation pre surgery vs maximal medical therapy (b-Blocker, Statin, Aspirin) outcome no different


• Half Postoperative MI occur in areas of non significant stenosis.

Coronary Artery Disease

The Surgery cannot wait 24 hours.

The risk of PCI or CABG greater than Surgery proposed with "Maximal Medical Protection" - (B Blockade, Statins, AP therapy)

Echo:

LV function
Valvular pathology

Proceed
Coronary Artery Disease

Resolve

The “Time critical” surgery can wait 2-3 months.

Indicated if High level proximal stenosis, large area of myocardium affected.

Unstable plaque

BMS, 4-6 weeks, ? Double AP therapy
Coronary Artery Disease

The “Time critical” surgery can wait 2-3 weeks

? Opinion for the Role of Isolated coronary Dilatation without stent.

Opinion Delay

Cath Lab

Delay

Echo:

LV function
Valvular pathology

Nothing to offer

Proceed
# Non Cardiac Surgery and Balloon Angioplasty

<table>
<thead>
<tr>
<th></th>
<th>Surgery within 60 days</th>
<th>Surgery within 14 days</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mortality</strong></td>
<td>0.3%</td>
<td>0.5%</td>
</tr>
<tr>
<td><strong>MI</strong></td>
<td>0.6%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Valvular Heart disease
Valvular Heart disease

Aortic Stenosis.

Un-Diagnosed AS and Non-Cardiac surgery - Comps 10-30%
Arrhythmias esp AF or SVT
Diastolic Dysfunction, filling and perioperative fluid use.
Systemic hypotension
Preoperative medications may need to be continued - Diuretics

Mitral Stenosis.

LV Failure - “Can the patient lie flat”

2014 AHA/ACC guideline for the management of patients with valvular heart disease.

Anaesthesia reduces systemic vascular resistance, tachycardia reduces LV filling and coronary perfusion and is associated with arrhythmias and large fluid shifts.
Severe AS

- Mortality no different to matched Controls
- Increased Cardiovascular morbidity (MI CHF)
  18.8% AS vs 10.5% Matched Controls n=256
  Mayo 2000-10 -Independent predictors AF, Cr>2mg/dl, Emergency Sx

Symptoms at Diagnosis of AS
- Frequent and Unrelated to severity.

Balloon Valvuloplasty
Average increase in valve area 0.6 to 0.9cm², improved symptoms and ‘may’ improve haemodynamics.
Case series 15 unsuitable for TAVI (Mayo 1989) Hayes et al
- 1 death due to VT, 4 Complications.
7 Roth (1989)
7 Levine (1988)
reports in pregnancy, cancer, liver transplantation.


Mitral Stenosis

TTE for assessment of severity and anaesthetic planning

MS difficult for Anaesthesia.

‘Heart ValveTeam’ review

Consider percutaneous balloon commissuropotomy.

VHA recomend valve morphology not favourable for balloon -

‘Maintain preload high enough to allow an adequate forward cardiac output across the stenotic valve but low enough to avoid pulmonary oedema’ (Level C)
Pulmonary Hypertension and non-cardiac surgery

*Cleveland Clinic experience.*

---

**Table 2** Perioperative outcomes in patients with and without pulmonary hypertension after non-cardiac surgery.

<table>
<thead>
<tr>
<th>Perioperative Outcome</th>
<th>PH (n = 96)</th>
<th>No PH (n = 77)</th>
<th>p-Value</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morbidity/Mortality*</td>
<td>26.0</td>
<td>2.6</td>
<td>&lt;.0001</td>
<td>13.1</td>
</tr>
<tr>
<td>Perioperative MI</td>
<td>1.0</td>
<td>.0</td>
<td>.28</td>
<td>–</td>
</tr>
<tr>
<td>Perioperative CHF</td>
<td>13.5</td>
<td>1.3</td>
<td>.001</td>
<td>11.9</td>
</tr>
<tr>
<td>Hemodynamic instability</td>
<td>8.3</td>
<td>0</td>
<td>.0020</td>
<td>–</td>
</tr>
<tr>
<td>Sepsis</td>
<td>10.4</td>
<td>0</td>
<td>.0005</td>
<td>–</td>
</tr>
<tr>
<td>Respiratory failure</td>
<td>7.3</td>
<td>0</td>
<td>.004</td>
<td>–</td>
</tr>
<tr>
<td>Prolonged intubation</td>
<td>8.3</td>
<td>0</td>
<td>.002</td>
<td>–</td>
</tr>
<tr>
<td>ICU length of stay (days)</td>
<td>.66 ± 2.7</td>
<td>.01 ± .11</td>
<td>.04</td>
<td>–</td>
</tr>
<tr>
<td>Hospital length of stay (days)</td>
<td>7.0 ± 9.3</td>
<td>3.2 ± 3.1</td>
<td>.0008</td>
<td>–</td>
</tr>
<tr>
<td>30 day hospital readmission</td>
<td>16.7</td>
<td>7.8</td>
<td>.08</td>
<td>2.4</td>
</tr>
</tbody>
</table>

MI = Myocardial Infarction; CHF = Congestive Heart Failure; ICU: Intensive Care Unit.

* Numbers represent percentages within each group unless otherwise noted.
Pulmonary Hypertension and non-cardiac surgery

1. Cleveland Clinic experience.

<table>
<thead>
<tr>
<th></th>
<th>PH</th>
<th>No PH</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPAP mmHg</td>
<td>37.3±8</td>
<td>17.4±4</td>
</tr>
<tr>
<td>PCWP mmHg</td>
<td>20.8±7.5</td>
<td>11.2±4.6</td>
</tr>
<tr>
<td>PVR Wood U</td>
<td>3.3±2.1</td>
<td>1.2±0.8</td>
</tr>
</tbody>
</table>

2. Mortality 7-9.4%


Ramakrishna G et al. J am Coll Cardiol 2005;45(10): 1691-9,
Pulmonary Hypertension and non-cardiac surgery

Preoperative
  Expert physician involvement “Pulm Hypertensionists”

Intraoperative
  Appropriate Site, - Time, Anaesthetic support
  Monitoring; - PA Catheter, Echo,
  Specialised intervention - Inotropes, NO, milrinone,
  prostaglandins IABP. Suddenafil

Postoperative support.
  ICU to actively treat CHF.

Now You can do the operation.
Delay

Is this an appropriate site?
Is this an appropriate time?
Skill set.
Support.
Resolve
Dual Antiplatelet therapy
Dual Platelet Therapy and Surgery

Thrombosis Risk

Low

High

Low Bleeding Risk

Surgery

High Bleeding Risk
DAPT - Bleeding Risk

Plastics
Moh Procedure. Complications 8x more likely on DAPT

Vascular surgery
n=647 no increased bleeding or transfusion
Increased haematoma in carotid surgery
10,406 vascular (carotid, lower extremities, AAA, Stent) no increased transfusion, reoperation, bleeding

Thoracic
No increased risk. One report increased transfusion

Orthopaedic
Major joint but not NOF increase bleeding and transfusion

Urology
TURP increased risk

Intra abdominal
‘Safe’

Cardiac
Increased bleeding
Reoperation rate 1.6 to 9.8%,
Transfusion 51% vs 73% and Blood Units 1.6 vs 3.0


Perioperative management of antiplatelet therapy

DAPT - Bleeding Risk

**Plastics** Moh Procedure. Complications 8x more likely on DAPT

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**Cardiac** Increased bleeding
Reoperation rate 1.6 to 9.8%,
Transfusion 51% vs 73% and Blood Units 1.6 vs 3.0


**Perioperative management of antiplatelet therapy**


Thrombosis Risk of DAP withdrawal

- Acute withdrawal AP
  - Rebound increased platelet adhesiveness
  - Prothrombotic due to excessive thromboxane A2
  - Decreased fibrinolysis associated with Acute-phase reaction with Surgery.
- DES thrombosis of 1.5% first year, but If discontinue hazard ratio 57 and if instent stenosis - mortality 45%.
- Clopidigrel stop in first month 10x likely to die.

Table 2. Evaluating Risk for Stent Thrombosis.

- Previous coronary stent and need for non-cardiac invasive procedure
- What type of stent?
- Bare metal stent
  - How long since stent was implanted?
    - < 6 weeks: High risk
    - > 6 weeks: Lower risk
- Drug eluting stent
  - How long since stent was implanted?
    - > 1 year: Presence of additional risk factors?
      - Yes: High risk
      - No: Low risk
    - < 1 year: High risk

Additional risk factors for stent thrombosis

<table>
<thead>
<tr>
<th>Clinical factors</th>
<th>Anatomic factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous stent thrombosis</td>
<td>Left main stenting</td>
</tr>
<tr>
<td>Advanced age (&gt;80 years)</td>
<td>Bifurcation stenting</td>
</tr>
<tr>
<td>ACS indication for stent</td>
<td>Ostial stenting</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Small (&lt;3 mm) stent</td>
</tr>
<tr>
<td>Renal impairment</td>
<td>Long (&gt;18 mm) stent</td>
</tr>
<tr>
<td>Low ejection fraction</td>
<td>Multiple stents</td>
</tr>
</tbody>
</table>
### Three Variables: Time Critical Surgery and DAP

<table>
<thead>
<tr>
<th>Surgery</th>
<th>Time</th>
<th>Thrombosis Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High Bleeding Risk</strong></td>
<td><strong>Hours</strong></td>
<td><strong>High</strong></td>
</tr>
<tr>
<td>Intracranial neurosurgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spinal canal surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eye Posterior chamber</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Intermediate Bleeding Risk</strong></td>
<td><strong>Day</strong></td>
<td><strong>Low</strong></td>
</tr>
<tr>
<td>Visceral Surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiovascular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major Orthopaedic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Otolaryngology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urological</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reconstructive Surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Low Bleeding Risk</strong></td>
<td><strong>Week</strong></td>
<td><strong>Low</strong></td>
</tr>
<tr>
<td>Peripheral</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor orthopaedic, otolaryngology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endoscopy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eye Anterior chamber</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**High-risk situations:**
- <6 weeks after MI, PCI, stroke
- <6 weeks after bare metal stent
- <3 months after stent sirolimus
- <6 months after stent paclitaxel
- multiple stent implantations, long stent (>36 mm), chronic total occlusions and bifurcation

**18 Scenarios plus the ‘what-ifs’**

*Perioperative management of antiplatelet therapy*
Therapy Options

Cancel

Duration depends on Stent
Cancel till on single platelet
therapy

Delay - 1 D

1. Withdraw Clopidogrel
2. Platelet Bridging therapy

Proceed

Low Bleeding Risk

Resolve - 5 D

1. Withdraw Clopidogrel
2. Withdraw Clopidogrel
plus
Tirrofiban bridging
Early reinstitution DAP
Monitoring


Perioperative management of antiplatelet therapy

No consensus on Bridging DES

<table>
<thead>
<tr>
<th>Medical Society</th>
<th>Bridging Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Chest Physicians</td>
<td>No bridging</td>
</tr>
<tr>
<td>Australia/ NZ Cardiac society</td>
<td>G11b/IIIa inhibitor and heparin</td>
</tr>
<tr>
<td>French</td>
<td>LMW Heparin plus NSAID</td>
</tr>
<tr>
<td>Austrian Anesthesiology Society</td>
<td>G11b/IIIa inhibitor</td>
</tr>
<tr>
<td>Japanese Circulation Society</td>
<td>Heparin</td>
</tr>
</tbody>
</table>

Bridging DES

• Site needs 24/7 PCI service
• Monitor in HDU
• Heparins no value
• Tirofiban/ Heparin - 5 days cease Clopidogrel, 3 days prior to surgery, Tirrofiban and heparin 8 hours prior to surgery
• >100 patients treated with no instent thrombosis - ‘minor bleeding’

Bridging Therapy for early surgery with DES

36 patients No MACE at 30 days
6/36 bleeding requiring transfusion.
Cease DAP 5 days prior to surgery
Admit 2-3 days Tirofiban therapy
Stop Tirofiban 4 hrs prior to surgery.

Bridging therapy for early surgery in patients on dual antiplatelet therapy after drug-eluting stent implantation

E. G. Marcos • A. C. Da Fonseca • S. H. Hofma
Neth Heart J (2011) 19:412-417
Which Stent?

- BMS
- 1st Gen DES
  - Sirolimus (Cypher)
  - Paclitaxel (Taxus)
- 2nd Gen DES
  - Everolimus
  - Zotarolimus
- BioCompatible Genous R Stent

Clopidogrel Therapy

4-6 weeks
12 months
6 months
10 Days

Bridging - Tirofiban and Heparin

Surgery

Aspirin Clearance 2hrs, Clopidogrel Clearance 6-8hrs and metabolite 6-8 hours.

Rational:
1. Platelet transfusion 5 half lives after cessation of Clopidogrel.
2. ASA affected platelets recruited by thromboxane in Platelet concentrate.

Caution - Platelets within the time frame of Clopidogrel working will just reverse aspirin and may increase thrombosis.


Note: Prasugrel and Ticagrelor is 8 and 13 h respectively, with up to 96 h of increased bleeding risk for the latter agent.
If appropriate, prasugrel should be ceased seven days before elective surgery, and ticagrelor between 3 and 5 days, depending on the patient’s thrombotic risk.

### Pharmacological summary of P2Y₁₃ Inhibitors

<table>
<thead>
<tr>
<th>Loading dose</th>
<th>Clopidogrel</th>
<th>Prasugrel</th>
<th>Ticagrelor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>300 mg or 600 mg</td>
<td>60 mg</td>
<td>180 mg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maintenance dose</th>
<th>75 mg daily</th>
<th>10 mg daily</th>
<th>90 mg twice daily</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>P2Y₁₃ receptor binding</th>
<th>Irreversible</th>
<th>Irreversible</th>
<th>Reversible</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Hepatic metabolism</th>
<th>Two-step metabolism involving CYP2C19 to convert it to an active metabolite&lt;sup&gt;2&lt;/sup&gt; Dysfuction of this enzyme may be the cause of clopidogrel resistance&lt;sup&gt;7&lt;/sup&gt;</th>
<th>Rapidly hydrolysed to an intermediate metabolite, and then further metabolised by CYP3A and CYP2B6&lt;sup&gt;3&lt;/sup&gt;</th>
<th>Metabolised by CYP3A4&lt;sup&gt;4&lt;/sup&gt;</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Examples of drug interactions affecting P2Y₁₃ inhibitors</th>
<th>CYP2C19 inhibitors will decrease efficacy e.g. clarithromycin, fluconazole, omeprazole</th>
<th>No significant CYP interactions, however data are limited</th>
<th>CYP3A4 inhibitors will increase adverse effects e.g. clarithromycin CYP3A4 Inducers will decrease efficacy e.g. carbamazepine, dexamethasone, rifampicin</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Examples of P2Y₁₃ inhibitors affecting other drugs</th>
<th>–</th>
<th>–</th>
<th>Inhibits CYP3A4 so may increase concentrations</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Time to onset of maximal platelet inhibition</th>
<th>8 hours (300 mg)&lt;sup&gt;2&lt;/sup&gt;</th>
<th>30 minutes&lt;sup&gt;4&lt;/sup&gt;</th>
<th>2 hours&lt;sup&gt;5&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 hours (600 mg)&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time to recover platelet function after ceasing medication</th>
<th>5 days&lt;sup&gt;3&lt;/sup&gt;</th>
<th>7 days&lt;sup&gt;5&lt;/sup&gt;</th>
<th>2–3 days&lt;sup&gt;5&lt;/sup&gt;</th>
</tr>
</thead>
</table>

* Simvastatin doses of 40 mg or more may be associated with an increased risk of myopathy and other adverse effects.*

CYP = cytochrome
**Clopidogrel** 600mg/75mgBD, v **Ticagrelor** 180mg/90mg BD

Non Reversible ADP-P2Y<sub>12</sub>  
Reversible Non competitive ADP-P2Y<sub>12</sub>

**Time to 10% IPA**

- Ticagrelor 109.19 hrs 4.5 Days
- Clopidogrel 195.66 hrs 8.1 Days

**Minor Bleeding–related events**

- Ticagrelor group 28.1%
- Clopidogrel 13.0%
- Placebo 8.3%

Chlopidogrel - Cmax of the active thiol derivative (T1/2 30 mins) is 2.0 x for a four fold increase in the dose. ie 300mg 2.0 x effect of 75mg BD dosing.

*Paul A. Gurbel, MD; Kevin P. Bliden et al. Randomized Double-Blind Assessment of the ONSET and OFFSET of the Antiplatelet Effects of Ticagrelor Versus Clopidogrel in Patients With Stable Coronary Artery Disease. The ONSET/OFFSET Study. Circulation.2009; 120: 2577-2585*
Oral Anticoagulants

Resolve

- Elixir, apixaban, 2.5 mg
- Adempas, rivaroxaban, 1 mg
- Pradaxa, 110 mg
- Pradaxa, 75 mg
## New Oral Anticoagulants

### Apixaban
- **Eliquis**
- **CrCl**: >50-<80 ml/min → 48hrs
- **CrCl**: <30 ml/min → 72hrs
- **Therapy**: APCC, PCC, rFVIIa

### Rivaroxaban
- **Xarelto**
- **CrCl**: >50-<80 ml/min → 48hrs
- **CrCl**: <30 ml/min → 72hrs
- **Therapy**: APCC, PCC, rFVIIa

### Dabigatran
- **Pradaxa**
- **CrCl**: >80 ml/min → 2 days
- **CrCl**: >50-<80 ml/min → 2-3 days
- **CrCl**: >30-<50 ml/min → 4 days
- **CrCl**: <30 ml/min → 5 days
- **Therapy**: Dialysis, rFVIIa, prothrombin X

TGA PI Apixaban, Rivaroxaban, Dabigatran
Clinical course of dabigatran-associated massive postcardiac surgery bleeding.

79 year, 80kg, AVR + CABG×1

Dabigatran 150mg BD stopped 48hrs before surgery.

CrCl 36mls/hr

[Dabigatran] level of 95ng/ml (same as in the RE-LY study Warfarin vs Dabigatran 110mg or 150mg bd).

Recommendation:


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Mortality in patients with Cirrhotic Liver disease:

- Abdominal Surgery 30%
- Cirrhotic Patients and Open Cholecystectomy Mortality 23-50%
- Cardiac Surgery 16-31%
- Laparotomy for Trauma 45%
- Oesophageal Surgery 17-26%

Anaesthesia considerations:

- Hyperdynamic cardiovascular system of sepsis
- Altered drug kinetics
- Hypoxia - Hepatopulmonary syndrome
- Altered neurological state
- Hyponatraemia and central pontine demyelination
- Glucose metabolism
- Coagulation

Cancel Liver Disease
Cancel

• The Diagnosis
• Wrong operation is planned
• The operation will not benefit the patient.
80 yr old female
For MVRepair, Single graft, ?TVR

Severe SOB
PHx Renal Impairment, Hypertension.
Echo: Severe MR, LVH.
E = 69 cm/sec
MV DecT 232 ms
E/Es’ = 17
S = 10 cm/sec
D = 33.7 cm sec
Dx Storage Disease. Amyloidosis
Cancelled - Pump Assist - TVR, Single graft, Cardiac Biopsy
Amyloid
Recovered. Died 6 months later.
Delay

Resolve

Cancel
Delay

Resolve

Cancel
Delay

Resolve

Cancel