

PROTOCOL FOR: Intra-Aortic Balloon Pump (IABP): Care of the Patient on the

- POLICY:
1. IABP insertion will take place in the ICU, Cardiac Cath Lab, or the OR. In a most emergent instance, an IABP may be placed in the ED with support of the cath lab and/or ICU staff. Radiology must be notified (for fluoroscopy) if insertion is take place in the ICU or ED.
 2. A signed consent from the patient or family will be obtained prior to insertion, unless emergency.
 3. A mask, cap and gown will be worn by all persons in immediate area during insertion.
 4. Initial IABP frequency (i.e. 1:1, 1:2) and subsequent frequency changes will be ordered by the MD/APRN. Balloon volume changes also require an MD/APRN order.
 5. Evaluation of timing and subsequent adjustments in mode (AutoPilot vs Operator), trigger, and inflation/deflation timing may be made by the ICU nurse. All timing evaluation will be conducted on at least a 1:2 ratio, as timing cannot be evaluated in 1:1.
 6. AutoPilot mode will be the preferred mode for console operation, as long as timing is evaluated to be appropriate. In this mode the console will select the ECG source, AP source, trigger, and timing. Should this function be evaluated to be suboptimal, operator control may be achieved by selecting the OPERATOR mode.
 7. Arterial pressure will be monitored through the central lumen of the balloon (aortic root). When a fiber-optic catheter is used, the fiber-optic wave will display on the console. The central lumen will then be transduced to the bedside monitor. Assisted, unassisted, mean and diastolic augmentation pressures displayed on the IABP console will be recorded on the IABP flow sheet.
 8. Unless otherwise ordered or contraindicated, a heparinized solution (1000 units in 500 ml NS) to a pressurized transducer flush system will be used to maintain the central balloon lumen.
 9. Due to risk of embolization, routine blood draws and bolus flushing from the central lumen are to be avoided. Even if the balloon lumen is the only arterial access, it is not to be used for aspiration of blood samples, unless authorized by the responsible physician / APRN.
 10. If flushing the central lumen is required, the RN may use the transducer flush system to flush as follows:
 - a. put the pump on standby,
 - b. draw off 3-5 mls of blood from the arterial line lowest port and discard this blood,

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c. squeeze transducer flush, observing square wave for response.

11. Manual flushing of the central lumen may only be performed by an MD/APRN. As above, the pump must be placed in standby, and 3-5 mls of blood must be aspirated and discarded prior to flushing.
12. If unable to aspirate blood from the central lumen, consider the line clotted and cap it. Do not attempt to use the central lumen for the remaining course of therapy.
13. If the balloon is inserted through an arterial sheath with a side lumen, this side lumen must be transduced and monitored. The side lumen may be used for blood draws. A pressurized NS flush is used to maintain this line.

DESIRED PATIENT

OUTCOME:

1. Chest pain will be relieved.
2. Hemodynamics will be optimized: Cardiac output/cardiac index will improve, PAOP will decrease, and systemic vascular resistance will be normalized.
3. Distal circulation will remain intact.

CLINICAL
ASSESSMENT
AND CARE:

PRIOR TO INSERTION

1. Obtain and record baseline vital signs and hemodynamic parameters.
2. Ascertain, if applicable, patient's intensity of chest pain using a 1-10 or other appropriate pain scale.
3. Assess and mark bilateral posterior tibial and dorsalis-pedis pulses. This is essential, since the balloon might occlude the vessel and therefore diminish the pulses after insertion. If possible, a baseline ankle/brachial index (ABI) should also be assessed (SBP ankle ÷ SBP brachial).

Ankle-brachial index: 0.90 - 1.3 normal
 0.70 - 0.89 mild circ impairment
 0.40 - 0.69 mod circ impairment
 < 0.4 severe circ impairment

4. The following blood tests should be drawn prior to insertion per MD order:

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- a. CBC with diff
 - b. PT, PTT
 - c. Electrolytes, BUN, Creat, CK, CK-MB and troponin
 - d. ALK. Phos, bilirubin (optional)
 - e. ABG (optional)
 - f. Type and Cross for one unit PRBC's (optional)
5. Perform a complete physical assessment of the patient with special emphasis on cardiovascular, respiratory system and neuro status.
6. Gather necessary equipment for IABP insertion.
- a. IABP console / cables
 - b. IABP catheter/insertion kit
 - c. Sizing recommendations:

Height	IABP size
4'10" - 5'4"	30ml
5'4" - 6'	40ml
> 6'	50ml
7. Prepare the pressure central lumen flush line/ transducer with heparin flush solution, 1000 units per 500 ml NS, assuring that all air is removed from the flush system. (Use plain NS for this lumen only if specifically ordered if heparin is contraindicated.)

Note: If the IABP is to be inserted through an introducer sheath with a side port, prepare a second transducer line with NS.

8. Prepare the IABP console:
- a. Plug in console power cord and turn power on
 - b. Open the helium tank and verify adequate helium supply
 - c. Place the 5 ECG electrodes on the patient's chest and connect IABP ECG source. (EKG waveform may be jacked in from bedside monitor in an emergency - requires special module.)
 - d. Connect arterial line transducer to the console. Level and zero the transducer. (If a fiber-optic catheter is used, the central lumen transducer will go to the bedside monitor.)
 - e. If a fiber-optic catheter is used, slide in the fiber optic slide connector and cal key. The system will then automatically zero. (Light bulb indicator will turn from blue to green after automatic zero.)

**** ZERO FIBEROPTIC CATHETER PRIOR TO INSERTION.**

IMMEDIATELY AFTER IAB IS POSITIONED in the patient:

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1. Hook up pressurized flush solution / transducer assembly to the central lumen. (This will be done after the MD aspirate blood from the central lumen and gently flushes the central lumen.)
2. Connect the helium drive line tubing from the IABP pump to the catheter. (Note: one-way valve on catheter must be removed.) Pumping may now be initiated.
3. To initiate pumping:
 - a. Check that the IABP is in the AutoPilot mode. (If the operator desires control of EKG, AP source, trigger and timing, utilize Operator mode).
 - b. Verify trigger recognition
 - c. Press the green ON (assist) key.
 - d. Observe arterial pressure tracing on screen and evaluate timing.
4. Once the MD has sutured the sheath hub and catheter in place, apply a sterile, occlusive dressing.

AFTER INSERTION:

1. Monitor and record HR and rhythm, B/P, hemodynamic parameters (RAP/PAP/PAOP), RR, and urine output every 1-2 hours.
2. Evaluate pedal and radial pulses every 1-2 hours (presence and quality). Obtain ankle/brachial index every 12 hours.
3. Evaluate timing every 1-2 hours and PRN. Mount a strip of arterial wave form with IABP on 1:2 on the IABP Flow Sheet at the beginning of each shift and with any significant changes.
4. Monitor function of IABP console, noting mode, trigger, frequency, and alarm status with each timing assessment.
5. Perform physical assessment every 2 hours minimum, again with special emphasis on cardiovascular, respiratory and neuro status. Monitor for any complaints of back pain.
6. Assess dressing and insertion site for any drainage, bleeding, swelling, redness and pain every 4 hours and prn.
7. Assess calf for hardness/swelling, which may indicate compartment syndrome every 12°.

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ONGOING:

1. Patient will be on bedrest while IABP is in place. HOB may be elevated up to 30°. Patient may be log-rolled side to side for skin care, lung assessment, etc. Lateral rotation to 20° may be tolerated. Flex the affected foot of the patient every two hours and PRN to promote circulation and prevent venous stasis.
2. Change the groin dressing per central line protocol (q.48 hours if gauze dressing / q.7 days for transparent dressing) and prn.
3. Maintain pressure bag of flush system at 300 mm Hg. A-Line tubing /flush system is changed every 72 hours.
4. Heparin therapy may be initiated after the IABP is inserted. PT, PTT are drawn every 24 hours or as ordered. Monitor these labs and regulate Heparin drip to keep PTT 1.5 to 2x the control level.
5. Change helium tank at 50 PSI.
6. While the patient is on the IABP, the following labs are recommended:
 - a. CBC with diff, PT, PTT, BUN, Creat, electrolytes daily.
 - b. CK isoenzymes, troponin daily x 3 days.
 - c. EKG daily.
7. For Transport:
 - a. Notify other departments (i.e. Respiratory Therapy, Diagnostic Imaging) of the transport.
 - b. The patient must be transferred with an IABP trained nurse
 - c. Verify that clear ECG and Arterial pressure signals appear on the IABP screen and check that the IABP battery is charged.
 - d. Verify adequate helium supply.
 - e. Disconnect ECG, arterial, and pulmonary artery transducers from bedside monitors.

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- f. Unplug the IABP power cord.
 - g. Transfer the patient via bed or stretcher, utilizing extreme caution to maintain all invasive lines. Avoid any tension of the IABP catheter by keeping the IABP as close to the bed/stretcher as possible.
8. Code blue:
- a. In the event of a Code Blue - two modes of action can be utilized.
 - 1) Once CPR is initiated and a sufficient blood pressure is generated with compressions, select the ARTERIAL PRESSURE trigger and initiate counterpulsation. This is the recommended option.
 - 2) In the event that CPR cannot generate a consistent trigger, the balloon console can be turned off, and the IAB central lumen manually inflated. Aspirate first, then inject volume of air equal to balloon capacity. Inflate/deflate 5 times every 5 minutes for the time that counterpulsation is discontinued.
9. IABP console or balloon failure:
- a. The IAB should not remain dormant in the patient for longer than 30 minutes. In the event of mechanical failure, separate the pump from the console. If no blood is observed in the gas lumen tubing, manually inflate/deflate the IAB every 5 minutes as above.
 - b. If blood is observed within the gas lumen (drive line) tubing, DO NOT attempt to inflate the IAB. Turn the IABP console OFF. Notify the physician /APRN immediately for IAB removal.
10. Weaning:
- a. When the physician / APRN makes the decision to attempt weaning the patient from the IABP, specific orders for timing changes, assessment criteria and length of wean need to be written. Usually the patient is weaned by changing the timing from 1:1 to 1:2, and then 1:4 for one to two hours at each interval, as tolerated. Weaning can also be

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accomplished by decreasing the volume delivered to the balloon. Volume should not be reduced to less than 2/3 of balloon capacity.

Note: 1:4 and 1:8 frequencies with a bradycardic rhythm may not provide sufficient balloon movement. In this instance, the IABP should be placed back on 1:1 for 5 minutes each 1/2 hour.

- b. Assessment parameters which indicate the patient is tolerating the wean are:
- 1) Urine output remains at least 30 cc/hour or > 0.5 ml/kg/hr with only small doses of diuretics.
 - 2) Minimal need for positive inotropic agents to maintain previous C.O / C.I.
 - 3) Less than a 10-20% increase in heart rate.
 - 4) PVC's less than 6/minute, unifocal and not coupled.
 - 5) Cardiac index \geq 2.
 - 6) PAOP does not increase greater than 20%.

11. Removal of IABP:

- a. Criteria for discontinuing the balloon include:
- 1) Successful wean on 1:2, 1:4 or 1:8 frequency.
 - 2) Vascular occlusion or compromise of the affected limb.
 - 3) IAB rupture / leak.
- b. The IAB may be removed at the patient's bedside or in the OR by the physician/APRN. If it becomes necessary to take the patient to the OR to remove the IAB, the MD/APRN will contact the vascular surgeon to perform the procedure.
- c. Prior to removal, heparin therapy will be discontinued and patient's PTT allowed to return to normal before balloon removal, as per MD /APRN order.
- d. Just prior to removal, turn the IABP console to OFF and disconnect the IAB catheter from the console.

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(The patient's blood pressure will collapse the balloon for withdrawal. Applying manual vacuum is not required.)

NOTE: The balloon and sheath should be removed simultaneously. (The IAB should NOT be withdrawn back through the sheath.) Any undue resistance to complete withdrawal should be immediately noted and surgical removal via arteriotomy needs to be considered.

- e. After removing the balloon and getting an initial spurt of blood, the physician/ARPN must either hold direct pressure manually or apply a fem-o-stop device, continuing to monitor for the initial 20-30 minutes.
 - f. A fem-o-stop or a 5-10 lb. sand bag will be applied after hemostasis is obtained, to be maintained for up to 6 hours or per MD/APRN orders.
 - g. If bleeding continues, resumes or is not controlled, notify the MD/ APRN as further measures may be required.
 - h. Obtain VS and evaluate distal pulses every 5 minutes while manual pressure is held, then every 15 minutes X 4, every 30 minutes x 4, then every 1-2 hours while on bedrest.
 - i. The patient will need to stay on bedrest for the next 12-24 hours. Encourage the patient to flex and extend his foot. Avoid hip flexion > 30 degrees during this time.
12. Notify M.D. for:
- a. Decrease in quality of pulses distal to IAB insertion site (Radial and pedal). (Loss of radial pulse may indicate that the IABP is too high and needs to be repositioned by MD.)
 - b. Impaired color or sensation in an extremity.
 - c. Bleeding at insertion site / hematoma.
 - d. Sudden onset of back pain/or shoulder blade pain.
 - e. Persistent or increased chest pain.
 - f. Temp > 101°.

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- g. IABP non-functioning or blood in IABP helium line tubing (Refer to step 9b.)
- h. Swelling and/or hardness in calf (possible compartment syndrome).
- i. Significant hemodynamic changes.
- j. Sudden decrease in urine output / anuria (May indicate that the IAB is too low in the aorta and may need to be repositioned.)

PATIENT

- EDUCATION:
- 1. Instruct patient/family to purpose of IABP therapy and related procedures.
 - 2. Instruct patient to notify RN for the following:
 - a. Continued, increased, or re-current chest pain.
 - b. Sudden onset back or shoulder blade pain.
 - c. Sensation of bleeding at insertion site.
 - d. Impaired sensation and/or movement of calf distal to insertion site.

APPROVAL: ICU Standards Committee
Nursing Standards Committee

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