Dr Matthew Ho
BSc(Med) MBBS(Hons) FANZCA

Cardiothoracic and Vascular Anaesthesia

2008B12: List the indications and contra-indications for the use of an intra-aortic balloon pump. Describe how its performance is optimized.

Intra-aortic balloon pump: a device inserted in the descending aorta which expands during diastole and contracts during systole to improve coronary perfusion and LV systolic ejection flow, without ↑ myocardial demand.

Indications: temporary awaiting treatment or recovery

1. Severe LV failure / acute cardiogenic shock:
    a. Infarction
    b. Stenting
    c. Trauma
    d. cardiomyopathy
2. Pre and Post-CABG: severe LM stenosis, EF < 30%
3. Refractory ventricular ectopy
4. Acute severe MR
5. VSD

Contraindications

1. Absolute:
    a. Aortic regurgitation (moderate – severe)
    b. Aortic stents, aneurysm, dissection
    c. Bilateral femoral artery disease, stents,
    d. Sepsis
2. Relative
    a. Anticoagulation
    b. Tachyarrhythmias (↓ diastolic time)

Optimise function: measured by ↓ augmented diastolic pressure,

1. Correct position (check with XR DSA or TOE) 2cm distal to L subclavian artery
2. Correct balloon volume/size to match patient size and condition: 25-50mLs helium, fully expanded should be < 80-90% diameter of aorta
3. Heart rate: greatest effect at slow rates → ↑ diastolic augmentation
4. Correct timing: inflation at onset of diastole, deflation just before systole
    a. ECG – mid T wave → p wave
    b. Arterial pressure wave – dicrotic notch → systolic upstroke

Complications:

- Local: infection, hematoma, false aneurysm
    a. Distal: thromboembolism, limb ischaemia
    b. Proximal: aortic dissection, rupture, balloon as embolism, entrapment (vascular surgery), malposition, cerebral/renal flow compromise

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2010B12: What are the advantages and disadvantages of general versus local anaesthesia for carotid endarterectomy?

Carotid endarterectomy is associated with significant morbidity and mortality – 1% 30 day mortality, 2% myocardial infarction, 3.5% stroke. Indicated in patients with neurological symptoms and >70% stenosis.

	PROs	**CONs**
GA	Best surgical operating conditions Secured airway in a shared airway environment, still patient Possible ↓cerebral metabolic rate with volatiles	No standard cerebral perfusion monitor (stump pressure, TC Doppler) shown to influence outcome GA complications – POCD, haemodynamic instability Unnecessary shunting with risks: microemboli
LA	Best monitor of neurology during cross-clamping → assess contralateral motor dysfunction, slurred speech, altered LOC → need shunt placement. Avoid complications of GA: General: PONV, sore throat, anaphylaxis, aspiration, awareness Specific: haemodynamic instability at induction / emergence, ↑ cardiovascular risk. Better post-op analgesia with deep cervical plexus block Evidence suggests: ↓ unnecessary shunting (10%), ↓ hospital stay and cost, ↓ post-op wound bleed	Requires patient compliance, ↓ patient comfort Anxiety → tachycardia, hypertension Cervical plexus block complications: may not work → top up / GA conversion, CSF injection, vertebral artery injection, nerve damage, blockade of phrenic, recurrent laryngeal, stellate ganglion. Conversion to GA will be difficult, disrupt sterile field No clear evidence of neurological benefit in GALA: no difference in 30 day mortality, MI or stroke

There is no clear-cut correct decision and the above factors must be taken into account in accordance with: patient preference, surgical preference, local protocols, facilities and skill.

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2012A6: A 25-year old man with recurrent pneumothorax and persistent air leak is scheduled for video-assisted thoracoscopic pleurodesis. Outline the considerations involved in induction of anaesthesia in a patient with a persistent air leak. Outline the management of an intraoperative deterioration of oxygen saturation in this patient.

An air leak is a connection between the bronchi and pleura with failure of resolution of pneumothorax despite a chest drain

Induction of Anaesthesia with Air leak

1. Size of air leak – large air leaks + VATS generally required lung isolation with DLT
2. Difficultly of intubation
    a. thorough airway assessment including risk factors (Marfan's)
    b. DLTs more difficult to insert. If this is the case, intubates with normal ETT, then convert to DLT
3. Positive pressure ventilation: RSI may be appropriate, or administration of muscle relaxant after placement of DLT.
    a. can precipitate tension pneumothorax if no ICC, or malfunctioning ICC.
    b. Leak will make PPV ineffective due to escape → cannot ventilate good lung
4. Generally reduced respiratory reserve
    a. Generous preoxygenation
    b. Consider inhalational induction
5. Require functional of chest drain and underwater seal
6. Airway protection: adequate fasting, aspiration prophylaxis

Given the above factors, my preference would be for gas induction, with remifentanil to aid DLT placement, prior to giving muscle relaxant.

Management of ↓ Oxygen saturations

1. Inform surgeons, call for help is acutely hypoxic or worried
2. ↑ FiO_2 100%
3. Check ABC:
    a. ETT position with FOB
    b. Auscultate air entry
    c. Check BP, HR
4. Exclude serious cause:
    a. Pneumothorax – require decompression with Cannula
    b. ETT dislodgement
    c. Circuit disconnection
5. Steps to ↑O_2 with OLV: this is due to shunting in the collapsed lung
    a. ↑FiO_2 100%
    b. Check tube position
    c. 5cm H_2O CPAP to non-ventilated lung

d. 5cmH_2O PEEP to ventilated lung. Variable effect depending on position of lung on pressure-volume loop
e. ↑ TV to 6mLs/kg, ↑RR
f. TIVA to reduce volatile inhibition of HPV
g. Intermittent 2 lung ventilation
h. Pulmonary artery clamping of operative lung

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2012A3: What are the prerequisites for separation from standard cardiopulmonary bypass after uneventful coronary artery bypass surgery? What are the likely causes of hypotension in the immediate post-separation period?

Cardiopulmonary Bypass

Pre-requisites for separation: requires physiological restoration of ventilation and circulation

1. Surgical:
    a. Working, patent grafts
    b. Relative haemostasis
2. Anaesthetic:
    a. Restoration of airway, breathing:
        i. Check ETT still in situ
        ii. Begin ventilation with recruitment – care with LIMA graft, do under direct surgical vision
    b. Restoration of cardiac output:
        i. Rate / rhythm: requires return of sinus rhythm with adequate HR (>80), or pacing if required
        ii. Preload: gradual clamping of venous line and reduction of bypass flows to fill ventricle
        iii. Afterload: aim for MAP > 65mmHg with use of vasopressors
        iv. Contractility: Inotropy, IABP may be required due to myocardial stunning (poor pre-op function, long bypass time)
    c. Restoration of anaesthesia – turn on sevoflurane, check BIS, adequate analgesia
    d. Restoration of haemostatic mechanisms:
        i. Order Blood products ready – PC, FFP, platelets
        ii. Check – Hb, ACT
    e. Others: electrolytes, temperature, glucose

Causes of Hypotension

1. Surgical:
    a. haemorrhage
2. Equipment:
    a. Damping of the radial arterial line – returns to normal after 60min
3. Anaesthetic:
    a. Reduced SVR:
        i. drugs – volatiles, protamine, GTN
        ii. vasoplegia
        iii. anaphylaxis
    b. Reduced preload:
        i. Hypovolaemia
        ii. pulmonary hypertension
        iii. tamponade
    c. Pump failure:
        i. Rate, rhythm, pacing disturbance
        ii. Contractility failure: ischaemia, stunning, long bypass time, graft failure, hypoxia, anaemia