5th Asia Pacific Congenital and Structural Heart (APCASH) Intervention Symposium 2014

Allied Health Session

What You Need to Know for Complication Management in Structural Heart Intervention (From Instrument to Procedure)

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Common Structural Heart Interventions

- Atrial Septal Defect (ASD) Occluder
- Patent Ductus Arteriosus (PDA) Occluder
- Ventricular Septal Defect (VSD) Occluder
- Mitral Valve Angioplasty
Complicated Structural Heart Interventions

- Left Atrial Appendage Occlusion (LAAO)
- Trans-Aortic-Valve Implantation (TAVI)
- MitraClip Implantation
Strategies in Complication Management

- Prevention
- Detection
- Correction
Detection of Complication

- ABP / NBP
- ECG rhythm & morphology,
- Limbs circulation
- Puncture site
- R/R & SpO2
- Blood result
  - Hb, WBC, PT/APTT/INR, Crea, Na, K, CPK/Troponin I
- CXR,
- GCS level
- Urine Output
- Echocardiogram
- Coronary Angiogram
Complications

- Bleeding
  - Perforation of heart Chamber
    - Cardiac tamponade
  - Vascular complication
- Acute Coronary Event
- Device Dislodgement
- Arrhythmia – VT/VF or Heart Block
- Stroke
Bleeding

Pericardial Effusion

Retroperitoneal Bleeding

Pseudoaneurysm
Sheath Size

Outer Diameter: 4.78

Outer Diameter: 4.67
Possible Cause of Cardiac Tamponade

- Devices caused perforation
  - Catheter,
  - Wire,
  - Transeptal needle
Management of Cardiac Tamponade

- start CPR if developed PEA
- perform echocardiogram to confirm diagnosis
- stop anti-coagulation therapy as instruction
- correct APTT (by IV Protamine), INR (by FFP) as instruction
  (if procedure continue, no need to correct anti-coagulation therapy)
- Preform pericardial tapping
- measure volume of tapping fluid
- connect the drainage catheter to BSB or low suction
- Maintain low blood pressure to prevent active bleeding
Occlusion of perforation was achieved with a 10 mm AMPLATZER® (AGA Medical Corporation, Plymouth, MN, USA) septal occluder and redeployment of the 12 mm ACP was successful. A pericardial drain (PD)

Instrument Preparation

- Disposable Pericardial Tapping Kit
- Septal Occluder ≤ 12mm and Delivery system
Acute Coronary Event

- Air embolism to coronary arteries
- Thrombus for prolonged procedure
- Obstruct coronary blood flow by device
Air Embolism
TAVI & Coronary Obstruction

Valve position may obstruct the blood flow to coronary arteries
Ischaemia

S/S: ECG with ST change and dropped in ABP
Instrument Preparation

Instrument for PC

Gabriel Greenberg, MD and Ran Kornowski, MDJ INVASIVE CARDIOL 2013;25(7):361-363
Dislodgement of Occluder

This TEE image shows the device floating freely in the left atrium (arrows).

Yu, C.-M. et al. (2013) Mechanical antithrombotic intervention by LAA occlusion in atrial fibrillation
*Nat. Rev. Cardiol.* doi:10.1038/nrcardio.2013.158
Failed Capture of Dislodged Occluder by Goose Snare & 13Fr Sheath
Capture of Dislodged Occluder by Goose Snare & 14Fr Sheath
Capture of Dislodged Occluder by EN Snare & 14Fr Sheath
Holding of Dislodged Occluder by Biopsy Forcep
Instrument Preparation

- Goose Neck Snare Kit 15-25mm
- 14Fr 85cm Mullins Sheath
Instrument Preparation

- 5.5Fr Biopsy forcep 104cm long (outer diameter 1.85mm)
- 7 Fr Guiding Cather 90cm long (Inner diameter 2.06mm)
Arrhythmia – VT / VF

S/S: ↓ABP, ↓ GCS, seizure and ECG with VT /VF
Arrhythmia - Bradycardia

S/S: dizziness, ↓ GCS ↓ ABP
Tachyarrhythmia

- Cause by pacing stimulant

**Intervention**

- Perform DC version or defibrillation for VT/VF
- Prepare antiarrhythmic agents
Defibrillation
Bradyarrhythmia

- Trauma by occluder
- MI

**Intervention**

- Give medication
  - Atropine, dopamine or adrenaline infusion
- Temporary Transvenous or Transcutaneous Pacing
Prevention of Stroke

Prepare Echocardiogram for baseline and post-op assessment to rule out intra cardiac thrombus
• Intracardiac Echocardiogram
• 2D Echocardiogram
• 3D Echocardiogram
Principle of Resuscitation

Circular ACLS Algorithm

- Shout for Help/Activate Emergency Response
- Start CPR
  - Give oxygen
  - Attach monitor/defibrillator
- Check Rhythm
- Return of Spontaneous Circulation (ROSC)
  - Post-Cardiac Arrest Care
  - Check Rhythm
- If VF/VT
  - Shock
- Continuous CPR
- Monitor CPR Quality
- Consider Advanced Airway
  - Quantitative waveform capnography
- Drug Therapy
  - IV/I/O access
  - Epinephrine every 3-5 minutes
  - Amiodarone for refractory VF/VT
- Treat Reversible Causes
- Return of Spontaneous Circulation (ROSC)
  - Post-Cardiac Arrest Care
- If VF/VT
  - Shock

CPR Quality
- Push hard (≥2 inches [5 cm]) and fast (≥100/min) and allow complete chest recoil
- Minimize interruptions in compressions
- Avoid excessive ventilation
- Rotate compressor every 2 minutes
- If no advanced airway, 30:2 compression-ventilation ratio
- Quantitative waveform capnography
  - If PETCO₂ <10 mm Hg, attempt to improve CPR quality
- Intra-arterial pressure
  - If relaxation phase (diastolic) pressure <20 mm Hg, attempt to improve CPR quality

Return of Spontaneous Circulation (ROSC)
- Pulse and blood pressure
- Abrupt sustained increase in PETCO₂ (typically ≥40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

Shock Energy
- Biphasic: Manufacturer recommendation (120-200 J); if unknown, use maximum available. Second and subsequent doses should be equivalent, and higher doses may be considered.
- Monophasic: 360 J

Drug Therapy
- Epinephrine IV/I/O Dose: 1 mg every 3-5 minutes
- Vasopressin IV/I/O Dose: 40 units can replace first or second dose of epinephrine
- Amiodarone IV/I/O Dose: First dose: 300 mg bolus. Second dose: 150 mg.

Advanced Airway
- Supraglottic advanced airway or endotracheal intubation
- Waveform capnography to confirm and monitor ET tube placement
- 8-10 breaths per minute with continuous chest compressions

Reversible Causes
- Hypovolemia
- Hypoxia
- Hydrogen ion (acidosis)
- Hypo-/hyperkalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary
Team Approach as Resuscitation

- Team Leader
- Airway
- Compressor
- IV/IO/Medications
- Monitor /Defibrillator
- Observer / Recorder
ACLS Algorithm – Cardiac Arrest VT / VF
ACLS Algorithm – PEA / Asystole
Post Cardiac Management

Immediate Post–Cardiac Arrest Care Learning Station Checklist

Adult Immediate Post–Cardiac Arrest Care

1. Return of Spontaneous Circulation (ROSC)

2. Optimize ventilation and oxygenation
   - Maintain oxygen saturation ≥94%
   - Consider advanced airway and waveform capnography
   - Do not hyperventilate

3. Treat hypotension (SBP < 90 mm Hg)
   - IV/IIO bolus
   - Vasopressor infusion
   - Consider treatable causes
   - 12-Lead ECG

4. Follow commands?

5. Consider induced hypothermia

6. Yes
   - STEMI OR high suspicion of AMI
   - Reversible Causes
     - Hypovolemia
     - Hypoxia
     - Hyperkalemia
     - Hypothermia
     - Tension pneumothorax
     - Tamponade, cardiac
     - Toxins
     - Thrombosis, pulmonary
     - Thrombosis, coronary

7. Yes
   - Coronary reperfusion

8. No
   - Advanced critical care

Doses/Details

Ventilation/Oxygenation
Avoid excessive ventilation. Start at 10–12 breaths/min and titrate to target PETCO₂ of 35–40 mm Hg. When feasible, titrate FIO₂ to minimum necessary to achieve SpO₂ ≥ 94%.

IV Bolus
1-2 L normal saline or lactated Ringer’s. If inducing hypothermia, may use 4°C fluid.

Epinephrine IV Infusion:
0.1-0.5 mcg/kg per minute (in 70-kg adult: 7-35 mcg per minute)

Dopamine IV Infusion:
5-10 mcg/kg per minute

Norepinephrine IV Infusion:
0.1-0.5 mcg/kg per minute (in 70-kg adult: 7-35 mcg per minute)
Emergency Cardiac Surgery

- Stabilize the patient
- Insert IABP or ECMO
- Arrange operation with CTSU
- Inform relative and obtain consent
- Arrange and collect blood product for OT
- Prepare all nursing records & discharge summary
- Collect all lab. result, ECG, CXR, Coro. Film, PTCA report and medication for transfer
- Arrange emergency ambulance with oxygen, defibrillator and confirm location to pick up patient (CCL/CCU)
- Escort patient direct to OT
- Inform CTSU that patient is on the way
Prevention of Complications

- Availability of techniques, equipment and facilities (good stocking & good maintenance)
- Staff Training
  - BLS & ACLS training, CPR drill in CCL
  - Ventilator checking
- Stabilize patient’s condition
  - Transvenous pacing
  - IABP insertion
  - ECMO insertion
- Good pre-operative preparation
  - Pre Op assessment
    - Coronary angiogram, echocardiogram, ECG, CXR, CBP, R/LFT, PT/APTT/INR
  - Withold anticoagulation therapy
Proper Stocking of Consumables
Proper Stocking of Consumables
Thank You