Management of Patients Undergoing General Anaesthesia or MAC in the Cardiac Cath Lab

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Queen Elizabeth Hospital, HKSAR
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Queen Elizabeth Hospital
Major Acute Hospital, cardiac surgery and trauma centre
>1800 acute beds
Almost all surgical and medical specialties
Disclaimer

- TAVI service
- No expert
- Workload – not heavy
- Mostly GA – ‘Technically’ no difference to OT
- No paediatric case
- The expert in our hospital: in fellowship examination as examiner
QEH experience

- One elective list in CCL weekly GA session (Tues am)
- TAVI started in December 2010
- 37 CoreValves
- 16 LAA Occlusion
- 4 Paravalvular Leakage Closure/Plug
- 2 Mitraclip
Scope of Procedures in QEH CCL

- Cardiac Cath Lab procedures (diagnostic → therapeutic) – require anaesthetic input

Procedures:
- TAVI (Transcatheter AV Implantation)
- LAAO (Occluder)
- Paravalvular leakage closure
- Mitraclip
- Pacemaker lead removal
- Paediatric: PDA/ASD occluder, pulmonary valvuloplasty, COA, CC
Worst nightmare....

Dyslexic CPR

EMS Flight Crew ... look for us on Facebook
Advanced Technology....
How far can we go?

The Final Frontier

Adventure and imagination will meet at the Final Frontier...
WHAT ARE THE CHALLENGES FOR ANAESTHESIOLOGISTS IN CCL?
Leave our comfort zone – offsite anaesthesia
1. Environment
So packed!!
Paediatric / Adult Cardiac Intervention

- Biplane XR
- Cardio
- Defib machine
- Contrast injector
- Cath lab kit
- Drip std + syr pump
- Anaes Machine
- Anaes trolley
- Nurse
- OTA
2. Lighting condition
3. Level of support

Different equipments inside OT

Specially designed working trolley
4. Equipments

Scavenging system and pipeline system
5. Patient Safety (1)

Circuit tubings and iv lines
5. Patient Safety (2)

Hypothermia

Positioning

CCL table surface
5. Patient Safety (3)

- Patient age extreme
- Comorbidity
- +/-Critical condition
- Contrast induced nephropathy
- Full bladder after procedure
6. Blood loss and transfusion

- Fragile, poor tolerance to anemia/hypovoleemia
- Antiplatelet agent/anticoagulant
- Unsuspected major blood loss
7. Miscellaneous

- Occupational hazard: XR, injury
- Variable procedures with increasing complexity
- Contingency planning and support
Summary of issues and strength

- Progress in medical technology
- Incessant introduction of new and complex therapeutic options inside CCL for structural or congenital heart diseases on sicker patients with limited cardiorespiratory reserve
- Significant improvements in monitoring and introduction of short-acting, fast-emergence anaesthetic drugs
Patient physical status & disease pathology

Anaesthesiologists Mission

Level of Anaesthesia needed

Procedure & location
What is the mission of anaesthesiologist in CCL?

- Guarantee the **safest** course of action for our patients through standardized care and monitoring in **GA** or **MAC** delivered outside operating room
MAC, Monitored Anaesthetic Care:

- Proper patient preparation
- Varying levels of sedation, analgesia and anxiolysis as necessary, with conversion to general anaesthesia whenever necessary during the diagnostic or interventional procedure
### Table 1
Continuum of the depth of sedation

<table>
<thead>
<tr>
<th></th>
<th>Minimal Sedation/Anxiolysis</th>
<th>Moderate Sedation/Analgesia</th>
<th>Deep Sedation/Analgesia</th>
<th>General Anesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsiveness</td>
<td>Normal response to verbal stimulation</td>
<td>Purposeful(^a) response to verbal or tactile stimulation</td>
<td>Purposeful(^a) response after repeated or painful stimulation</td>
<td>Unarouseable even with painful stimulus</td>
</tr>
<tr>
<td>Airway</td>
<td>Unaffected</td>
<td>No intervention required</td>
<td>Intervention may be required</td>
<td>Intervention usually required</td>
</tr>
<tr>
<td>Spontaneous ventilation</td>
<td>Unaffected</td>
<td>Adequate</td>
<td>May be inadequate</td>
<td>Frequently inadequate</td>
</tr>
<tr>
<td>Cardiovascular function</td>
<td>Unaffected</td>
<td>Usually maintained</td>
<td>Usually maintained</td>
<td>May be impaired</td>
</tr>
</tbody>
</table>

\(^a\)Purposeful response to verbal or tactile stimulation

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**Ramsay Sedation Assessment Scale**

<table>
<thead>
<tr>
<th>Awake Levels:</th>
<th>Patient anxious or agitated or both</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levels:</td>
<td>Patient cooperative, oriented and tranquil</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Patient responds to commands only</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Asleep Levels:</th>
<th>A brisk response to a light glabellar tap</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A sluggish response to a light glabellar tap</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>No response</td>
<td>6</td>
</tr>
</tbody>
</table>
Image intensifier limits access to head and makes monitoring difficult
What are the facts?

- Preventable complications are more common and more severe in remote locations than in operating theatre.
- Litigations/claims 8x more common in remote locations than OT.
- Inadequate oxygenation / hypoventilation 7x more common.
- 30% of complications are caused by narcotic/sedative overdose.
Can we get our job done?

- **Multidisciplinary** team approach involving cardiologists, anaesthesiologists, cardiac surgeons, cardiac nurses, OT cardiac nurses, perfusionists, radiologists
- Start planning **early**: patient selection & preparing, CCL layout and manpower arrangement, special equipments, postoperative care, contingency planning
How?

- Misconception
- Perioperative anaesthetic care
- Better team communication
- Team experience
- Hybrid OT
How?

- Misconception
- Perioperative anaesthetic care
- Better team communication
- Team experience
- Hybrid OT
Misconception

1. Less invasive procedure $\rightarrow$ lighter level of anaesthesia and lower level of monitoring needed X

2. LA +/- sedation can overcome the problem of administering anaesthesia in hostile environment (patient and anaesthesiologist) of CCL X
How?

- Misconception
- Perioperative anaesthetic care
- Better team communication
- Team experience
- Hybrid OT
Perioperative Anaesthetic Care

A. Preoperative
B. Intraoperative
C. Postoperative
A1. Preoperative Preparation - patient and staff

- New, unfamiliar and continually evolving techniques and approaches
- Start of close interdepartmental cooperation and collaboration
### Patient category for TAVI

#### Table 1: Patient, Cardiac, and Operative Variables Used in the Simple or Additive European System of Cardiac Operative Risk (EuroSCORE)

<table>
<thead>
<tr>
<th>Patient-Related Factors</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
</tr>
<tr>
<td>Chronic pulmonary disease</td>
<td>1</td>
</tr>
<tr>
<td>Extracardiac aortopathy</td>
<td>2</td>
</tr>
<tr>
<td>Neurologic dysfunction</td>
<td>2</td>
</tr>
<tr>
<td>Previous cardiac surgery</td>
<td>3</td>
</tr>
<tr>
<td>Serum creatinine</td>
<td>2</td>
</tr>
<tr>
<td>Active endocarditis</td>
<td>3</td>
</tr>
<tr>
<td>Critical preoperative state</td>
<td>3</td>
</tr>
<tr>
<td>Cardiac-related factors</td>
<td></td>
</tr>
<tr>
<td>Unstable angina</td>
<td>2</td>
</tr>
<tr>
<td>LV dysfunction</td>
<td>1</td>
</tr>
<tr>
<td>Recent myocardial infarct</td>
<td>1</td>
</tr>
<tr>
<td>Pulmonary hypertension</td>
<td>2</td>
</tr>
<tr>
<td>Surgery-related factors</td>
<td></td>
</tr>
<tr>
<td>Emergency</td>
<td>2</td>
</tr>
<tr>
<td>Other than isolated CABG</td>
<td>2</td>
</tr>
<tr>
<td>Surgery on thoracic aorta</td>
<td>3</td>
</tr>
<tr>
<td>Postinfarct ischaemic rupture</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Table 2: Patient Criteria for TC-AVI

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>High operative risk score (EuroSCORE and STS PROM Score)</td>
<td>Excessive risk of operative mortality with conventional aortic valve replacement</td>
</tr>
<tr>
<td>Advanced lung disease</td>
<td>Excessive risk of prolonged requirement for mechanical ventilation postoperatively</td>
</tr>
<tr>
<td>Denied surgery by at least 2 cardiac surgeons</td>
<td>Significant risk of cardiac and/or coronary graft damage during surgical dissection</td>
</tr>
<tr>
<td>Previous sternotomy with functional coronary artery bypass grafts</td>
<td>Significant risk of cardiac and/or coronary graft damage during surgical dissection</td>
</tr>
</tbody>
</table>

Abbreviations: LV, left ventricular; PA, pulmonary artery; CABG, coronary artery bypass graft surgery. Adapted from [http://www.euroscore.org](http://www.euroscore.org) (accessed March 20, 2010).
A2. Preoperative Preparation

- Procedure
  Thorough understanding of the key parts

- Patient
  Ability to lie flat
  Respiratory motion requirement
  Cardiorespiratory reserve
  Cardiac output (oversedated with a usual dose of sedative)

- CCL
  Drug, equipment
Perioperative Anaesthetic Care

A. Preoperative
B. Intraoperative
C. Postoperative
B1. Intraoperative Management

- GA/MAC
- Sedation must be deep enough to ensure that the patient does not move (immobility) at a critical moment
- Respiratory motion, use of TEE for 3D guidance, long duration, multiple comorbidities
- Higher procedure success rate (GA 88% vs MAC 69%, p<0.01), shorter total duration and fluoroscopy times (Heart Rhythm 2011)
B2. Intraoperative Management

- Hemodynamic
- Pulmonary vascular resistance, PA pressure
- Systemic vascular resistance, systemic BP
- L $\rightarrow$ R shunt
- LVH $\rightarrow$ poor tolerance to ischemia
- Effect of general anaesthesia/sedation and mechanical ventilation on preload, afterload, contractility, SVR and PVR
- Possible pharmacodynamic interaction of anaesthetic drugs with rhythm and conduction (remifentanil, volatile agent, antiemetic)
B3. Intraoperative Management

- Introduction of short-acting, fast-emergence anaesthetics
- Hypoventilation, hypoxia, hypercapnia
- Protective airway reflexes, aspiration injury
- Alarming speed of transition from moderate into deep sedation
B4. Intraoperative Management

- Control of airway
- Oxygenation and ventilation
- Respiratory drive & respiratory complications
B5. Intraoperative Management

- **Endovascular**: bleeding, dissection, vascular injury, embolization, ischemia
- **Heart**: dysrrhythmia, cardiac perforation, acute heart failure, cardiac injury
- **External defibrillation pad**
- Adherence to the safety standards seen in OT
- Prevent and manage potential life-threatening complications
Dislodged paravalvular plug
Pericardial effusion

Blood Clot

LA
Pleural effusion
Embolized ASD occluder

Cardiac surgery

Bifurcation of pulmonary trunk
Perioperative Anaesthetic Care

A. Preoperative
B. Intraoperative
C. Postoperative
C. Postoperative Care

- Adherence to safety standards seen in OT
- Transport and relevant logistic problem
- 3 operation-specific factors: emergency, duration of surgery $\geq 3$ hrs., type of surgery including cardiac catheterization are independent risk factors for reintubation
- Rhythm, transfusion
- Shivering 2nd to hypothermia or general anaesthetic
PACU in CCL
How?

- Misconception
- Perioperative medicine
- Better team communication
- Team experience
- Hybrid OT
Design must balance the work requirement of different parties of multidisciplinary team.
Personnel

1. Echo cardiologist
2. Anaesthetist
3. Anaesthesia assistant
4. Cardiothoracic surgical assistant
5. Cardiothoracic surgeon
6. Cardiology assistant
7. Cardiologist
8. TAVI technician
9. Perfusion technician
10. Surgical scrub nurse
11. Surgical nurse
12. CCL nurse
Hybrid OT

- Sterile
- Laminar airflow
- Spacious
- Pipeline gases/scavenging/suctioning
- High quality imaging system
- Can proceed to salvage surgery if needed

- Expensive
- Challenges in scheduling between different specialties
Summary

- CCL a challenging environment
- Different teams and personnel
- Complexity of procedure on diverse patient group
- Communication and teamwork vital for planning
- Reasonable plan for anaesthesia, monitoring, venous access, additional equipments required and potential complications of the procedure
- A balance between patient safety and economic restriction despite an increased patient age extreme and risk profile
THANK YOU
**TAVI Fundamentals Workshop**

**For Hospital Authority Physicians Only**

**Date:** Saturday 25th October, 2014  
**Venue:** 4/F, Multidisciplinary Simulation and Skills Center, Block F, Queen Elizabeth Hospital  
**Time:** 13:00 - 17:30

<table>
<thead>
<tr>
<th>TIME</th>
<th>PROGRAM</th>
<th>SPEAKER</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:00 - 13:25</td>
<td>Light Refreshment</td>
<td>ALL</td>
</tr>
<tr>
<td>13:25 - 13:30</td>
<td>Opening</td>
<td>CS Chiang</td>
</tr>
<tr>
<td>13:30 - 13:40</td>
<td>The Real Landscape of Aortic Stenosis</td>
<td>KT Chan</td>
</tr>
<tr>
<td>13:40 - 14:00</td>
<td>Study of the Year: The CoreValve US Pivotal Trial</td>
<td>Michael Lee</td>
</tr>
<tr>
<td>14:00 - 14:20</td>
<td>Patient Selection: From Echocardiographic to MSCT Assessment</td>
<td>CY Wong</td>
</tr>
<tr>
<td>14:20 - 14:40</td>
<td>Complications: Perforation, Stroke, Paravalvular Leak, and AV Block</td>
<td>Jason Chan</td>
</tr>
<tr>
<td>14:40 - 15:00</td>
<td>Coffee Break</td>
<td></td>
</tr>
<tr>
<td>15:00 - 15:15</td>
<td>TAVI From a Surgeon’s Perspective</td>
<td>HL Cheung</td>
</tr>
<tr>
<td>15:15 - 15:30</td>
<td>Should TAVI be Done Under GA or MAC?</td>
<td>Douglas Fok</td>
</tr>
<tr>
<td>15:30 - 15:45</td>
<td>Challenging Case: TAVI in Patient with Bicuspid Aortic Valve</td>
<td>Alan Chan</td>
</tr>
<tr>
<td>15:45 - 16:00</td>
<td>3-Years Outcomes after CoreValve: QEH Experience</td>
<td>Michael Lee</td>
</tr>
<tr>
<td>16:00 - 17:30</td>
<td>Break-out Session:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Simulator Hands-On</td>
<td>ALL</td>
</tr>
<tr>
<td></td>
<td>2. Loading Device Hands-On</td>
<td></td>
</tr>
</tbody>
</table>