

Intra-aortic Balloon Counterpulsation Therapy: Care of patient receiving

Site Applicability

PHC: SPH (CICU, CSICU, Cath Lab, OR)

VCH: VGH (CSICU, CCU, Cath Lab, OR)

Practice Level

RN: Specialized Skills

- Restricted to Registered Nurses in CICU and CSICU who have received education and supervised practice.
- Only nurses trained in managing compression devices (e.g. CompressAR clamp) may manage the clamp post removal.

Policy Statement

1. Perfusionists are responsible for the initial set up of the intra-aortic balloon pump (IABP)
2. Perfusionists or physicians are responsible for adjusting IABP timing
3. Physicians are responsible for:
 - a. Initiating weaning, and determining the mode of weaning
 - b. Verifying IAB position on CXR
 - c. Removing the IABP
4. Nurses are responsible for:
 - a. Set up and management of IABP machine in emergent cases when perfusionist not present (see [Appendix A](#))
 - b. All initial and ongoing patient assessments and related documentation
 - c. Patient and family education

Need to Know

IABP is a type of mechanical hemodynamic support and is used in a variety of clinical conditions:

- Cardiogenic shock
- Intractable angina
- Low cardiac output following cardiopulmonary bypass
- Adjunctive therapy in high risk or complicated angioplasty
- Prophylaxis in patients with severe left main coronary artery disease, pending surgery
- Intractable myocardial ischemia awaiting further therapy
- Intractable ventricular arrhythmias as a bridge to further therapy
- Mechanical bridge to other assist devices

Contraindications:

- Severe aortic insufficiency
- Abdominal and thoracic aneurysm
- severe calcific aorta-iliac disease or peripheral vascular disease
- Sheathless insertion with severe obesity, scarring of the groin
- Aortic dissections

The IAB *inflates* during diastole and displaces the blood around the balloon. This causes up to 30 percent higher diastolic filling pressures which may increase coronary artery blood flow and improve renal perfusion.

The IAB *deflates* during systole and can create a vacuum effect which decreases afterload. The systolic pressure can decrease by as much as 20 percent, therefore decreasing cardiac workload.

Weaning from IABP therapy is dictated by the patient's hemodynamic status, need for inotropes, and general condition. The most common method used to wean a patient from the IABP is to gradually decrease the frequency of assistance from 1:1 to 1:3.

Practice Guideline

INITIAL IABP MONITORING	
Assessment	Rationale/Interventions
Pre-IABP insertion: 1. Assess and document: <ul style="list-style-type: none"> VS (left and right arm NBP, HR, RR, SpO₂ or SaO₂, T) ECG rhythm, ST-segment hemodynamic parameters (e.g. CVP, PAP, PCWP* if available) LOC and pain (if awake) skin color and warmth breath and heart sounds. 	Establish baseline assessment
2. Document CO prior to insertion	If PA catheter in situ, calculate CO if continuous CO is not available
3. Assess and document peripheral pulses (pedal, brachial, or radial) and examine color, warm, movement, and sensation of all limbs	
Immediately following insertion of an IABP: 1. Assess and document: <ul style="list-style-type: none"> VS (BP, HR, RR, SpO₂ or SaO₂, T) ECG rhythm, ST-segment Hemodynamic monitoring parameters (e.g. CVP, PAP, PCWP*, CO if available) IABP parameters (diastolic augmentation, assisted systole, unassisted end diastolic pressure, unassisted systole, assisted end diastolic, MAP) LOC (GCS, RAAS or CAM) and pain (if awake) Skin color and warmth Breath and heart sounds Peripheral pulses (pedal, brachial, or radial); color, warm, movement, and sensation of limbs Sheath and IABP catheter insertion site Right and left calf circumference measurement 	Observe for complications of IABP therapy (see Table 2) Determine patients' response to intervention See Table 3 to troubleshoot dysrhythmias Monitor closely for limb ischemia and notify physician of any changes from baseline: pale or dusky pallor, cool skin, diminished or absent pulses Monitor for hematoma at insertion site and observe for bleeding, swelling, redness Mark calf measurement point with indelible marker to maintain consistent calf circumference measurements
2. Perform IABP checks: <ul style="list-style-type: none"> Zero IABP transducer, inflate flush solution to 300 mmHg. NS flush solution and leveled to 	Notify perfusionist when helium cylinder PSI reaches 500 as cylinders are usually changed at this level

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<p>the phlebostatic axis</p> <ul style="list-style-type: none"> ensure helium PSI is above 500 PSI verify slow gas loss alarm is on and system is set to "autofill" confirm operation mode is set to "AUTO" or "SEMI-AUTO" 	<p>Perfusionist will assess pump and helium level per individual hospital and unit protocol (minimum once a shift) To set "autofill," use the "Pump Options" menu on the left side of the pump console</p> <p>In AUTO mode, timing is automatically set by the system. In SEMI-AUTO mode, inflation and deflation timing is set by perfusionist/physician, and the pump will then adjust timing if the HR or rhythm changes</p>
<p>3. Record IABP measurement/settings</p> <ul style="list-style-type: none"> Frequency Trigger Timing, including assessment of inflation and deflation points (for assessment purposes use 1:2 frequency if patient condition allows- see Table 1) 	<p>Inform perfusionist/physician STAT of early or late inflation/deflation</p>
<p>4. Arrange for a chest x-ray as per the physician's order</p>	<p>Chest x-ray is performed post-insertion, and daily, to ensure accurate balloon placement in aorta Note: IABP should be placed on standby during CXR in order to facilitate a clear picture</p>

*PCWP may not be performed on patients with continuous CO measurements

ONGOING IABP MONITORING	
Assessment	Interventions
<p>Monitor the following until IABP discontinued and for 24 hours following removal:</p> <ol style="list-style-type: none"> Assess and document Q1H and PRN: <ul style="list-style-type: none"> VS (BP, HR, RR, SpO₂ or SaO₂, T) ECG rhythm, ST-segment Hemodynamic monitoring parameters (CVP, PAP, PCWP*, CO) IABP parameters (diastolic augmentation, assisted systole, unassisted end diastolic pressure, unassisted systole, assisted end diastolic, MAP) LOC (GCS, RAAS or CAM) and pain (if awake) Skin color and warmth Breath and heart sounds Peripheral pulses (pedal, brachial, or radial); color, warm, movement, and sensation of limbs Urinary output Sheath and IABP catheter insertion site 	<p>Observe for complications of IABP therapy (see Table 2)</p> <p>Assess for signs of altered cerebral tissue perfusion (monitor neurological vital signs as per critical care assessment guidelines)</p> <p>The IAB can impair renal perfusion. Monitor urine output hourly and notify physician with decreasing urine output trends</p> <p>Observe for signs of bleeding (blood at site, swelling or palpable hematoma, bruising) and infection (purulent drainage, redness)</p>

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<p>2. Record IABP measurement/settings Q1H and PRN:</p> <ul style="list-style-type: none"> • Frequency • Timing, including assessment of inflation and deflation points (for assessment purposes use 1:2 frequency if patient condition allows- see Table 1) <p>Nurse patients to avoid leg flexion and position head of bed 15 to 30 degrees</p>	<p>Inform perfusionist/physician STAT of early or late inflation/deflation</p> <p>NOTE: Routine Q hourly flushing is no longer required. Fast flush the catheter only if you see dampening on the waveform</p>
<p>3. Assess skin integrity Q2H and PRN</p>	<p>Reposition patient using log roll technique Q2H and consider use of air mattress to maintain skin integrity.</p>
<p>4. Assess and document Q4H and PRN:</p> <ul style="list-style-type: none"> • Timing, including assessment of inflation and deflation points (for assessment purposes use 1:2 frequency if patient condition allows- see Table 1) <p>Measure and record right and left calf circumference.</p> <ul style="list-style-type: none"> • Assess skin color and warmth, breath and heart sounds: SPH: see NCS6074 – Physical assessment 	<p>Mark measurement point with indelible marker to maintain consistent calf circumference measurement</p>
<p>5. Perform IABP checks Qshift and PRN:</p> <ul style="list-style-type: none"> • Zero IABP transducer at start of shift, inflate flush solution to 300 mmHg • Ensure helium PSI is above 500 PSI • Verify “slow gas loss” alarm is on and system is set to “autofill” • Confirm operation mode is set to “AUTO” or “SEMI-AUTO” • Chart Trigger at beginning of each shift or with any change 	<p>Notify perfusionist when helium tank PSI reaches 500</p> <p>In AUTO mode, timing is automatically set by the system. In SEMI-AUTO mode, inflation and deflation timing is set by perfusionist/physician, and the pump will then adjust timing if the HR or rhythm changes</p>
<p>6. Perform the following daily:</p> <ul style="list-style-type: none"> • Replace electrodes and ensure contact leads are secured and taped to patients’ skin • Apply clear occlusive dressing to insertion site and change Q7 days and PRN • Chest x-ray is usually performed daily (as per the physician’s order) 	<p>Physician is responsible for verifying IAB position. Note: IABP should be placed on standby during CXR in order to facilitate a clear picture</p>

*PCWP may not be performed on patients with continuous CO measurements

IABP MONITORING DURING WEANING	
Assessment	Rationale/Interventions
Monitoring and assessments during weaning from IABP: 1. Assess and document: <ul style="list-style-type: none"> VS (BP, HR, RR, SpO₂ or SaO₂, T) ECG rhythm, ST-segment Hemodynamic monitoring parameters (e.g. CVP, PAP, PCWP*, CO, if available) IABP parameters (diastolic augmentation, assisted systole, unassisted end diastolic pressure, unassisted systole, assisted end diastolic, MAP) Cerebral tissue perfusion (neurological vital signs), LOC (GCS, RAAS) and pain (if awake) Skin color and warmth Breath and heart sounds Peripheral pulses (pedal, brachial, and radial); color, warm, movement, and sensation of limbs Urinary output 	Determine patients' response to weaning Monitor for signs failure of weaning and notify perfusionist/physician STAT Indications that weaning may not successful include: <ul style="list-style-type: none"> Hemodynamic instability Tachycardia Arrhythmias Decrease in CO, CI Increase in PAW, PAD Chest pain Respiratory distress Assess for alterations in renal perfusion by monitoring urine output hourly

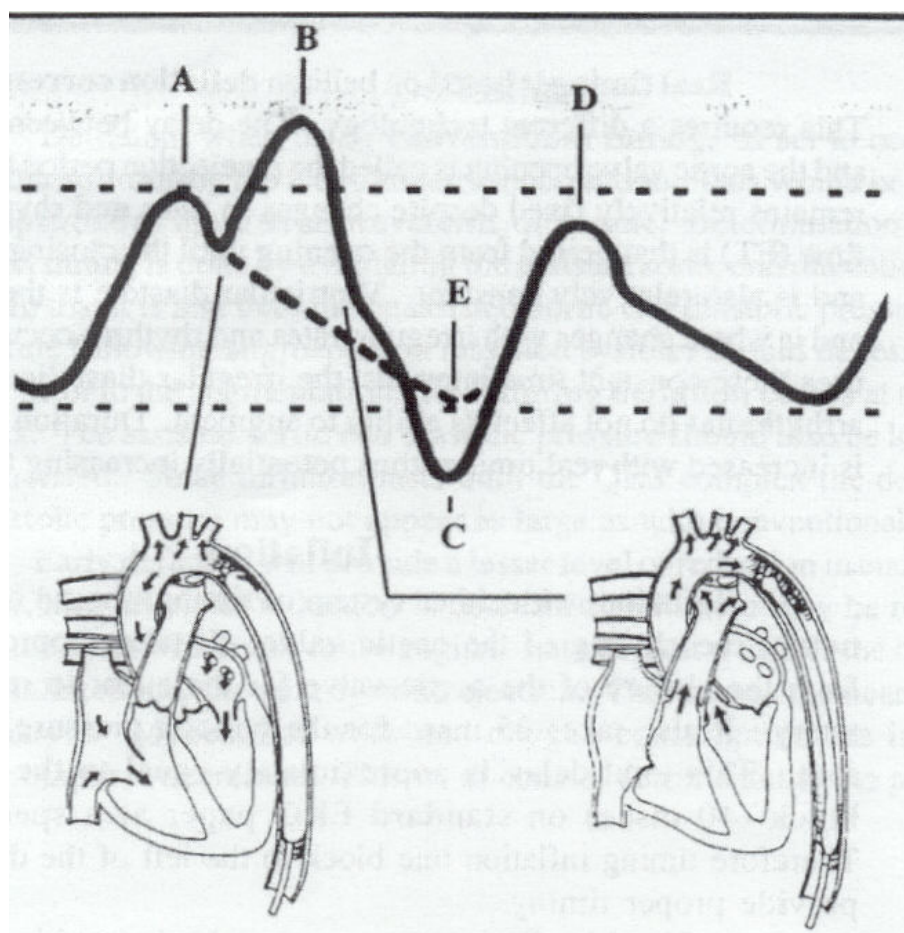
*PCWP may not be performed on patients with continuous CO measurements

Removal of IABP

1. Assess PTT/ platelets prior to IABP removal as per physician order.
2. D/C heparin infusion as per physician order.
3. Physician preference determines if manual pressure or compression device (e.g. CompressAR clamp) is used to control bleeding from the insertion site.
Only nurses trained in using compression devices (e.g. CompressAR clamp) may manage the clamp.
4. Monitoring:
 - SPH:**
 - Refer to [NCS6319](#) Cardiac Cath Lab: Post Procedure, protocol
 - VGH:**
 - While clamping or manual pressure:** site check (including color, warmth, sensation and movement) and VS Q15min and PRN
 - Post clamping:** site check (including color, warmth, sensation and movement) and VS Q15min x 4, then Q30min x 2, then Q1H and PRN
 - Continue to monitor pedal pulses and vascular perfusion Q1H x 24 hrs
5. Maintain immobility of the affected limb, bed-rest and HOB no greater than 30 degrees for 6 hours.
6. Measure calf circumference Q4H post removal x 24 hrs and monitor for signs of compartment syndrome such as swelling, redness, pain, numbness or tingling, change in pulse characteristics, and/or restricted mobility of limb.

TABLE 1: Interpreting IABP waveforms

If Frequency 1:1	If Frequency 1:2 or 1:3
<p>B Diastolic augmentation pressure</p> <p>C Assisted aortic end diastolic pressure</p> <p>D Assisted systolic pressure</p>	<p>A Unassisted Systolic pressure</p> <p>B Diastolic augmentation pressure</p> <p>C Assisted aortic end diastolic pressure</p> <p>D Assisted systolic pressure</p> <p>E Unassisted aortic end diastolic pressure</p>



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TABLE 2: Assessing for signs and symptoms of complications

Potential Complications	Preventive Assessment	Nursing Intervention
Limb ischemia	<ul style="list-style-type: none"> Q1H assessments: peripheral pulses (pedal, brachial, or radial); color, warm, movement, and sensation of limbs 	<ul style="list-style-type: none"> Notify physician immediately Removal of IABP may be necessary May need fasciotomy if compartment syndrome develops Measure calf circumference Q4H x 24 hours post removal of IABP
Failure to augment	<ul style="list-style-type: none"> Ongoing nursing assessments Auscultate chest for sounds of balloon inflate/deflate 	<ul style="list-style-type: none"> Confirm diastolic augmentation control on IABP is set to MAX. Consult with perfusionist to assess inflation and deflation timing IABP autofills automatically Q2H. Nurses may initiate autofill fill PRN (e.g.: helium drive line becomes disconnected, IABP is placed on standby). The nurse can initiate a manual autofill if patient is experiencing decreased augmentation Consult with physician re: HR or volume status Physician may need to replace, reposition, or remove balloon
Balloon Leak/Rupture	<ul style="list-style-type: none"> Ongoing nursing assessments Observe for loss of Augmentation Check for blood in catheter 	<ul style="list-style-type: none"> Stop pumping. Place patient in Trendelenberg position & call Perfusion Stat Clamp the IAB catheter Prepare to remove balloon (the balloon should not remain immobile for greater than 30 mins due to risk of thrombus formation. All suspected leaky balloons should be given to Perfusion to start an investigation)
Aortic Dissection Rupture	<ul style="list-style-type: none"> Assess for: abdominal pain, acute back or flank pain, ↑HR, ↓BP, ↓Hct, ↓pulses bilat 	<ul style="list-style-type: none"> Notify physician immediately Prepare for fluid /blood administration Prepare for stat OR
Loss of ECG trigger	<ul style="list-style-type: none"> Check ECG connections 	<ul style="list-style-type: none"> Switch to a different lead Switch to pressure trigger or pacer trigger In arrest situation: if in auto mode machine will automatically switch to pressure mode In semi auto mode you must switch to pressure mode or put in auto mode
Pumping has stopped	<ul style="list-style-type: none"> Check ECG signal Check leads or slave cable Check all connections & electrical plug Check helium supply 	<ul style="list-style-type: none"> Call perfusionist stat Increase ECG gain Change to a different lead Switch to arterial pressure trigger If pump stopped for 30 minutes inflate with 40 mL of air every 5 minutes (while waiting for perfusion or physician)
Dampened waveform	<ul style="list-style-type: none"> Check flush system for: adequate pressure of pressure bag, flush solution not empty, connections tight 	<ul style="list-style-type: none"> Ensure pressure bag inflated to 300 mmHg Place pump on standby & flush IABP transducer for 3 to 5 seconds
Catheter whip or fling	<ul style="list-style-type: none"> Assess monitoring system 	<ul style="list-style-type: none"> Often due to fast HR therefore treat cause, notify physician.

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TABLE 3: Optimizing IABP settings for different cardiac rhythms

Rhythm	Nursing Interventions
Ectopic beats (any focus)	<ul style="list-style-type: none"> • In AUTO mode: the balloon automatically deflates if the ectopic R-wave is sensed • In SEMI-AUTO mode: the ECG lead may need to be changed in order to minimize the amplitude difference between the normal QRS and the ectopic beat • Treat ectopy as per usual treatment regimen
Atrial fibrillation	<ul style="list-style-type: none"> • In AUTO mode: no changes need to be made to the pump • In SEMI-AUTO mode: use ECG trigger. The system software will invoke "Auto R-Wave Deflation" in AUTO and SEMI-AUTO Operation • Treat atrial fibrillation as per usual treatment regimen
Tachycardia	<ul style="list-style-type: none"> • Leave in ECG mode • Patient may benefit from changing timing to 1:2 • Treat arrhythmia
Cardiac Arrest	<ul style="list-style-type: none"> • When possible, use ECG or Arterial Pressure Trigger during CPR • In AUTO mode: the quality of the signal will determine if the trigger source is ECG or Arterial pressure • Internal trigger is not recommended during CPR • Manage patient as per ACLS guidelines

Patient Education & Resources

1. Purpose and function of IABP
2. Routine nursing actions and assessments
3. Other routine assessments (e.g. ECG, CXR)
4. Positioning (HOB no higher than 30°, leg to remain straight)
5. Process and expectations of weaning and removal
6. Comfort management

Documentation

1. Nurses' Notes:

SPH: (Form PHC-NF035): Date, time, routine assessments and interventions, signs and symptoms of complications and interventions taken, weaning attempts and responses, IABP removal and complications, physician communication (see [Appendix B](#))

VGH: ([Form VCH.0339](#)) Critical Care Nursing Assessment Record, document as per unit protocol

2. Critical Care 24-Hour Flow sheet:

SPH: (Form PHC-IC037) (see [Appendix B](#)): Document **Q1H:** VS (HR, RR, SaO₂, T); hemodynamic parameters (e.g. CVP, PAP, PWP); IAB timing, frequency, and trigger; brachial, pedal, and radial pulses; and IAB arterial pressures as per [Table 4](#). Document left and right calf circumference **Q4H**.

VGH: (Form [VCH.VA.VGH.0468](#)) Critical Care Flow sheet and VGH Perfusion Services IABP Record and IABP Flow Record.

TABLE 4: Documenting IABP parameters for different frequencies

For IAB Frequency 1:1	For IAB Frequency 1:2 or 1:3
Diastolic augmentation pressure (formerly BAD)	Unassisted Systolic pressure
Assisted aortic end diastolic pressure (formerly BED)	Diastolic augmentation pressure (formerly BAD)
Assisted systolic pressure	Assisted aortic end diastolic pressure (BED)
	Assisted systolic pressure
	Unassisted aortic end diastolic pressure

3. ECG Rhythm Strip Flow sheet:

SPH: (PHC Form PHC-IC004): Cardiac rhythm strip, ST-segment analysis strip, IABP pressure waveform Q shift and PRN

VGH: ([Form VCH.0339](#)) Critical Care Nursing Assessment Record and as per unit protocol\

4. Medication Administration Record: Medications administered

Related Documents

PHC:

- [NCS6319](#) – Cardiac Cath Lab: Post Procedure Care
- [NCS6074](#) – Physical Assessment (Critical Care Areas)
- [NCS6045](#) – Cardiac Monitoring: protocol

VCH: [VA F-045](#): Femoral Arterial Sheath/Line: Removal and Groin Clamp

References

Castellucci, D. (2011). Intraaortic Balloon Pump Management. In D.L.Weigland (Ed.), *AACN Procedure Manual for Critical Care* (6th ed pp 443-463). Philadelphia: Saunders.

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Laham, R., & Aroesty, J. (2013). Intraaortic balloon pump counterpulsation. In UpToDate. D. S. Baslow (Ed.), Uptodate. Waltham, MA.

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Health Authority Interprofessional Advisory Council Chairs (HAIAAC)
VCH Operations Directors
VCH Professional Practice Directors
PHC: Professional Practice Standards Committee

Final Sign-off & Approval for Posting by

Vice President Professional Practice and Chief Nursing Officer – VCH
Professional Practice Standards Committee – PHC

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Appendix A: Cath Lab – Intra-Aortic Balloon Pump Set Up Guide

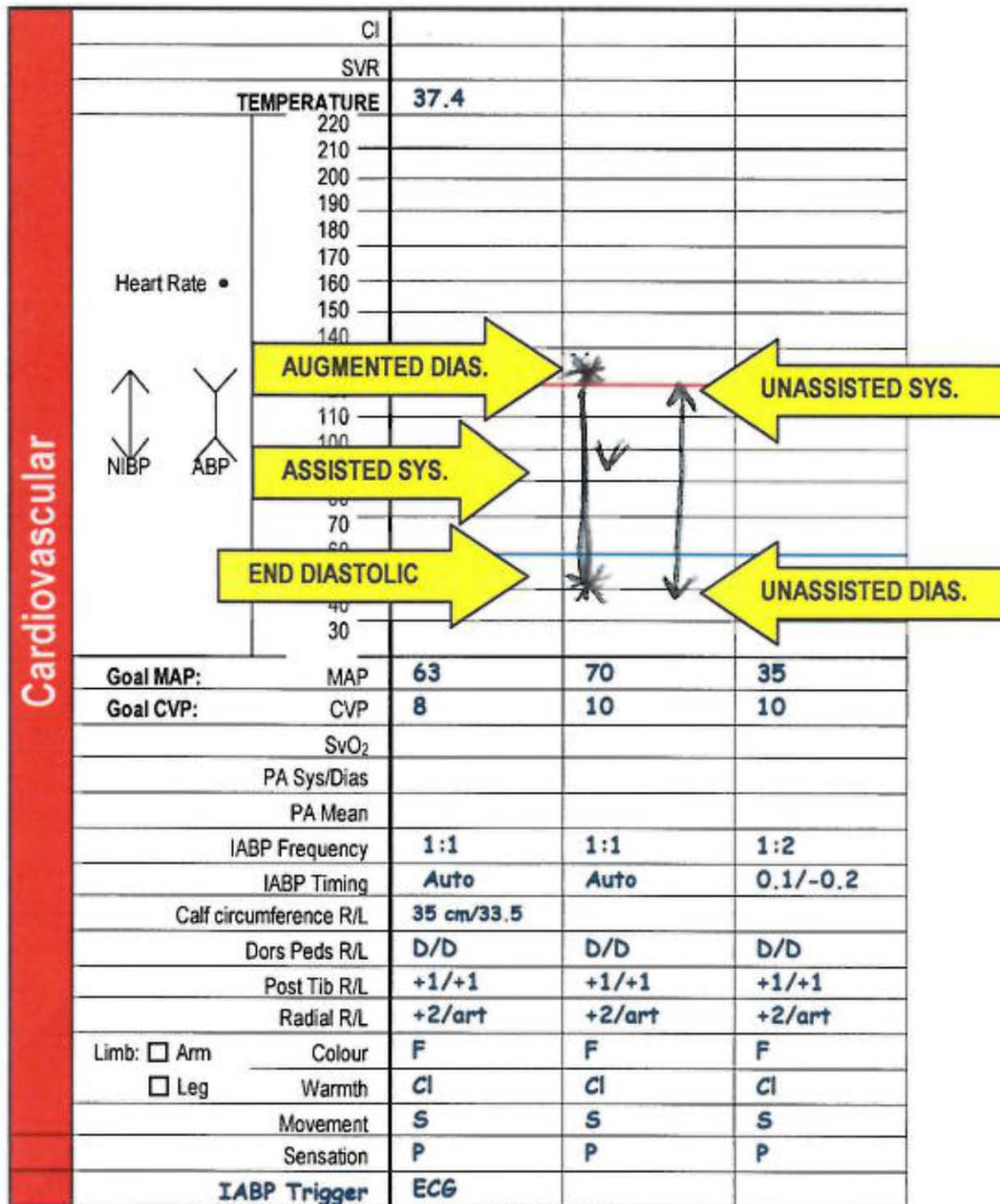
Preparation

1. Plug in the balloon
2. Insert Datex Slave cable into the back of the balloon console (ECG only)
3. Open the helium cylinder/ Ensure helium PSI more than 1000
4. Switch on Balloon Console and Zero the pressure transducer (press for 3 seconds)
5. Ensure an ECG trace is displayed
6. Inflate the pressure bag with 500 mL saline to 300 mmhg
7. Spike the bag with the supplied pressure transducer
8. Connect a 7 foot line handed back from the sterile field (Female connection) to the top of the transducer.
9. Flush the 7 foot line for 30 to 40 seconds and ensure the line is free of air/bubbles.

Insertion

1. Once Balloon is inserted, (whilst flushing) connect the pressure line to the pressure port of the balloon and continue to flush for 1 minute.
2. Ensure a pressure reading is being displayed.
3. Receive the male ended connection of the balloon gas line and insert into the gas outlet (at the back of the balloon console).
4. Once balloon is in confirm with cardiologist to start the balloon at 1:1 ratio and press the Start button once.

Appendix B: IABP Charting (SPH content)



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