

## INTRA-AORTIC BALLOON COUNTERPULSATION

### Main Indications:

- Cardiogenic Shock
  - Reversible mechanical defects complicating myocardial infarction. Eg MR, VSD
- Failure to wean from cardiopulmonary bypass
- Bridge to definitive intervention in refractory heart failure and myocardial ischaemia

### Contraindications:

absolute: severe aortic regurgitation, aortic dissection and severe aorto-iliac disease

### Technical issues:

Insertion: IABP insertion in our ICU is usually performed by the cardiologists or cardiothoracic surgeons. May be inserted with or without a sheath. Preferably it is inserted under fluoroscopic guidance (in CCU). It is also inserted in the unit by anatomical landmark: the length of catheter inserted should be about the distance from the angle of Louis down to the umbilicus and then to the femoral artery

Size - Choice of sizes depend on patient height.

<u>Adult height</u>	<u>Size</u>
< 152 cm	25cc
152 – 163cm	34cc
163 – 183cm	40cc
>183 cm	50cc

Post insertion – Essential to check for **correct position** on CXR: tip should be 1-2 cm below the left subclavian artery (or below the aortic knuckle)

Anticoagulation: by intravenous heparin. Monitor APTT Q6H

## **Functional problems:**

Problems encountered with balloon pumps fall into three interrelated categories:

- 1) Operator related problems
- 2) Patient related problems
- 3) Pump related problems

### 1) Operator related problems

Both knowledge and hands-on experience is required. Resource personnel must be identified. Proper timing of pump inflation and deflation is essential.

Steps to troubleshoot:

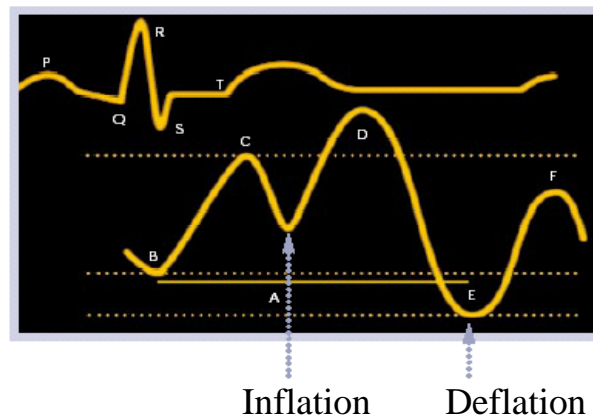
- Set pump at 1:2 ratio in order to identify arterial waveforms
- Check inflation

Identify the diacrotic notch. The upstroke of diastolic augmentation (balloon inflation) should be 40 ms prior to the diacrotic notch. Therefore the diacrotic notch should not be visible. Look for a V shape at the onset of the upstroke

- Check deflation

The lowest point of the IABP blood pressure curves should be the assisted aortic end diastolic pressure. This should be lower than that of the unassisted aortic end diastolic pressure. Again look for the V shape. The assisted aortic systolic pressure should be lower than the previous unassisted aortic systolic pressure.

- A- One pump cycle
- B- Unassisted aortic end diastolic pressure
- C- Unassisted aortic systolic pressure
- D- Augmented diastolic pressures
- E- Assisted aortic end diastolic pressure
- F- Assisted aortic systolic pressure



### Errors in Timing

#### **Early balloon inflation**

- Upstroke greater than 40ms before the diacrotic notch. This is *potentially dangerous* as this result in premature closure of the aortic valve.

#### **Late balloon inflation**

- A portion or the entire diacrotic notch is visible. This error is not dangerous but the maximum benefit of IABP will not be available

#### **Early balloon deflation**

- A U wave rather than the desired V wave is inscribed prior to the next assisted aortic systolic upstroke. The assisted aortic systolic pressure may be equal to the previous unassisted aortic systolic pressure. Again, this error is not dangerous but this will cause a suboptimal afterload reduction and the time period for diastolic augmentation is reduced.

#### **Late balloon deflation**

- The assisted aortic end diastolic pressure is equal or greater than the previous unassisted aortic end diastolic pressure. This is *extremely dangerous* as the left ventricle must eject against the inflated balloon.

## 2) Patient related problems

#### **Low amplitude QRS complex**

- Find the lead with the tallest R wave. May consider lead placement in an AP position [negative electrode (RA) on the back of mid-scapula and positive electrode (LL) on the chest and then select Lead II]

### **Tachycardia**

- Treat the underlying cause. May consider reducing support with either reducing the augmentation ratio or reducing the balloon's augmentation volume

### **Atrial fibrillation**

- Treat the underlying cause. May consider reducing the augmentation ratio and if available use the automatic timing mode.
- Use waveform trigger instead of ECG waveform trigger

### **Cardiac arrest**

- Resuscitate the patient. May consider using the pressure trigger mode or internal rate control mode

## 3) Pump related problems

### **Balloon pressure baseline depression**

- Place pump on stand by. May be required to replace the balloon. The problem may be within the balloon (Helium leak), connecting tubing or the IABP console.

### **Balloon pressure baseline elevation**

- May be due to restriction of gas flow or gas system over-pressurization

### **Low balloon pressure plateau**

- Correct hypovolemia. The balloon may be positioned too low, the size may be too small or the inflation volume may be inadequate.

### **High balloon pressure plateau**

- The balloon may be too large or the presence of gas flow restriction.

## Watch out for complications

### During insertion

- Failure to pass the iliofemoral system
- Aortic dissection – usually fatal
- Arterial perforation – an acute emergency requiring surgical intervention.

### During maintenance

- Limb ischemia – need to check all the foot pulses
- Compartment syndrome

- Rhabdomyolysis
- Infection
- Splenic infarct
- Spinal cord paralysis
- Thrombocytopenia
- Systemic embolization
- Balloon rupture – look for blood in the connection tubing; must stop pump immediately.

After removal

- Hematoma
- False aneurysm
- Arteriovenous fistula