

HNE Area Intensive Care

Practice Guideline

Guideline approved for :JHH ICU only

IABP IntraAortic Balloon Pump : Medical Issues for ICU

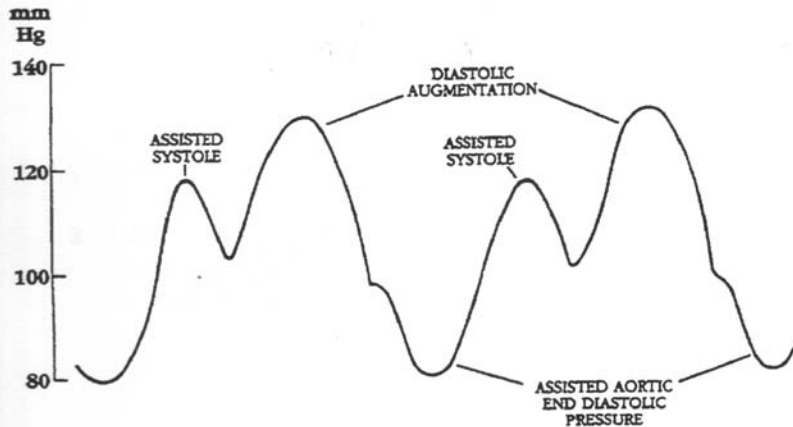
Preface: The following is to be used as an introduction and a guide to the management of patients with an IABP. For more detailed information see the Further Reading section.

1. Theoretical Considerations : An IABP catheter is placed in the descending Thoracic Aorta. Inflation during diastole increases blood flow (and pressure) proximal (coronary and cerebral) and distal (renal and rest of the body) to the Balloon. Deflation just before systole lowers Aortic pressure and reduces LV afterload. The IABP thus supports the failing LV (particularly when due to ischaemia) by improving myocardial oxygen supply and reducing oxygen demand.
2. Correct Positioning: the tip of the catheter 2-3cm distal to the (L)subclavian artery and the proximal end above the renal arteries. Palpate for loss of (L) arm pulses – in too far.
CXR: just distal to the Aortic knob or lateral to the carina.
3. Indications:
 - Cardiogenic shock due to severe LV failure
 - Severe LV failure post cardiac surgery (usually inability to wean CPB)
 - Prophylactic support after high risk PCI
4. Contraindications
 1. Absolute : mod-severe AI, dissecting Aortic aneurysm
 2. Relative: severe AortoIliac / peripheral vascular disease
AAA unresected , end stage terminal disease
5. Anticoagulation : Necessary to prevent thrombus formation on the catheter.
post cardiac surgery – heparin 5000 u TDS
Cardiology pts – full heparinisation usually
*BALLOON MUST NEVER BE LEFT OFF FOR MORE THAN 20 MINUTES (risk thrombus) !
*DO NOT SAMPLE BLOOD FROM THE IABP CATHETER (RISK OF CLOTTING OFF THE LUMEN) !
6. Triggering is the signal the pump uses to identify the onset of systole and thus initiate the deflate/inflate cycle. Trigger methods:
 1. ECG (called “Pattern”) preferred method. deflation on the R wave, inflation on T wave. The ECG signal comes usually from separate ECG leads direct to the IABP machine or may be “slaved” from the bedside monitor.
 2. Pacing: use of V pacing spikes
 3. Arterial Pressure : deflation triggered by the upstroke of the arterial waveform; said to be the least preferred method of triggering. Particularly used in the OT where diathermy intereferes with the ECG signal. Used during CPR.
 4. Internal : asynchronous cycling used during Cardiopulmonary Bypass to prevent thrombus formation on the balloon catheter.
7. Timing : once triggering is satisfactorily set , adjustments may be made to the exact

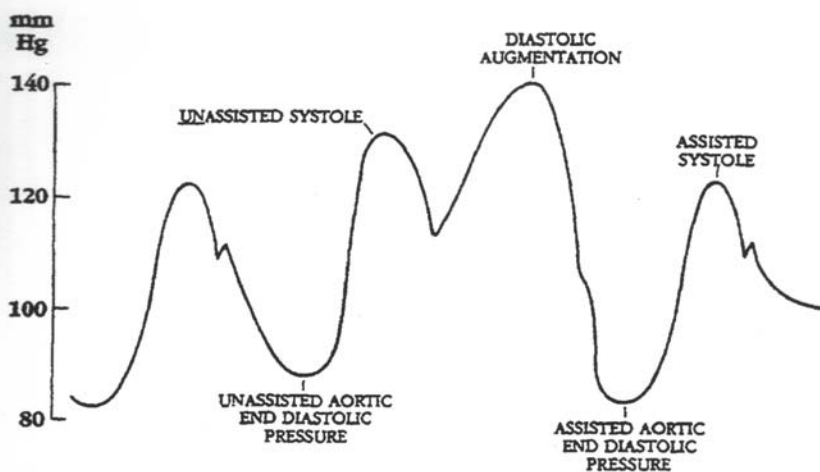
timing (of deflation and inflation) to optimize balloon function. This is done with the balloon ratio set at 1:2 . The following waveforms shows 1:1 ratio and below 1:2 ratio with optimal timing:

Arterial Waveform Variations During IABP Therapy

1:1 IABP Frequency



1:2 IABP Frequency



Correct timing will have the following features :

1. V shaped aortic notch.
2. Balloon (assisted) Aortic EDP < Patient Aortic EDP
3. Assisted Peak Systolic Pressure < unassisted PSP

Incorrect timing patterns are as follows:

EARLY INFLATION

Inflation of the IAB prior to aortic valve closure.

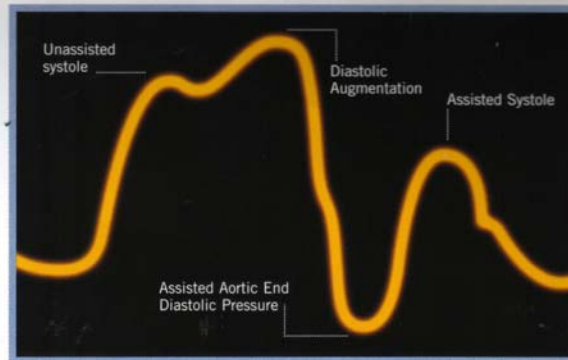
Waveform Characteristics:

- Inflation of IAB prior to dirotic notch.
- Diastolic augmentation encroaches onto systole, (may be unable to distinguish).

Physiologic effects:

- Potential premature closure of the aortic valve.
- Potential increase in LVEDV and LVEDP or PCWP.
- Increased left ventricular wall stress or afterload.
- Aortic regurgitation.
- Increased MVO_2 demand.

Incorrect IABP Timing



LATE INFLATION

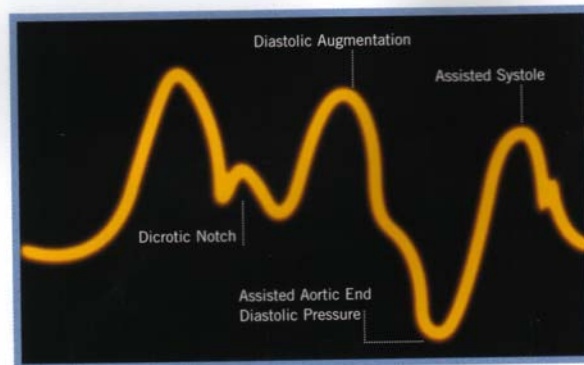
Inflation of the IAB markedly after closure of the aortic valve.

Waveform Characteristics:

- Inflation of IAB after the dirotic notch.
- Absence of sharp V.

Physiologic Effects:

- Sub-optimal coronary artery perfusion.



EARLY DEFLATION

Premature deflation of the IAB during the diastolic phase.

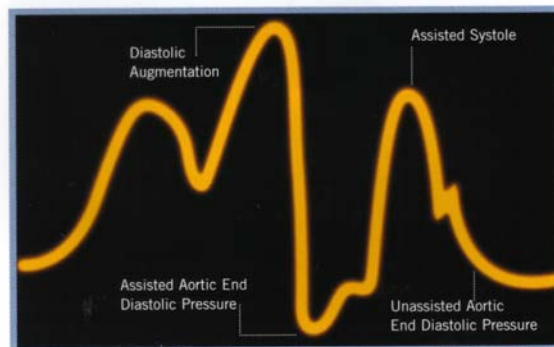
Waveform Characteristics:

- Deflation of IAB is seen as a sharp drop following diastolic augmentation.
- Sub-optimal diastolic augmentation.
- Assisted aortic end diastolic pressure may be equal to or less than the unassisted aortic end diastolic pressure.
- Assisted systolic pressure may rise.

Physiologic Effects:

- Sub-optimal coronary perfusion.
- Potential for retrograde coronary and carotid blood flow.
- Sub-optimal after load reduction.
- Increased MVO_2 demand.

Incorrect IABP Timing



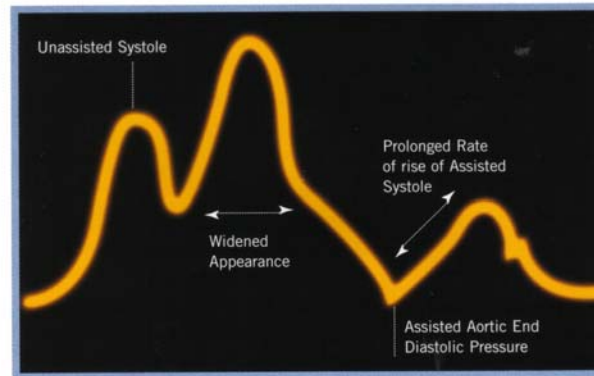
LATE DEFLATION

Waveform Characteristics:

- Assisted aortic end diastolic pressure may be equal to the unassisted aortic end diastolic pressure.
- Rate of rise of assisted systole is prolonged.
- Diastolic augmentation may appear widened.

Physiologic Effects:

- Afterload reduction is essentially absent
- Increased MVO_2 consumption due to the left ventricle ejecting against a greater resistance and a prolonged isovolumetric contraction phase
- IAB may impede left ventricular ejection and increase the afterload



8. Complications:

1. **Limb Ischaemia** : a serious problem which requires removal of the balloon catheter \pm vascular surgical review. If signs of ischaemia develop (loss of pulses) call cardiac surgeon or cardiologist and the Intensivist.
2. **Aortic dissection** : subintimal placement with back pain requires pompt removal of the balloon catheter if suspected.
3. **Renal Ischaemia**: malposition with occlusion of the renal arteries or embolisation.
4. **Bleeding** : usually at the femoral insertion site and related to anticoagulation.
5. **Infection** : rare unless prolonged use.

9. Monitoring: which pressures to record is a controversial issue.

- The Peak Diastolic Pressure (also called Diastolic Augmentation pressure) will usually be greater than the Peak Systolic Pressure (Assisted systolic pressure)
- The bedside monitor will thus call the Peak Diastolic Pressure the Systolic Arterial pressure !!
- The IABP console monitor displays the following pressures:
 - PSP peak systolic pressure (aka. Balloon assisted systolic P)
 - PDP peak diastolic pressure(aka. Diastolic augmentation P)
 - EDP end diastolic pressure
 - MAP mean arterial pressure
- The consensus is to :
 1. use the MAP (bedside monitor) as the target for systemic perfusion pressure (in adjusting inotropes and vasopressors)
 2. if no Arterial line – use MAP from the IABP machine
 3. the PDP from the IABP monitor is used as an indication of effective functioning of the IABP.

10. Alarms and Troubleshooting: predominantly looked after by the nurses . Refer to Product guide at the bedside.

11. Weaning:

- indications – stable haemodynamics , usually after 24-48 hrs
- method – by reducing the ratio of inflations slowly and progressively to 1:4;removal after 2 hours at 1:4 ratio; rarely by decreasing the balloon volume

12. Clinical reference sizing chart

Height Balloon Size

<152 cm	25cc
152-163cm	34cc
163-183cm	40cc
>183 cm	50cc

13. Further Reading:

* Iabp_education_nepean.pdf

_Created: 11/2008 by Dr A Mullens Reviewed: 11/2008 by Dr A Mullens
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Disclaimer: These guidelines are intended for and to be used only by experienced critical care staff under direct supervision of Hunter Health Area Intensive Care Specialists in designated Hunter Health Area Critical Care Areas. The Authors will not be responsible for inappropriate use of these guidelines.