PERFORMED BY:

CRITICAL CARE PARAMEDIC/TRANSPORT
REGISTERED NURSE

INDICATIONS:

a. Hemodynamic support during or after catheterization
b. Cardiogenic shock
c. Weaning from cardiopulmonary bypass
d. Preoperative use in high-risk CABG patients
e. Refractory unstable angina
f. Refractory left ventricular failure
g. Impending infarction
h. Mechanical complication due to acute myocardial infarction
i. Ischemia-related intractable ventricular arrhythmias
j. Mechanical bridge to insertion of other cardiac assist devices

CONTRAINDICATIONS:

a. Severe aortic insufficiency
b. Abdominal or aortic aneurysm
c. Severe calcific aorto-iliac disease
d. Severe peripheral vascular disease
e. Sheathless insertion with severe obesity and scarring of the groin

SIDE EFFECTS/COMPLICATIONS:

a. Limb Ischemia
b. Excessive Bleeding from Insertion Site
c. Infection
d. Balloon Leak/Rupture / Immobility of intra-aortic balloon
e. Thrombocytopenia
f. Thrombosis
g. Peripheral embolization
h. Aortic Dissection
i. Compartment syndrome
j. Death

Immediately after dispatched for IABP Transport the team will:

A. Contact dispatch for report on sending/receiving hospitals and their IABP consoles. The Cardiosave Rescue fiberoptic catheter requires a special adaptor to be used with the CS 100 IABP console.

Upon arrival at the referring facility, the Transport Team will:

a. In some instances, the transport nurse may have to assist in insertion of the IABP catheter prior to transport from the referral facility
b. Verify IAB placement appropriate via chest x-ray (tip of IAB should be at 2nd or 3rd intercostals space)
c. Make note of the size of the balloon used
d. Assess the patient. Set up the transport balloon pump, attach the electrodes (tape and mark as IABP)
e. Set up and assure appropriate connections with arterial line transducer and transport monitor (no more than 8 feet/ 2.5 meters of pressure tubing should be used)
f. Switch the patient to the transport balloon pump and manage the balloon for optimal therapeutic effect.
g. Change intravenous infusions to transport pump and arrange for additional personnel to help load the patient and pump into the waiting transport vehicle.
h. Assure proper and safe securing of pump console for transport.
i. Maintain an ongoing assessment of the patient's condition and intervene to maintain both patient stability and optimal operation of the balloon pump.
j. Prior to arriving at the receiving facility, report should be called to the receiving unit. Provide them with an estimated time of arrival, applicable intravenous drips and assure of balloon pump awaiting the patient's arrival.

At the receiving facility:

a. The Transport Team will assist with transfer of intravenous lines, drips, invasive lines and assist with the transfer of the patient to the bed.
b. The transport team will assist with the change-over from the transport pump to the waiting balloon pump unless the transport balloon pump will be utilized at the bedside.

Documentation:

a. Complete all documentation per protocol
b. Document vital signs every 15 minutes if stable and Q5 min if unstable or titrating vasoactive infusions
    i. Include HR, systolic/ diastolic arterial pressure, diastolic augmentation, MAP and SPO2. Additionally CVP, PAP, ETCO2 should be included if applicable.
c. Documentation must include recordings of the ECG strip and arterial waveform used as the source for timing of the intra-aortic balloon pump at the beginning of transport, end of transport and Q1 hr during transport (utilize strips from IABP console)
d. Documentation on tracings should include
    i. Operational mode (Auto vs Semi-auto) **Auto is the preferred mode of operation, if not utilized you must provide rationale.**
    ii. Site of arterial pressure waveform being used for IABP timing
    iii. Balloon pump trigger selection
    iv. Balloon pump timing mode
    v. Recording of augmented diastolic pressure
    vi. Recording of the assisted and unassisted systolic and aortic end-diastolic pressure as appropriate
e. Document quality of pedal pulses on initial assessment and every 30 minutes and observe for signs of limb ischemia in IABC leg.
f. Document urine output every hour

g. Document left radial pulses on initial assessment and every hour

Special Treatment Needs:

a. Do not flex the balloon leg (knee immobilizer should be utilized during transport)
b. Do not elevate head of cot greater than 30 degrees

Potential Problems/Interventions:

a. Excessive bleeding at the insertion site
    i. Assessment must include both anterior insertion site for bleeding and posterior area of leg for hematoma formation, indicating bleeding into the leg
    ii. Control bleeding using direct pressure to the insertion site or by application of a pressure dressing
    iii. Replace volume as needed (refer to shock protocol)
    iv. Contact medical control if applicable
b. Balloon rupture
    i. If blood/ or brown flakes are observed within the catheter or extender tubing at any time during the IABP, stop pumping immediately.
    ii. Assess tubing on initial assessment and every hour, and after the following alarms: Blood detect, low augmentation, and / or gas loss or IAB catheter alarm.
    iii. Do not restart for any reason. Contact Medical control. Discuss alternative therapies to maintain cardiac output. Consider diversion to closer facility if unstable and facility has necessary resources to assist in stabilization.
c. Immobility of the balloon
    i. If the IABP is immobile for greater than 5 minutes in situ, notify medical control for appropriate interventions. Conditions that may cause immobility of the IABP are:
        1. Balloon leak or rupture
        2. Kinking of catheter or sheath restricting helium flow
d. System Failure - microprocessor or other electronic/pneumatic failure.
    i. In cases of IABP immobility not related to a confirmed or "suspected" balloon leak/ rupture, the operator may connect a 60 mL syringe and 3-way stopcock to the catheter extension tubing and manually inflate the balloon with 10 – 50 mL (as appropriate to size of balloon) of either room air or helium drawn from the helium tank. This is not to be timed to the cardiac cycle but inflated and deflated (over a period of 1-2 seconds) once every minute. This prevents clot formation on the surface of the balloon. For patients receiving anticoagulation, this procedure does not have to be repeated as frequently. (Every 5 minutes.) Care must be taken to avoid over-inflation of the balloon with resultant balloon rupture.
e. Cardiac Arrest.
    i. The arterial pressure trigger is the most effective mode of balloon pumping in situations where CPR is being performed. The IABP will trigger from the pressure wave generated by chest compressions. Adjust the threshold level as needed for effective trigger in the pressure mode. A mean arterial pressure of about 50 mmHg is required to visualize augmentation.
f. Altitude changes during air transport.
    i. In the auto fill mode, the system will automatically purge and fill the IABP when local atmosphere pressure decreases or increases by 25 or 50 mmHg respectively. These pressure changes occur approximately every 1,000 feet of assent or 2,000 feet of descent in altitude.

The auto fill mode should be used during air transport. If the auto fill mode cannot be used and the manual fill mode is required, a manual fill must be initiated with every 1,000 feet assent and /or every 2,000 feet descent.

Clinical Considerations:

a. Reliable ECG: There are several methods to correct conditions that hamper the acquisition of a reliable ECG.
    i. Reposition electrodes to the anterior thoracic chest/ limbs or replacement of the electrodes.
    ii. Check that patient cable is property connected.
    iii. Choose alternate lead selection.
    iv. Manipulate the ECG Gain setting.
    v. Assure that the appropriate cables are utilized.
b. Arrhythmias
    i. Atrial Fibrillation
        1. Use AUTO mode and ECG trigger, in this mode the IABP will automatically readjust for changes in rate and rhythm. .
    ii. Ectopics
        1. To ensure reliable triggering with ectopics, use AUTO mode, this will assure the selection of lead that minimizes the amplitude differences between the normal QRS and the ectopic.

Description:

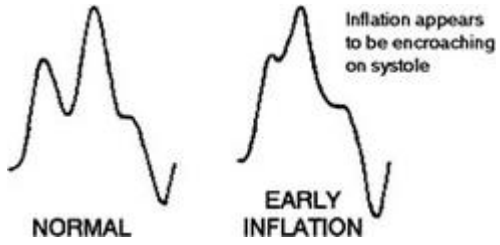
a. The Intra-aortic Balloon is a polyurethane or durathane membrane balloon mounted on a vascular catheter that may include a fiberoptic option. It is attached to an external console that regulates its inflation and deflation.
b. The balloon ranges in volume from pediatric sizes 2.5 mls – 50 mls (adult) and is usually inserted through the common femoral artery. It is positioned in the descending thoracic aorta so that it lies proximal to the left subclavian artery, and distal to the renal arteries.
c. The console, which can be triggered in various modes will synchronously inflate and deflate the balloon. If the balloon is timed correctly, it will inflate during diastole and deflate prior to systole. This process is called counter-pulsation. The newer generation of IABP will when in AUTO mode will automatically change leads, change triggers if patient becomes disconnected from selected trigger, and will also change beat to beat timing with arrhythmias.

Counterpulsation and Cardiac Principles:

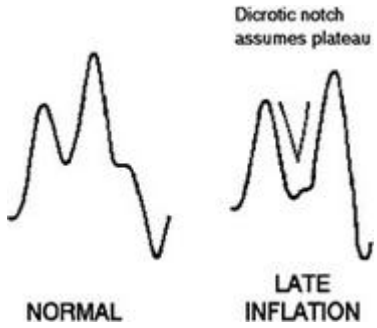
a. Inflation:
    i. Aortic valve closure occurs at the beginning of diastole. Since the dicrotic notch on an arterial waveform represents the aortic valve closing, inflation of the balloon is aimed at this landmark.
    ii. As the balloon inflates during diastole, the blood volume is displaced in the aortic arch. This blood displacement improves coronary artery perfusion. The process is known as diastolic augmentation.
b. Deflation:
    i. Deflation occurs just prior to systole. During deflation, the balloon provides 10 – 50 mL (depending on balloon size) of potential space in the aorta, which is filled by blood in the aortic root. The space created allows for improved left ventricular emptying (decreased afterload).

Highlights to Proper Timing:

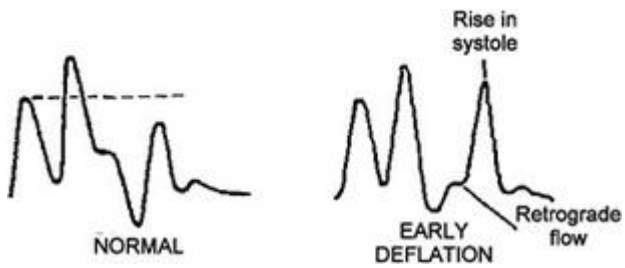
a. Inflation should begin at the dicrotic notch of the arterial waveform (creates an augmented diastolic pressure).
b. The balloon should be deflated until you obtain a maximum assisted end diastolic pressure (this reduces the patients afterload).
c. Examples:



Early Inflation
Regurgitation of blood backward into the LV. Premature closing of the aortic valve.
⇑ afterload.

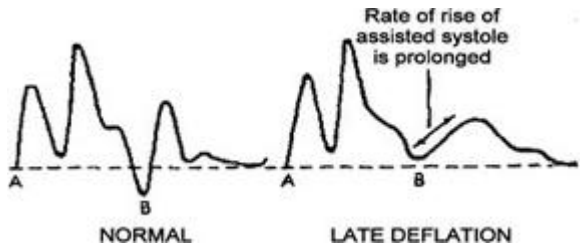


Late Inflation
⇓ Augmentation. Aortic diastolic pressure. Perfusion of the coronary arteries as compared to what they would have had if augmentation would have been "on-time" at the dicrotic notch.



Early Deflation
The drop in balloon assisted AEDP occurs too soon to reduce the work of the next systole. This causes BP of the assisted systole. There is then no

reduction of LV workload resulting in MVO2 as compared to an assisted systole.



Late Deflation
No reduction in ADEPT prior to the next systole. Only a small amount of blood in the aortic root will have run off. Aortic BP will be just as the ventricle tries to open the aortic value (afterload).

Approver Date