

Section xx. Intra-Aortic Balloon Pump (IABP)

- The most commonly used mechanical circulatory support (MCS) device.
- Percutaneous, temporary (days to week), LV supportive device.
- Partially support. Low CO augmentation when compare to VAD.

Anatomy

- A catheter with a counter pulsation balloon (usually 30-50 ml, 8 F).
- The catheter is connected to a console, arterial line and ECG monitor.
- The balloon is in a descending aorta, distal to left subclavian and end prior to renal artery.
- The balloon is inflated during diastole and deflated during systole.

Physiology

- Inflating (during diastole) → blood displacement → ↑ pressure during diastole (called “augmented pressure”) → ↑ coronary blood flow → ↑ O₂ supply to myocardium.
- Deflating (right before systole) → suction effect → ↓ end diastolic pressure, decreased systolic pressure of the next cardiac cycle → ↓ afterload → ↓ myocardial O₂ demand, ↑ SV.

Indication

- Cardiogenic shock in AMI, ADHF
- Mechanical complication after AMI (acute MR, VSD)
- Intractable ischemia, angina, VT
- Support for a high risk cardiac procedure eg. PCI, ablation
- Bridge to more definitive Rx eg. CABG, LVAD, OHT

Contraindication

- Aortic dissection, aneurysm
- Significant AI
- Severe PAD, hypercoagulopathy, active infection

Placement procedure:

- Mostly in a cath lab, but can be done in the OR and at the bedside
- Supine position. Sterile technique
- Procedure:
 1. Access a common femoral artery with a needle.
 2. Place the introducer sheath over the guide wire using Seldinger technique (advance J-tipped wire in a needle → remove a needle → place the introducer sheath with a dilator over the wire → remove the dilator and a wire)
 3. Place the IABP over the wire. Adjust the position and suture

* IABP can be place “sheathless” which is believed to be less thrombogenic.

Function

- IABP can be set to inflate every 1, 2 or 3 cardiac cycle (ie. 1:1, 1:2, and 1:3) and how many % of gas inflation (%augmentation).
- The pumping timing is triggered by either ECG, pressure waveform or pacemaker.
- The inflation and deflation time can be manually fine-tuned.
- The efficacy of IABP still depend on native cardiac function such as HR, rhythm, CO, SVR.

Routine care:

- Monitor the pressure tracing, augmentation pressure
- Need a systemic anticoagulation to decrease thromboembolic risk unless IABP was placed without an introducer sheath and on a 1:1 setting.

- CXR daily to confirm the position. A radio opaque tip should be at a corina level or 2nd ICS.
- Check distal pulses, check waveform, CBC.

Complication (JACC 2001;38(5):1456)

- Major bleeding (0.8%), major limb ischemia (0.9%), amputation (0.01%), aortic dissection, rupture balloon, infection.
- IABP associated mortality = 0.05%.
- More common in PAD, female, BSA <1.65, age >75

Evidence of efficacy

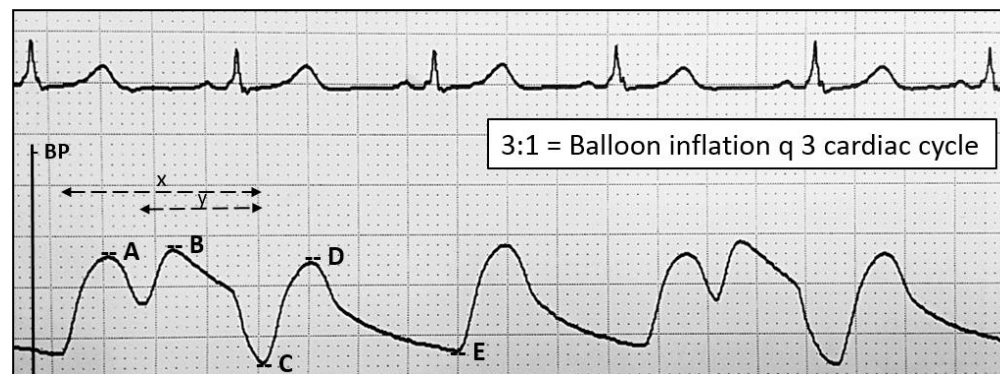
- Many ongoing studies compare with other temporary ventricular assisted devices ie. TandemHeart, Impellar.

AMI

- Likely benefit in an acute MI patient with cardiogenic shock. Historically (in fibrinolysis era), IABP is associated with lower in-hospital mortality (SHOCK. JACC 2000, GUSTO1. JACC 1997).
- No mortality benefit in MI with cardiogenic shock undergoing PCI (IABP-SHOCK II. NEJM 2012)
- STEMI: In pts with anterior STEMI without cardiogenic shock undergo primary PCI, a prophylaxis placement of an IABP showed no Δmortality or Δinfarct sized (CRISP-AMI. JAMA. 2011)
- ? Most effective in mechanical complication of MI eg. MR
- ? No or minimal effect on coronary blood flow

High risk PCI

- No benefit in routine IABP placement before high risk PCI (BCSI-1. JAMA 2010, Circ 2013)



Arterial wave form

Note

- A: Unassisted systolic pressure : patient native SBP
- B: Augmented pressure : higher is better, usually higher than SBP
- C: Assisted diastolic pressure : lower than E. E-C is termed “afterload reduction”
- D: Assisted systolic pressure : lower than A
- E: Unassisted diastolic pressure : patient native DBP
- X: 1 cardiac cycle
- Y: balloon inflation