

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

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Queen Elizabeth Hospital

Major Acute Hospital, cardiac surgery and trauma centre

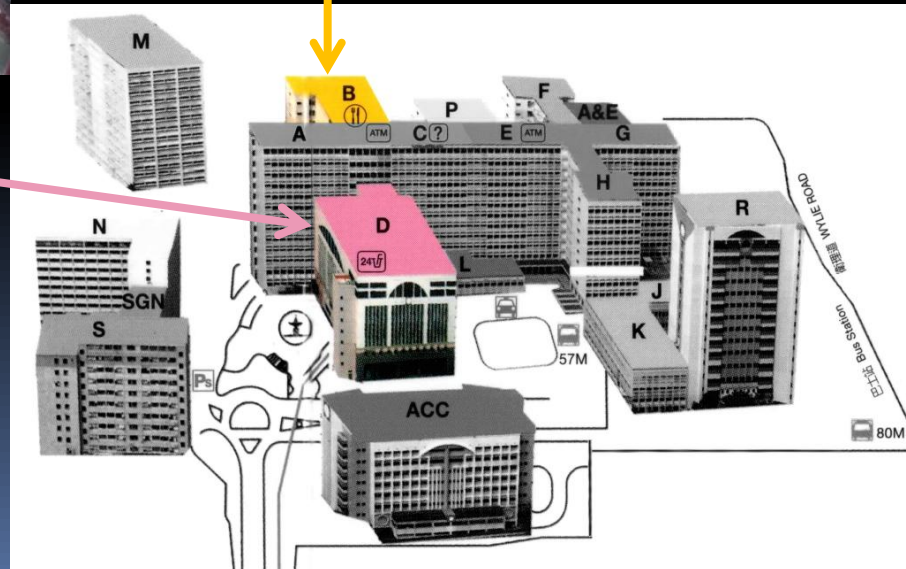
>1800 acute beds

Almost all surgical and medical specialties



OT

CCL



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



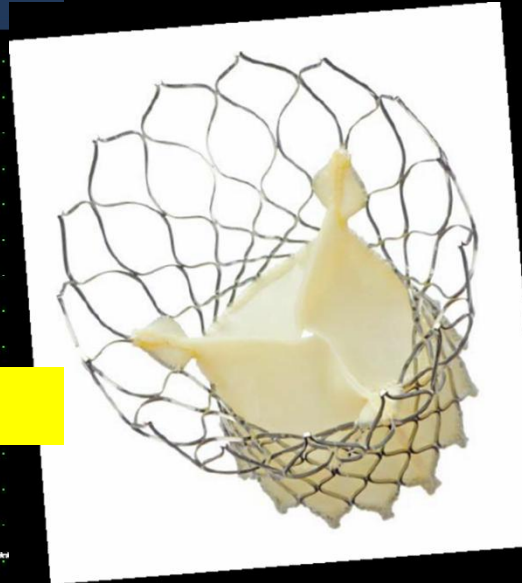
Advanced Technology...

PHILIPS CHAN, MAN NANG 06/12/2010 04:27:47PM TIB0.2 MI 0.5
26561320101206 X7-2t/Adult

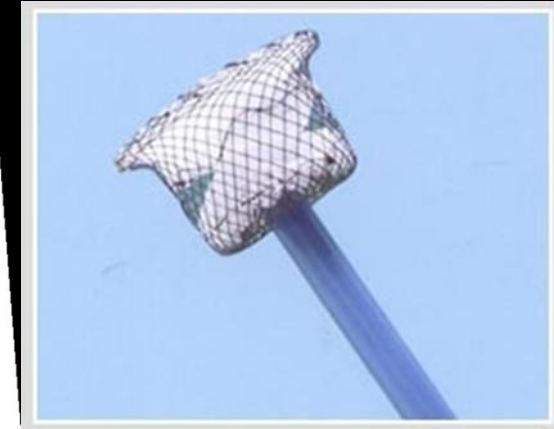
FR 24Hz 10 mm
12cm
Full Volume 0 30 180
3D 4.7%
3D 40dB



TAVI



ASD occluder

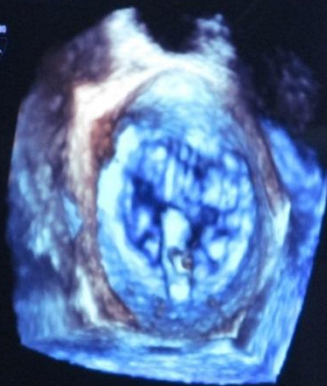


PAT T: 37.0C
TEE T: 36.4C

JPEG

PHILIPS SØRENSEN, EVALD 11/06/2013 08:41:03 TIS0.2 MI 0.5
NIHL 200540-0557 RIGSHOSPITALET X7-2t/Adult
FR 6Hz 3D Beats 1
7.9cm

2D 150 mm
86%
C 50
P Off
Gen

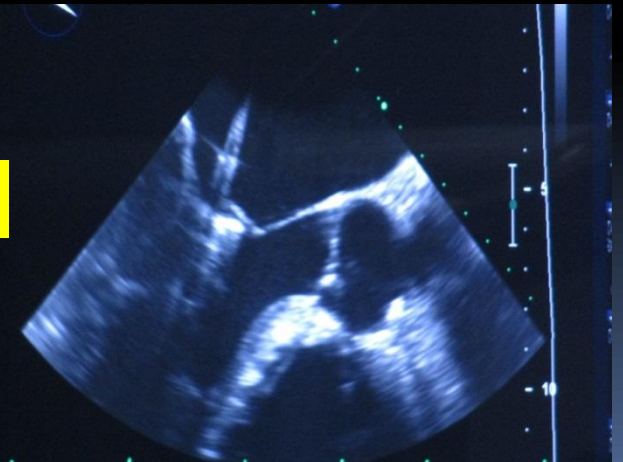


Mitraclip

PAT T: 37.0C
TEE T: 39.8C

93bpm

C 50
P Off
Gen




PAT T: 37.0C
TEE T: 39.3C

73bpm

How far can we go?



ADVENTURE AND IMAGINATION WILL MEET AT THE FINAL FRONTIER...



WHAT ARE THE CHALLENGES FOR ANAESTHESIOLOGISTS IN CCL?

Leave our comfort zone – offsite anaesthesia

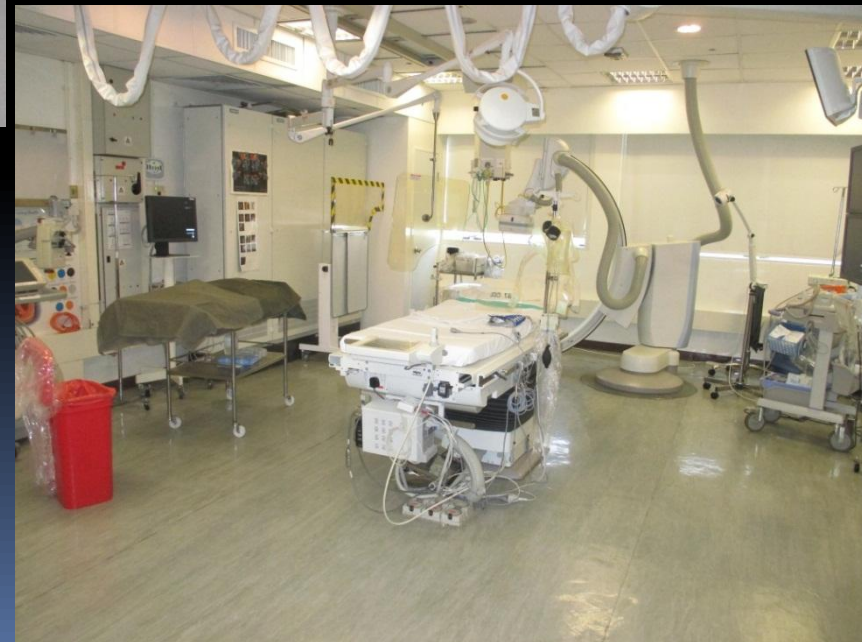


1. Environment



OT

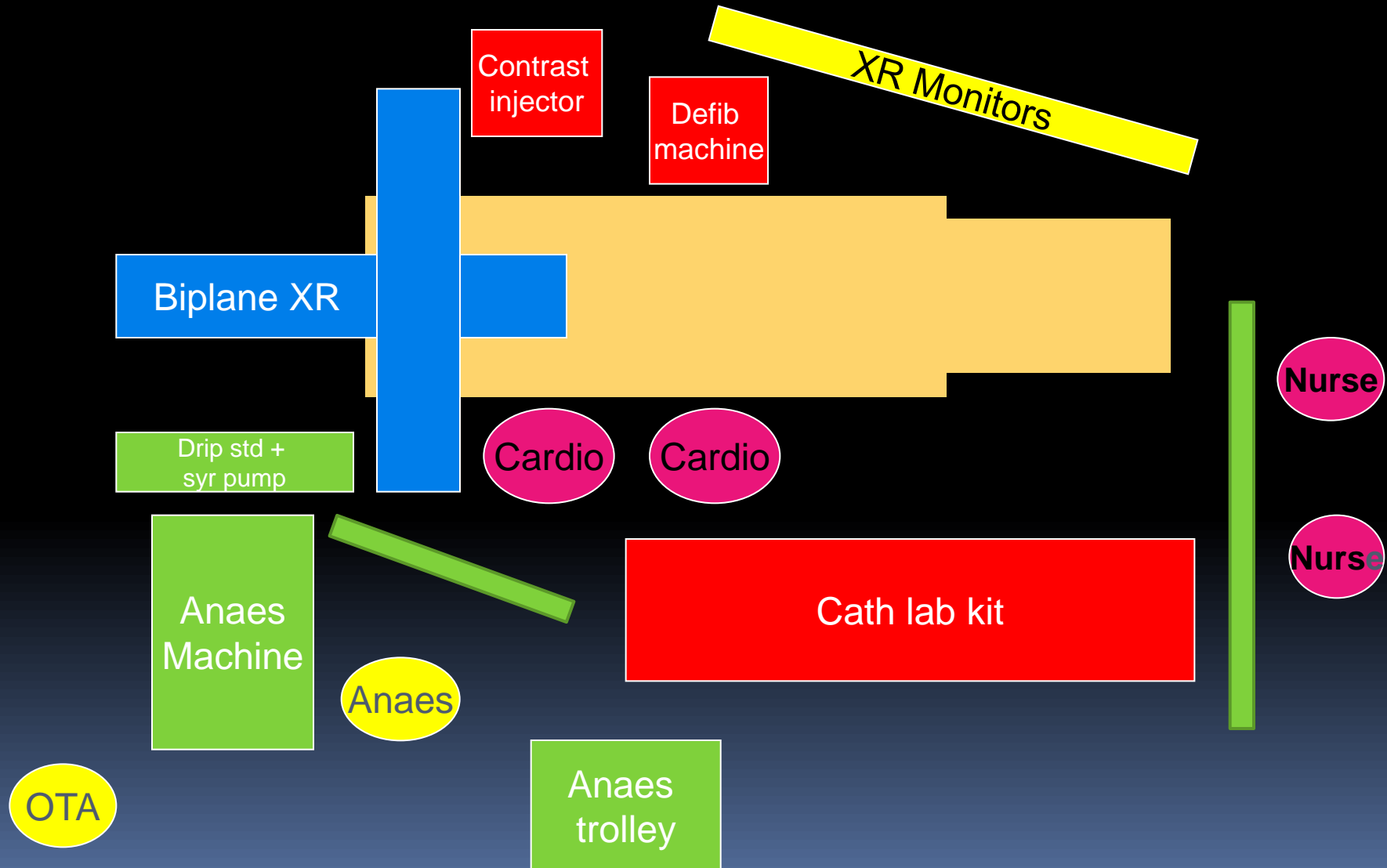
CCL



So packed!!



Paediatric / Adult Cardiac Intervention



CP bypass

Cardio

Valve preparation

Nurse

CT Surg

Echo Machine

Nurse

Contrast injector

Defib machine

XR Monitors

Nurse

Fluoro

Drip std + syr pump

Fluoro

Rad

Anaes

Cardio

Cardio

Cardio

Nurse

Tech

ODA

Anaes Machine

Cath lab kit

Sales

Anaes trolley

TAVI

2. Lighting condition



OT

CCL



3. Level of support



Different equipments inside OT



Specially designed working trolley

4. Equipments

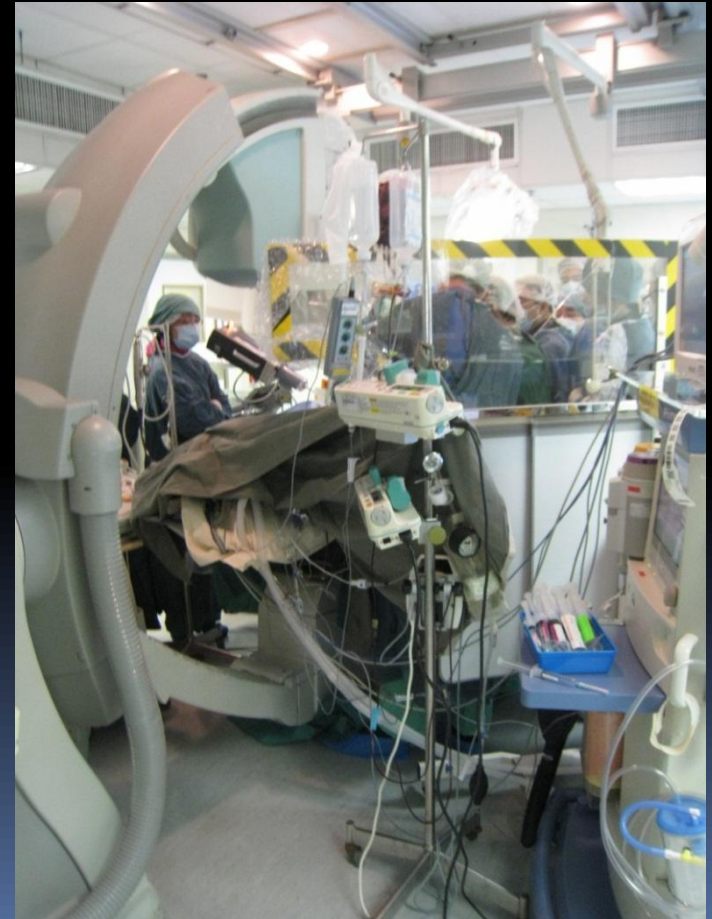


Scavenging system and pipeline system

5. Patient Safety (1)



**Circuit tubings and
iv lines**

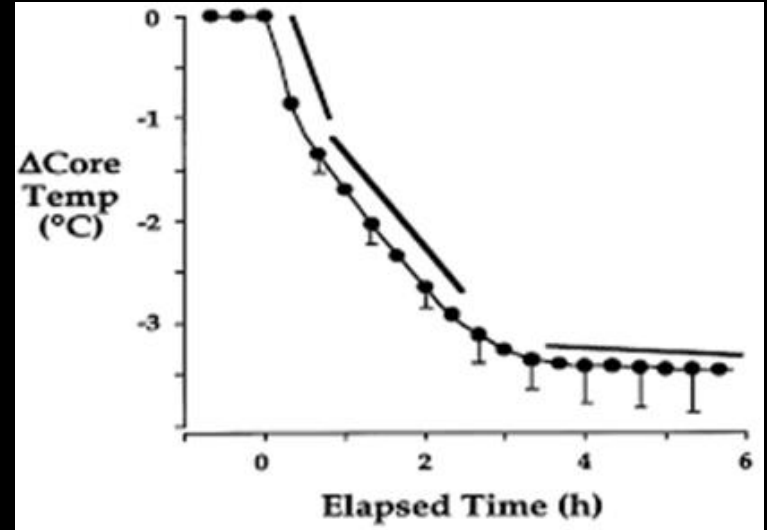


5. Patient Safety (2)

Hypothermia



Positioning



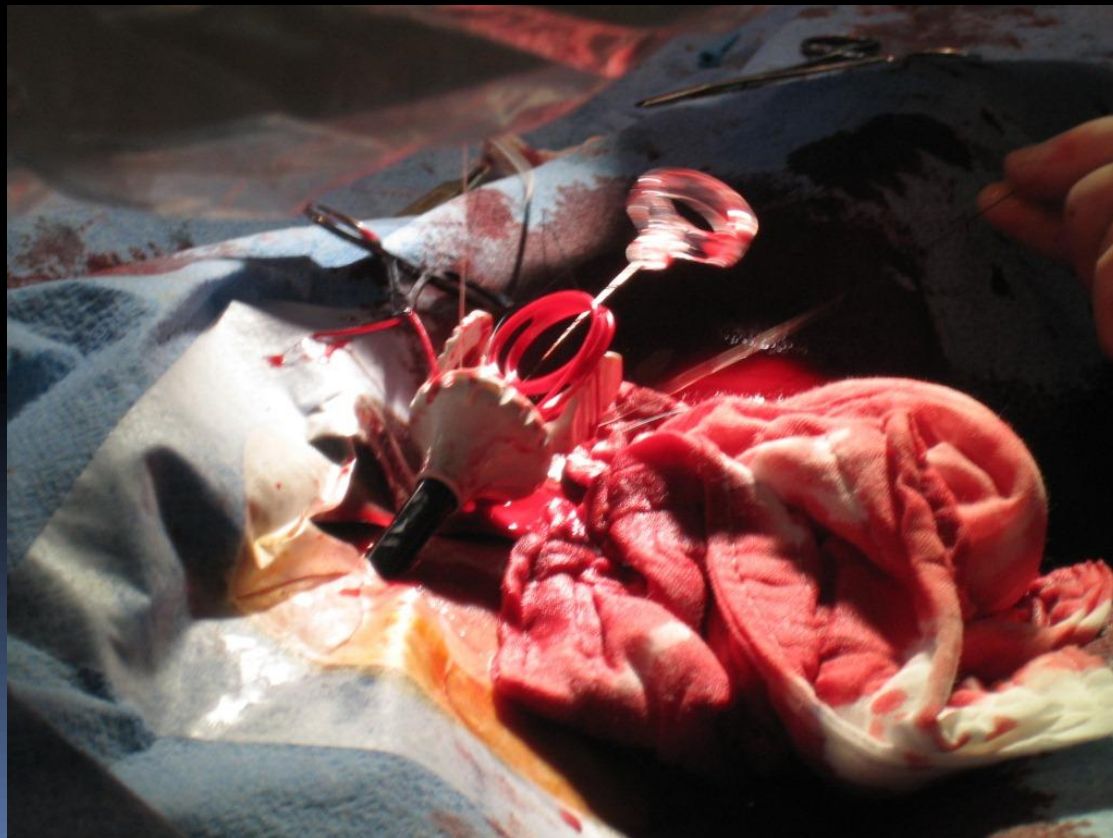
CCL table surface

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/hypovolemia
- 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

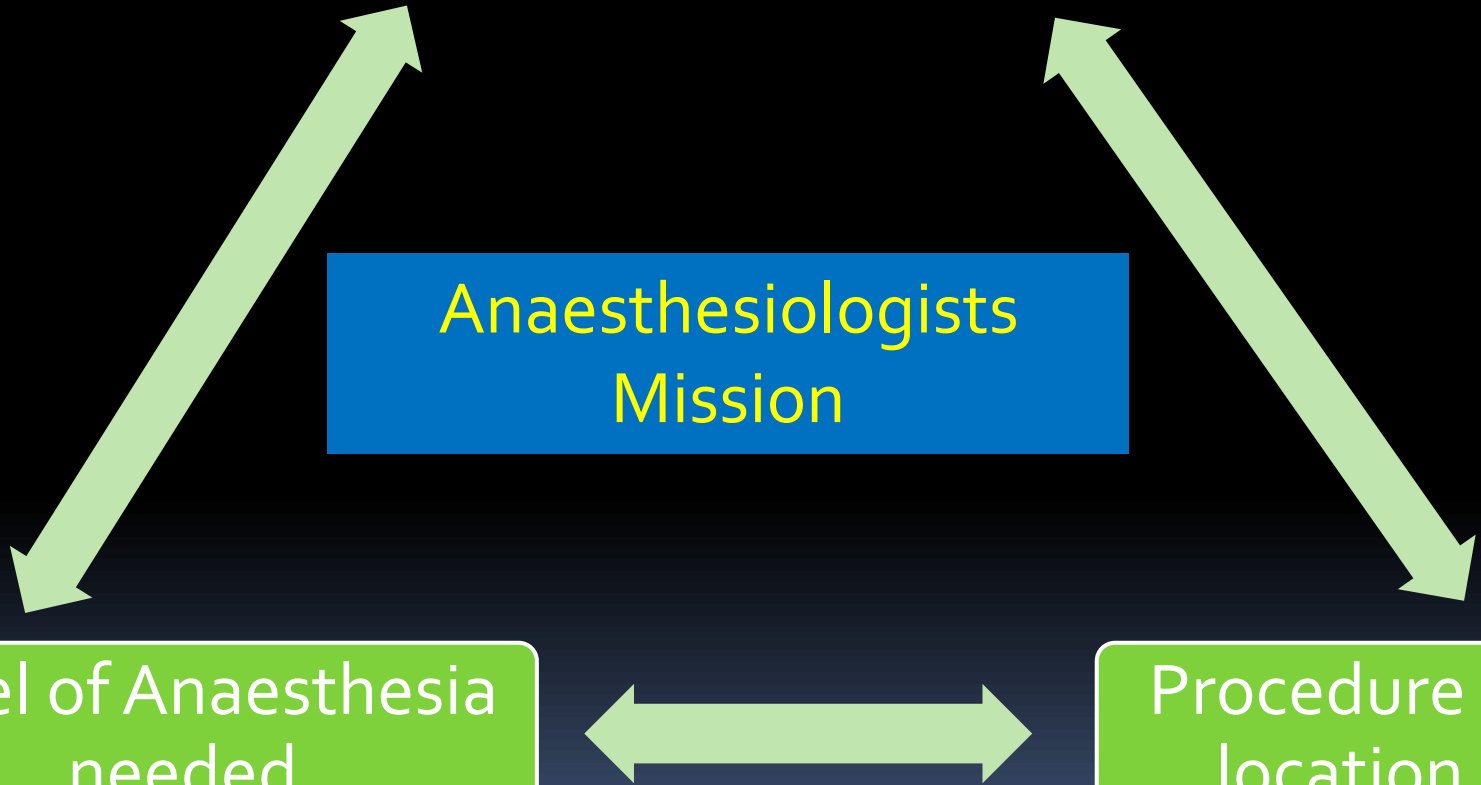
- Progress in medical **technology**
- Incessant introduction of **new and complex** therapeutic options inside CCL for structural or congenital heart diseases on **sicker** patients with limited **cardiorespiratory** reserve
- Significant **improvements** in monitoring and introduction of short-acting, 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

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

Ramsay Sedation Assessment Scale

Awake	Patient anxious or agitated or both	1
Levels:	Patient cooperative, oriented and tranquil	2
	Patient responds to commands only	3
Asleep	A brisk response to a light glabellar tap	4
Levels:	A sluggish response to a light glabellar tap	5
	No response	6

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
- 

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Misconception

1. Less invasive procedure → 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
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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)

Patient-Related factors		Score
Age	Per 5 years or part thereof over 60 years	1
Sex	Female	1
Chronic pulmonary disease	Long-term use of bronchodilators or steroids for lung disease	1
Extracardiac arteriopathy	Any 1 or more of the following: claudication, carotid occlusion or >50% stenosis, previous or planned intervention on the abdominal aorta, limb arteries or carotids	2
Neurologic dysfunction disease	Severely affecting ambulation or day-to-day functioning	2
Previous cardiac surgery	Requiring opening of the pericardium	3
Serum creatinine	>200 µm/L preoperatively	2
Active endocarditis	Patient still under antibiotic treatment for endocarditis at the time of surgery	3
Critical preoperative state	Any one or more of the following: ventricular tachycardia or fibrillation, sudden death, preoperative cardiac massage, preoperative ventilation before arrival in the anaesthetic room, preoperative inotropic support, intra-aortic balloon counterpulsation or preoperative acute renal failure (anuria or oliguria <10 mL/h)	3
Cardiac-related factors		
Unstable angina	Rest angina requiring intravenous nitrates until arrival in the anaesthesia room	2
LV dysfunction	Moderate or LVEF 30%-50%	1
Recent myocardial infarct	Poor or LVEF <30% (<30 days)	3
Pulmonary hypertension	Systolic PA pressure >60 mmHg	2
Surgery-related factors		
Emergency	Carried out on referral before the beginning of the next working day	2
Other than isolated CABG	Major cardiac procedure other than or in addition to CABG	2
Surgery on thoracic aorta	For disorder of ascending, arch or descending aorta	3
Postinfarct septal rupture		4

Abbreviation: LVEF, left ventricular ejection fraction; PA, pulmonary artery; CABG, coronary artery bypass graft surgery. Adapted from <http://www.euroscore.org> (accessed March 20, 2010).

Table 2. Patient Criteria for TC -AVI

Criteria	Rationale
High operative risk score (EuroSCORE and STS PROM Score)	Excessive risk of operative mortality with conventional aortic valve replacement
Advanced lung disease	Excessive risk of prolonged requirement for mechanical ventilation postoperatively
Denied surgery by at least 2 cardiac surgeons	Sufficient consensus that conventional aortic valve replacement is contraindicated
Previous aortotomy with functional coronary artery bypass grafts	Significant risk of cardiac and/or coronary graft damage during surgical dissection

Adapted from Klein et al.²¹

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 → R **shunt**
- LVH → 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** (remifentanyl, 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:** dysrhythmia, 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



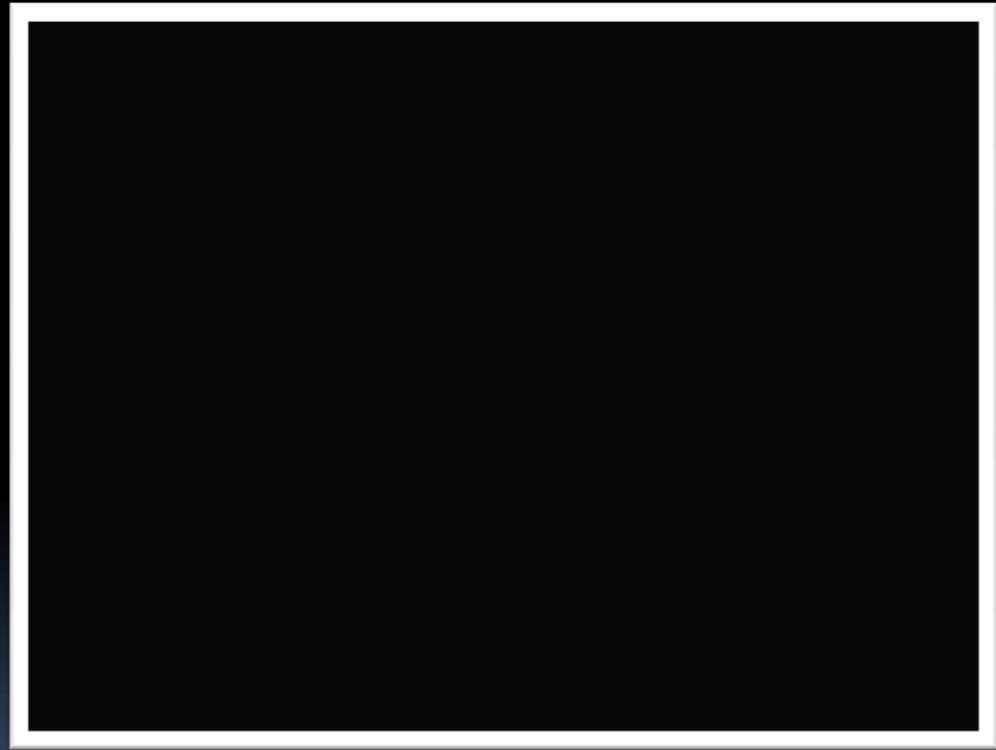
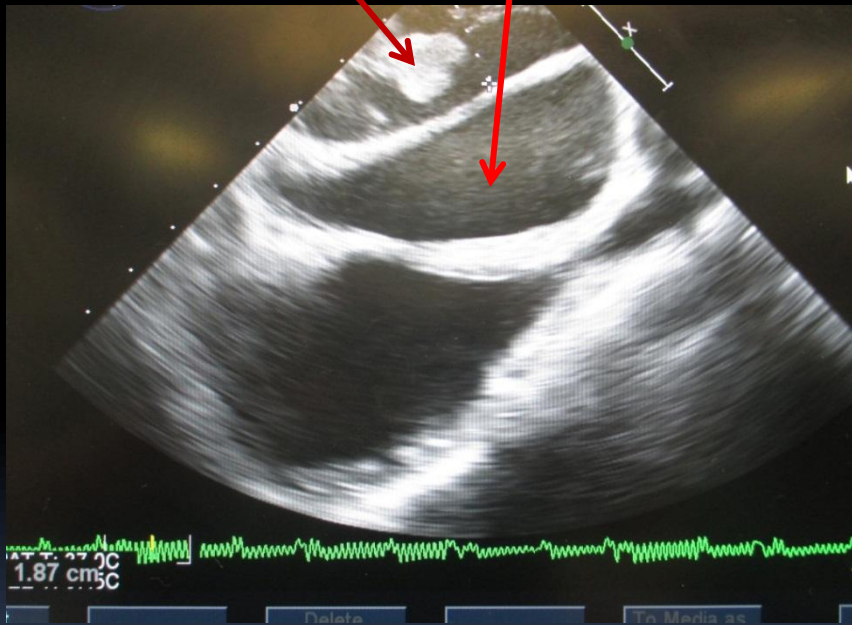


Dislodged paravalvular plug



Pericardial effusion

Blood Clot
LA



Pleural effusion



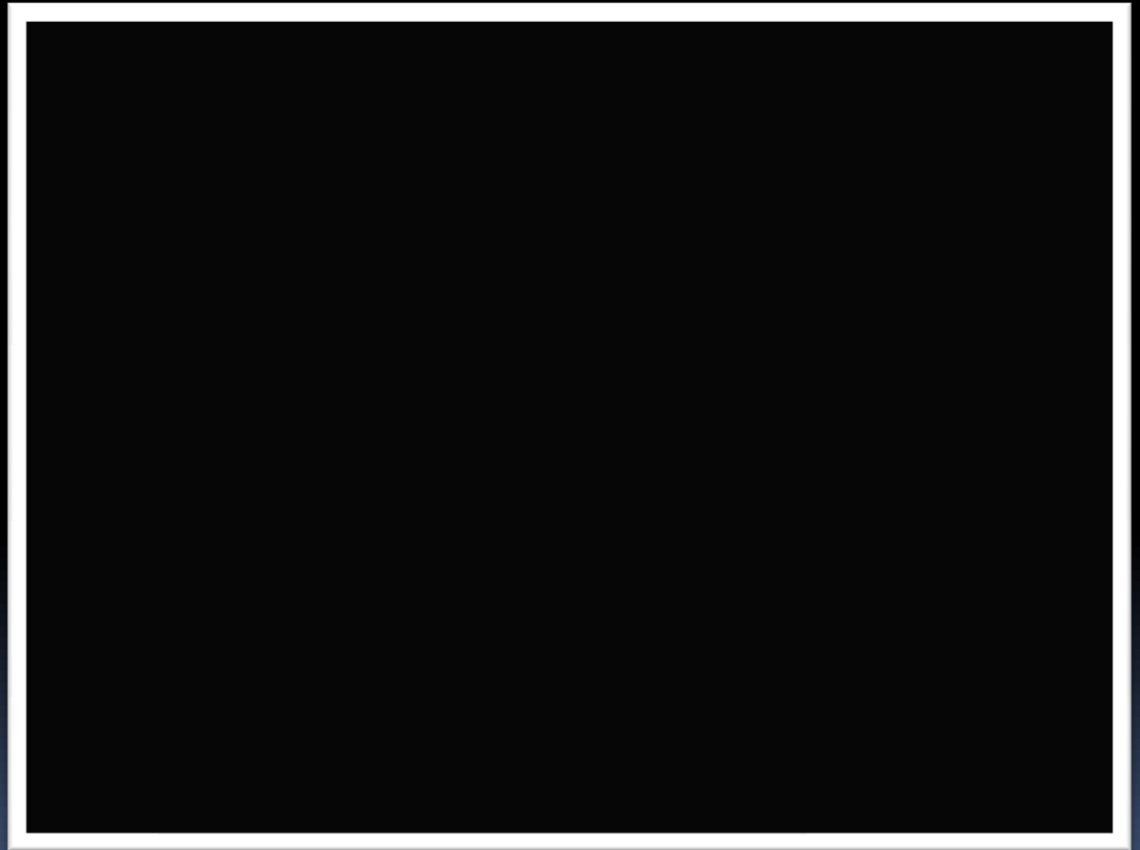
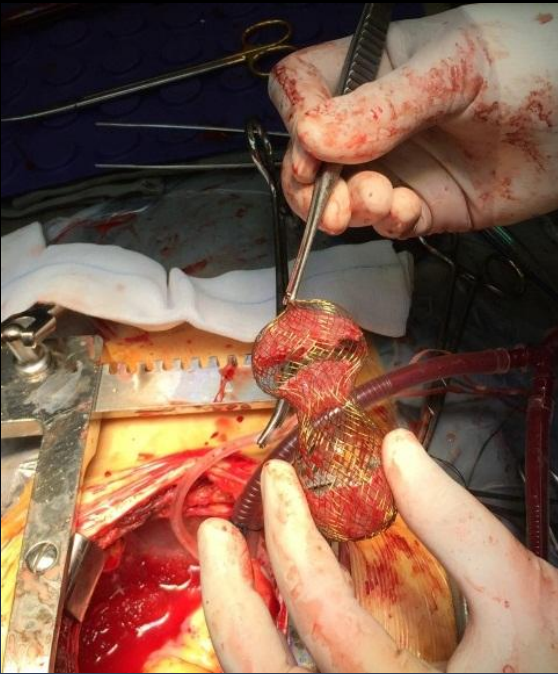
Lung

Spine

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 ≥ 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

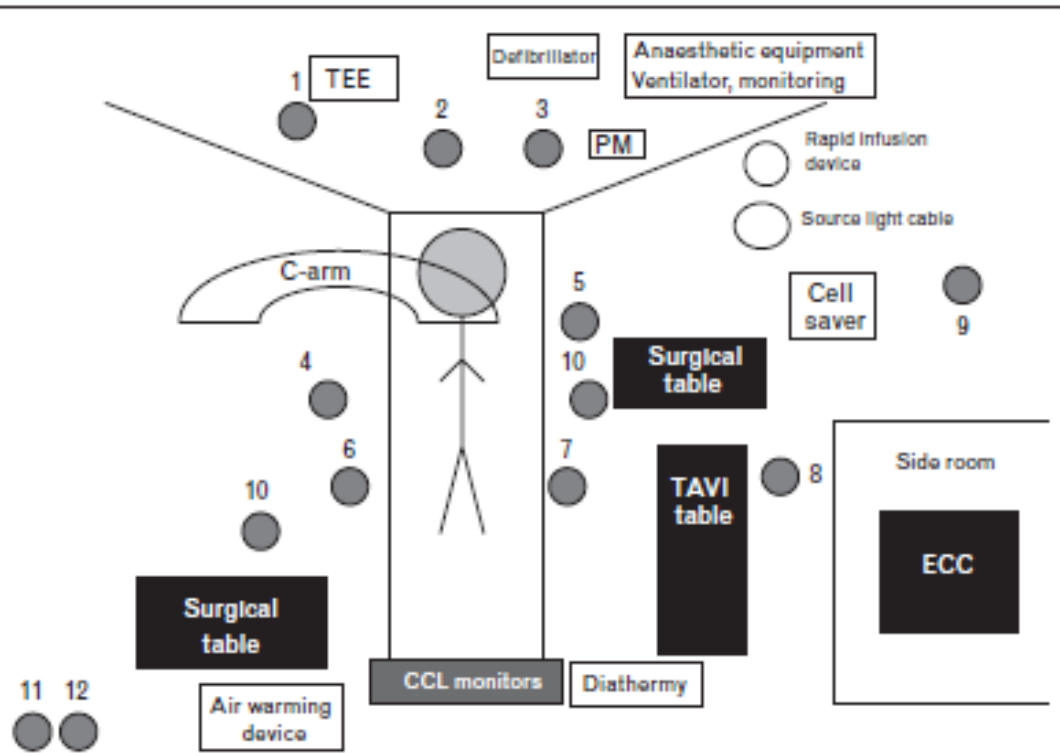


How?

- 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 | 7. Cardiologist |
| 2. Anaesthetist | 8. TAVI technician |
| 3. Anaesthesia assistant | 9. Perfusion technician |
| 4. Cardiothoracic surgical assistant | 10. Surgical scrub nurse |
| 5. Cardiothoracic surgeon | 11. Surgical nurse |
| 6. Cardiology assistant | 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



Part of the team





THANK YOU

Co-organized by:



Queen Elizabeth Hospital
Department of Medicine



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

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