PRE OP ASSESSMENT CARDIAC SURGERY
IHD – CPB

N R Burri
LEARNING OUTCOMES:

• 1. LIST PRE OP ASSESSMENT TOOLS & AN UNDERSTANDING OF ONE METHOD OF RISK ASSESSMENT

• 2. DESCRIBE THE PRACTICAL CONDUCT OF CPB

• 3. DIFFERENCES BETWEEN CABG & OPCABG
1. Preoperative assessment for Cardiac Surgery
PRE OP ASSESSMENT

• Essential component - Preoperative care.
• Undiagnosed pathology ≈ 5%
• Sym/Signs/Capacity: Use Conventional indices.
• Tailor management to suit patients needs.
• Risk assessment: Sophisticated tools available.
USUAL ASSESSMENT ALGORITHM

HISTORY

EXAMINATION

INVESTIGATIONS
HISTORY : Case Notes / Interview
HIGH RISK FACTORS

- Age > 60yrs
- HTN
- BMI <20 or >35 kg/m\(^2\)
- CCF
- PVD
- Aortic atheroma

- Diabetes mellitus
- Renal insufficiency
- ACS
- COPD
- Neurological disease
- Previous cardiac surgery
MEDICATION

CARDIAC
• Anti-angina
• Antihypertensives, Statins
• Diuretics
• Anti-platelets / Anti-coagulants.

OTHERS:
• Oral hypoglycaemics,
• Histamine (H2) antagonists / PPIs
• Bronchodilators
• Corticosteroids
• Psychotropic drugs
## Medicines to continue / discontinue?

<table>
<thead>
<tr>
<th>CONTINUE</th>
<th>CONTROVERSIAL</th>
<th>DISCONTINUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statins</td>
<td>Aspirin</td>
<td>Clopidogrel</td>
</tr>
<tr>
<td>β blockers</td>
<td>ACE inhibitors</td>
<td>Tirofiban</td>
</tr>
<tr>
<td>Nitrates</td>
<td>ARBs</td>
<td>Diuretics</td>
</tr>
<tr>
<td>Calcium channel blockers</td>
<td></td>
<td>NSIADs</td>
</tr>
<tr>
<td>K⁺ channel openers</td>
<td></td>
<td>MAO inhibitors</td>
</tr>
<tr>
<td>Corticosteroids</td>
<td></td>
<td>Biguanides</td>
</tr>
<tr>
<td>Antidysrhythmics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bronchodilators.</td>
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</tbody>
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Symptoms & Signs

• Chest Pain:  
  Angina

• Breathlessness:  
  Dyspnoea

• Fainting:  
  Syncope

• Exercise tolerance:  
  Functional Capacity
## Angina

### Canadian Cardiovascular Society class

<table>
<thead>
<tr>
<th>Class</th>
<th>Angina</th>
<th>OPA</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Yes</td>
<td>Unaffected</td>
<td>Angina on Exertion</td>
</tr>
<tr>
<td>II</td>
<td>Yes</td>
<td>Slight Limitation</td>
<td>&gt; 1 flight of stairs</td>
</tr>
<tr>
<td>III</td>
<td>Yes</td>
<td>Marked limitation</td>
<td>1 flight of stairs</td>
</tr>
<tr>
<td>IV</td>
<td>Yes</td>
<td>Unable</td>
<td>Angina at Rest</td>
</tr>
</tbody>
</table>

**OPA:** Ordinary Physical Activity

CABG Mortality is 2.2% but 4.2% if CCS IV
# Functional Capacity

## New York Heart Association (NYHA) Class

<table>
<thead>
<tr>
<th>Functional Class</th>
<th>Description</th>
<th>Grade</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>OPA: No F P D A</td>
<td>A</td>
<td>No evidence of Dis.</td>
</tr>
<tr>
<td>II</td>
<td>OPA: Causes F P D A</td>
<td>B</td>
<td>Minimal CVS dis.</td>
</tr>
<tr>
<td>III</td>
<td>&lt; OPA: Causes F P D A</td>
<td>C</td>
<td>Moderate CVS dis.</td>
</tr>
<tr>
<td>IV</td>
<td>At Rest: Have F P D A</td>
<td>D</td>
<td>Severe CVS dis.</td>
</tr>
</tbody>
</table>

**OPA**: Ordinary Physical Activity  
**F P D A**: Fatigue, Palpitations, Dyspnoea, Angina

CABG Mortality is 2.2% but 6.6% if NYHA IV
Functional Capacity
Duke Activity Status Index

- **Poor:**
  \(<4 \text{ METs} = \text{ Walking indoors to self caring.}\\
- **Intermediate:**
  \(4 - 7 \text{ METs} = \text{ Walk 1 or 2 blocks to playing golf}\\
- **Good:**
  \(>7 \text{ METs} = \text{ Swimming to Heavy work}\\

\text{1 MET Metabolic Equivalent of Task = 3.5ml O}_2/\text{kg/mt}
EXAMINATION - MINIMUM

• **CVS:** HR, Rhythm, NIBP,
   Central/peripheral pulses
   Auscultation of Precordium

• **RS:** SpO$_2$, RR, Auscultation

• **Dentition & Airway**

• **Neurological:** Deficits ? / Documentation
PRESSURES - HAEMODYNAMIC DATA

- RA: 6mmHg
- RV: 25/2 mm Hg
- PA: 25/12 mmHg (16)

PCWP / LVEDP: 12 mmHg
LV: 140/12 mmHg
AO: 140/90 mmHg (105)

- SVR: 800 – 1200 dyne.s.cm\(^{-5}\)
- PVR: \approx100 dyne.s.cm\(^{-5}\)
- CI: 2.5 – 4.2

MAP COP SVR Relationship: Ohm’s Law: \( V = I \cdot R \)
INVESTIGATIONS:

ROUTINE & SPECIFIC:
- FBC
- Coagulation, G&S
- U&E
- LFT
- 12 Lead ECG
- PFT
- Catheterization:
- TTE / TOE

LEFT HEART
- Coronary angiography
- Aortography
- Ventriculography

RIGHT HEART
- PA Pressures
- Cardiac Output
- Transpulmonary gradient
- Vascular resistances
- Shunt fraction
RISK ASSESSMENT TOOLS

- Parsonnet Score
- EuroSCORE
# Parsonnet Additive Score: 14 Factors

## Patient Related
- Age: 7 - 20
- Female: 1
- Morbid Obesity: 3
- DM: 3
- HTN: 3
- LV dysfunction: 0 - 4
- LV Aneurysm: 5
- Reoperation: 5 - 10
- IABP: 2
- Dialysis dependent: 10
- Recently failed intervention: 5 - 10

## Surgery Related
- MV: 5 - 8
- AV: 5 - 7
- Valve + CABG: 2

## Mortality Risk
<table>
<thead>
<tr>
<th>Risk Level</th>
<th>Score Range</th>
<th>Mortality Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Risk</td>
<td>0 - 4</td>
<td>1%</td>
</tr>
<tr>
<td>Elevated Risk</td>
<td>5 - 9</td>
<td>5%</td>
</tr>
<tr>
<td>Significantly Elevated Risk</td>
<td>10 - 14</td>
<td>9%</td>
</tr>
<tr>
<td>High Risk</td>
<td>15 - 19</td>
<td>17%</td>
</tr>
<tr>
<td>Very High Risk</td>
<td>&gt;19</td>
<td>31%</td>
</tr>
</tbody>
</table>
# European System for Cardiac Operative Risk Evaluation - EuroSCORE

## GENERAL
- Age $> 60$ (per 5yrs) $\quad 1$
- Sex Female $\quad 1$
- COPD $\quad 1$
- Extra cardiac arteriopathy $\quad 2$
- Neurological dysfunction $\quad 2$
- Serum Creatinine $> 200$ $\quad 2$
- Critical preoperative state $\quad 2$
- Previous cardiac surgery $\quad 3$
- Active endocarditis $\quad 3$

## CARDIAC
- Unstable angina $\quad 2$
- LV dysfunction $\quad 1 / 3$
- Recent Mi $\quad 2$
- PAH $\quad 2$

## OPERATIVE
- Emergency $\quad 2$
- Other than Isolated CABG $\quad 2$
- Thoracic aortic surgery $\quad 3$
- Post infarct septal rupture $\quad 4$
Example – Risk Assessment

60 yr male
Asymptomatic
Critical LMS stenosis
Normal LV: 1%
(0.94 logistic)

75 yr Female
Angina, CCS IV
Emergency CABG
Poor LV 13%
(38.74% logistic)

LOGISTIC SCORE IS MORE ACCURATE FOR HIGH RISK PATIENT RATHER THAN ADDITIVE
ADDITIONAL ASSESSMENT

• Intended conduit:  
  Harvest sites ?
• Recent anticoagulation
• PPM / ICD presence:  
  Reprogramming
• Oesophagaeal pathology:  
  TOE probe ?
• Jehovah’s witness
ISCHEMIC HEART DISEASE - OPTIONS
TIME LINE - HEART SURGERY

- **1916**: Heparin / **1937**: Protamine
- **1953**: Gibbon: Successful CPB use in human
- **1956**: Bubble & Disc oxygenators
- **1958**: Melrose: First open heart surgery in UK
- **1970**: Centrifugal pumps
- **1980**: Hollow fiber membrane oxygenators
MANAGEMENT OF IHD

NON SURGICAL

• PCI

SURGICAL

• CABG
• OPCABG
• MIDCAB
• TECAB (Robotic)
• TMR
### Coronary Artery Surgery Study (CASS)

<table>
<thead>
<tr>
<th>Survival Benefit from Surgery</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>+++</td>
<td>&gt; 50% stenosis LMS</td>
</tr>
<tr>
<td>++</td>
<td>Proximal stenosis of LAD Cx RCA</td>
</tr>
<tr>
<td>+</td>
<td>&gt; 50% stenosis 2 major + High Grade stenosis Prox. LAD</td>
</tr>
</tbody>
</table>

Young Fit patient with 90% LMS  
vs  
Old Unfit Diabetic arteriopath with single vessel Cx branch
Coronary Artery Surgery Study (CASS): a randomized trial of coronary artery bypass surgery
Survival data

CASS Principal Investigators and their Associates*
INDICATIONS - CABG

- LMS Stenosis > 50%
- Triple vessel EF < 50%
- Triple vessel EF >50%, inducible ischaemia
- Two vessel Proximal LAD, EF < 50%
- Non stentable Lesions
2. ON PUMP CABG
## PREMEDITANTS

### ORAL

**(90 – 120 mts prior)**
- **LORAZEPAM**: 2 – 4 mg
- **TEMAZEPAM**: 10 – 20 mg
- **CLONIDINE**: 100 – 150 μg
- **METHADONE**: 0.1–0.2 mg/kg

### INTRA MUSCULAR

**(45 – 60 mts prior)**
- **Morphine Sulfate**: (0.2 – 0.3 mg/kg)
  + **Hyoscine hydrobromide**: (200 - 400μg)
IDEAL CARDIAC ANAESTHETIC AGENT

- Unaltered haemodynamics
- Lack of myocardial depression
- Lack of coronary constriction or steal
- Non anaesthetic cardio protective effects
- Residual analgesia
- Rapid onset offset & titration
ROUTINE CONDUCT

• PREMEDICATION
• WHO SAFETY CHECK
• VASCULAR ACCESS: Art / CVC / ± PAFC sheath
• INDUCTION: Preoxygenation, Balanced GA
• MAINTENANCE: Volatile: 0.5 – 1MAC or
  Propofol: 3 – 4 mg/kg/hr
  Plasma level: 1.5 – 3 μg/ml
Anaesthetic Check List:
(prior to starting surgery)

• Ventilation
• Zero lines
• Five A’s: Access
  Anaesthesia
  ABG
  ACT
  Antibiotics
• Check X matched blood
DEGREES OF ANAESTHETIC/SURGICAL STIMULATION

HIGH
- Laryngoscopy
- Tracheal intubation
- Skin incision
- Sternotomy
- Sternal retraction
- Sternal elevation

LOW
- Post intubation
- Preparing & draping
- Surgical delays
- Mammary harvesting
PRACTICAL CONDUCT OF CPB
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• Preparation
• Communication
• Anticoagulation
• Cannulation
• Initiation
• Management (Cardiovascular)
• Weaning
BASIC COMPONENTS OF CPB SYSTEM

- Venous Reservoir
- Pump
- Heat Exchanger
- Membrane Oxygenator
- Arterial
- Venous
- Lungs
- Ventricles
- RA
COMMUNICATION

• Heparin administration
• FULL FLOWS: Commencement of CPB
• Lungs OFF (Following full flows)
• Lungs ON (Before weaning CPB)
• Termination of CPB
• Protamine administration.
ANTICOAGULATION

• Precedes / accompanies Aortic Cannulation.
• 3 mg/kg = 300 U/kg
• Point of Care anticoagulation monitor
• ACT: > 300s suction / > 400s Cannulation
• Resistance: AT deficiency
CANNULATION

Arterial always precedes Venous.
• Aorta / Femoral/ SCV
• MAP < 80 mmHg @ insertion (Position check)

Venous Cannula: CABG: Single cannula in RA
RA/LA access: BiCaval

Additional Cannulae:
Root: Aortic root / Sinus
Vents: Superior PV / Main PA / LV Apex
INITIATION OF CPB: AVID

- **Arterial inflow:**
  Oxygen, Malposition, Dissection

- **Venous drainage:**
  Good drainage / SVC obstruction

- **Incomplete bypass:**
  Pulsatile pressures, inadequate flows

- **Drugs:**
  Discontinue vasoactive medications/ventilation
MANAGEMENT CPB

- Physiological targets
- Pump Flow rate
- Haematocrit
- Anaesthesia (Volatile / Propofol)
- Cardioplegia (K⁺ rich = diastolic arrest)
- Rewarming (Arterial – NP = 4⁰ / SvO₂ >65%)
- Deairing (Inflate lungs / TEE)
- Defibrillation

Drugs

Pacing
PHYSIOLOGICAL TARGETS: CPB

- **MAP:** 50 – 70 mmHg
- **CVP:** 0 – 5 mmHg
- **Pump Flow:** 2.2 – 2.5 l min\(^{-1}\) m\(^{-2}\)
- **SvO\(_2\):** > 65%
- **Hct:** 0.2 – 0.25
- **ABG:** α stat approach.
- **Glucose:** 5 – 9 mmol.l\(^{-1}\)
FACTORS DETERMINING PUMP FLOW RATE

• Body surface area (2.2 – 2.5 l/mt/m²)
• Haematocrit (22- 25%)
• Depth of anaesthesia
• Neuromuscular block
• Systemic Vascular Resistance
20ml

Sterile Concentrate for Cardioplegia Infusion

Magnesium Chloride 3.253g,
Potassium Chloride 1.193g,
Procaine Hydrochloride 272.8mg
Also contains: Disodium Edetate,
Sodium Hydroxide and Water for Injections

30ml to be diluted immediately before use with 1 litre.
WEANING: TRAVVEL

- **T**emperature: NP 36 – 37° C
- **R**ate / Rhythm: Fixed rate epicardial pacing
- **A**ir: Removal of air / TOE check
- **V**enting: Lines clamped/ removed
- **V**entilation: Initiate
- **E**lectrolytes: 10/5 O₂/CO₂, BE <- 5, K⁺ > 4.5
- **L**evel: Table, Re-zero transducers
CONCLUDING SURGERY

- Termination of CPB
- Venous cannula & Vents are removed
- Protamine (1mg = 100 units heparin)
- Aortic cannula removed
- Haemostasis secured
- Transfer to ICU