Guideline Title  Pulmonary Artery Catheter Management

Summary: Patients admitted to the ICU who require a pulmonary artery catheter (PAC) for haemodynamic monitoring will be managed and monitored appropriately. Haemodynamic calculations will be managed incorporating clinical assessment.

Approved by: Prof Michael Parr ICU Director
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Replaces Existing Guideline: Management of Pulmonary Artery catheter _2011


1. Background Information: The pulmonary artery catheter is a balloon tipped, thermodilution catheter that is inserted through a sheath into a large vein and floated into the pulmonary artery. It is used to measure cardiopulmonary pressures and to perform haemodynamic calculations. In conjunction with other clinical assessments the values obtained via the PA catheter can assist in management of the patient’s fluid and inotrope requirements and assessment of haemodynamic status.

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**Fluid/medication port**

**Temperature cable port**

**Markings for length of catheter**
- Thick black line = 50 cm
- Thin black line = 10cm

**Proximal infusion lumen 31cms**

**Proximal injectate lumen 30cms**

**Thermistor 4cms**

**PA distal lumen**

**PA transducer port**

**CVP transducer port**

**Wedging port and syringe**
Accurate placement of the catheter can give direct measurements of central venous, right-sided intracardiac, pulmonary arterial, and pulmonary artery wedge (pulmonary capillary wedge) pressures.

Tracings obtained in the right atrium or pulmonary capillary wedge position share similar morphology. The transition from the right ventricle to the pulmonary artery tracing can be identified by the increase in diastolic pressure and the presence of a dicrotic notch. The diastolic "step-up" results from the transducer crossing the pulmonic valve; the dicrotic notch reflects closing of the pulmonic valve.

Diagram demonstrates key features of the pulmonary artery pressure tracing. A simultaneous ECG is shown to demonstrate the timing of the different components. The peak systolic pressure falls within the electrocardiographic T wave.

Diagram shows the different components of the pulmonary artery wedge pressure tracing. A simultaneous ECG is shown to demonstrate the timing of the different components. The peak of the 'V' wave falls outside the peak of the electrocardiographic T wave.
Thermodilution techniques can be used to estimate cardiac output. Other haemodynamic parameters, including systemic and pulmonary vascular resistance, can be calculated on the basis of vascular pressures and cardiac output. In addition, samples of mixed venous blood can be used to quantify oxygen utilisation.

**Cardiac Output Studies**

- Cardiac output studies can obtain the following advanced hemodynamic values:
  - Cardiac index
  - Systemic vascular resistance (SVR)
  - Pulmonary vascular resistance (PVR)
  - Systemic vascular resistance index (SVRI)
  - Pulmonary vascular resistance index (PVRI)
  - Pulmonary artery wedge pressure (PAWP)

- As the fluid (mixed with blood) passes through the right atrium, right ventricle and then into the pulmonary artery, its temperature changes.
- The temperature probe on the end of the PA catheter measures this temperature change. The change in temperature is then plotted on a time – temperature curve. An equation that accounts for a change in temperature is then used to calculate the cardiac output.

\[
\text{CO} = \frac{V \times (TB - TI) \times (SI \times CI) \times 60 \times CT \times K}{A \times (SB \times CB)}
\]

- **CO** = cardiac output
- **V** = volume of injectate (ml)
- **A** = area of thermodilution curve in square mm divided by paper speed (mm/sec)
- **K** = calibration constant in mm/°C
- **TB, TI** = temperature of blood (B) and injectate (I)
- **SB, SI** = specific gravity of blood and injectate
- **CB, CI** = specific heat of blood and injectate
- \((SI \times CI) = 1.08\) when 5% dextrose is used
- \((SB \times CB)\)
- **60** = 60 sec/min
- **CT** = correction factor for injectate warming

**Mixed venous oxygenation**:

- Oxygen saturation (SO2) is a measurement of the amount of oxygen bound to haemoglobin (Hb).
- Oxygen saturation is the ratio of the amount of oxygenated haemoglobin to the total haemoglobin in 100 ml of blood. It is frequently expressed as a percentage.

\[
\text{SO}_2 = \frac{\text{HbO}_2}{\text{Hb} + \text{HbO}_2} \times 100
\]

- The oxygen saturation of arterial blood is normally 95-98%, whereas the saturation of venous blood is typically 60-80%.
- The saturation in venous blood is referred to as *mixed venous oxygen saturation* (*SvO2*). It reflects the average saturation of venous blood as it returns to the right side of the heart from the various tissues.
### PAC HAEMODYNAMIC VALUES AND WHAT THEY REVEAL:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Normal range</th>
<th>Clinical relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central venous pressure (CVP)</td>
<td>0 – 6 mm Hg</td>
<td>Used to determine volume status and right ventricle (RV) function; correlates with right ventricular end-diastolic pressure (RVEDP)</td>
</tr>
<tr>
<td>Right ventricular pressure (RVP)</td>
<td>20 – 30/0 – 6 mm Hg</td>
<td>Used to determine RV function and volume</td>
</tr>
<tr>
<td>Pulmonary artery pressure (PAP)</td>
<td>20 – 30/6 – 10 mm Hg</td>
<td>Used to determine state of resistance in pulmonary vasculature and RV function</td>
</tr>
<tr>
<td>Pulmonary artery wedge pressure (PAWP)</td>
<td>4 – 12 mm Hg</td>
<td>Used to determine left ventricle (LV) function; correlates with left ventricular end-diastolic pressure (LVEDP)</td>
</tr>
<tr>
<td>Stroke volume (SV)</td>
<td>60 – 80 ml/beat</td>
<td>Amount of blood ejected during systole; decreased SV indicates ventricular dysfunction</td>
</tr>
<tr>
<td>Cardiac output (CO)* (SV x heart rate)</td>
<td>4 – 8 L/min</td>
<td>Describes blood flow through tissues; reflects adequacy of overall cardiac function</td>
</tr>
<tr>
<td>Stroke volume index (SVI)</td>
<td>33 – 47 ml/beat/m²</td>
<td>SV adjusted for patient’s body surface area (BSA)</td>
</tr>
<tr>
<td>Cardiac index (CI)</td>
<td>2.5 – 4 L/min/m²</td>
<td>CO adjusted for patient’s BSA</td>
</tr>
<tr>
<td>Pulmonary vascular resistance (PVR)</td>
<td>20 – 120 dynes/sec/cm⁵</td>
<td>Describes state of resistance in pulmonary vasculature</td>
</tr>
<tr>
<td>Systemic vascular resistance (SVR)</td>
<td>770 – 1,500 dynes/sec/cm⁵</td>
<td>Describes state of resistance in systemic vasculature</td>
</tr>
<tr>
<td>Right ventricular stroke work (RVSW)</td>
<td>10 – 15 g-m/beat</td>
<td>Defines how hard right ventricle is working to pump blood</td>
</tr>
<tr>
<td>Left ventricular stroke work (LVSW)</td>
<td>60 – 80 g-m/beat</td>
<td>Defines how hard left ventricle is working to pump blood</td>
</tr>
<tr>
<td>Mixed venous oxygen saturation (SvO₂)</td>
<td>60% – 75%</td>
<td>Index of oxygenation status that measures the relationship between O₂ delivery and O₂ demand; reflects cardiovascular tissue perfusion</td>
</tr>
</tbody>
</table>


### 2. Introduction:
The risk addressed by this policy:

- **Patient Safety**

### The Aims / Expected Outcome of this policy:

Staff caring for a patient with a pulmonary artery catheter will have the knowledge and skills to provide safe and effective management

### Related Standards or Legislation

- [NSQHS Standard 1 Governance](#)
3. Policy Statement:
   - All care provided within Liverpool Hospital will be in accordance with infection prevention/control, manual handling and minimisation and management of aggression guidelines.
   - Insertion and “floating” of a PAC in ICU should only be performed by an ICU Consultant or Registrar who have been trained in this procedure.
   - Patients with a pulmonary artery catheter will only be managed by Registered Nurses who have completed appropriate education and competency assessment on Management of Pulmonary Artery Catheter
   - Liaison with the Medical Team regarding treatment is essential

Pulmonary Artery Occlusion/Wedge Pressure (PAOP/PAWP):
   - Must be approved by handover Anaesthetist or ICU Specialist.
   - Should only be done by an accredited RN or Doctor
   - Parameters for the management of the PAWP with fluid and vasoactive drugs must be documented in a management plan by the medical officer
   - After wedge procedure syringe should always be left with no air in it and tap open to prevent accidental occlusion of the pulmonary artery.
   - Drugs or infusions are NEVER to be injected into the distal PA lumen as this lumen sits in the pulmonary artery and the waveform is measured from the PA lumen.
   - Pulmonary artery pressures and waveforms must be monitored at all times

Cardiac Output Studies:
   - Cardiac output studies should be performed at least once per shift and whenever clinically indicated.
   - The cardiac output thermodilution syringe must be connected to the CVP lumen

4. Principles / Guidelines
   Equipment:
   - Central line dressing pack
   - Sterile gown, drapes, gloves, protective eyewear
   - Pulmonary Artery Catheter (Edwards)
   - Sheath Edwards 9F
   - Thermodilution Catheter Introducer Set
   - Cardiac output injectate set
   - 500 ml 5% Glucose
   - Cardiac Output module & cable
   - ECG and 2 pressure modules & cables
   - Inflatable pressure bag
   - 2 Pressure Transducers
   - 2 Pressure line extension tubing
   - 500 ml 0.9% Sodium chloride
   - 2 x 10 mL 0.9% Sodium chloride
   - 5 mL Lignocaine 1%
   - 2/0 Silk Suture
   - Large and Small Opsite Dressing
   - 2 Three Way Taps for CVP and PA lumens
Procedure: Insertion

- Observe universal precautions.
- Place ECG, Pressure Module and a Cardiac Output Module into the monitor.
- Connect the 2 pressure cables, and the cardiac output cable.
- Prime both transducers & pressure extension lines with 0.9% sodium chloride from the same flask. Ensure that there are no bubbles in the lines or transducers.
- Place the 0.9% sodium chloride in the inflatable pressure bag, and inflate to 300mmHg.
- Label transducer as “CVP” and the other as “PA” & then place them in the transducer holder.
- Connect PA transducer line to PA (yellow/distal) port. As seen in picture below. This needs to be connected and transduced to have a pressure waveform on the monitor for insertion.


- Connect one of the pressure cables to the “PA” transducer.
- Turn the stopcock on the (PAP) pulmonary artery pressure transducer off to the patient (open to air).
- Transducer holder with transducers should be placed level with the patient’s 4th intercostal space in the midaxillary line. (see picture below)
  - Select the “0- Zero” soft key. Press “ZERO PAP”
  - Once calibrated, turn the PAP transducer stopcock back to the patient and resume tracing.
  - Check that the scale of the PAP trace is set at optimal.
  - If the PAP trace is dampened, flush the line well.
  - Always ensure that the PAP trace is visible at all times and that the alarms are on.
  - Prime the enclosed injectate delivery system set with 5% Glucose

Set up the basic tray with the requirements for catheter insertion.

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PA Catheter Insertion: (ICU Registrar)

- Observe universal precautions - Surgical scrub. Don gown, gloves and mask.
- Prep and drape the insertion area.
- Position’s patient to maximise access to desired area of insertion i.e. Trendelenberg position if required
- Attaches monitoring ECG, SpO2
- Flush/prime each lumen with 0.9% sodium chloride
- Zero, level and transduce the CVP and PA lumens for correct waveforms
- Infiltrate the skin with 1% Lignocaine.
- Position the patient as appropriate for the insertion site chosen.
- Attach the long 18G needle to the 10ml syringe, and puncture the desired vein. Use of ultrasound to identify and guide central venous cannulation is desirable.
- Remove the syringe, and confirm that a free flow of non-pulsatile blood is returned.
- Insert the guide wire through the needle, maintaining control of the proximal end.
- An assistant should observe the monitor for arrhythmia caused by irritation of the myocardium with the wire. If arrhythmias occur, withdraw the wire slightly.
- Remove the needle. Make a small skin incision with the scalpel blade, at the point of entry of the guide wire.
- Insert the dilator through the haemostasis valve, and into the sheath.
- Thread the dilator/sheath/haemostasis valve assembly over the guide wire. Holding skin taut at the insertion site, advance the assembly into the vessel with a slight twisted motion, maintaining control of the proximal end of the guide wire.
- Remove the guide wire.
- Attach a 10ml syringe to the side point of the sheath, and aspirate blood to confirm that the sheath is in position. Flush the port with 10mls 0.9% sodium chloride, and apply the cap.
- Firmly suture the sheath in position (see picture on right).
- Check the balloon on the pulmonary artery catheter by inflating it inside the testing chamber with 1.5mls air. Use only the special syringe supplied for this purpose.
- Allow the balloon to passively deflate.
- Check the patency of each lumen by flushing with 0.9% sodium chloride.
- Insert the catheter through the haemostasis valve on the sheath.
- The balloon is clear of the sheath when the catheter is inserted to 18cm (note the 10cm graduations along its length).
- Insert the catheter until a CVP waveform appears on the monitor.
- Inflate the balloon with 1.5mls, and close the red tap on the balloon inflation port.
- Feed the catheter through the sheath while observing for the characteristic waveforms which indicate transition from: CVP → RV → PA → PCWP
• When a PCWP trace is obtained, deflate the balloon and confirm that a PA trace returns on the monitor.
• If the trace remains wedged, the catheter will need to be withdrawn slightly. Usually, the correct insertion distance is:
  ➢ 50 to 60cm for subclavian or internal jugular approach

**Final position**
• The final position of the catheter within the PA must be such that a PCWP tracing is obtained whenever 75 to 100 percent of the 1.5 mL maximum volume of the balloon is inflated.
• If less than 1 mL is required to obtain a PCWP tracing, the tip of the catheter is probably in the distal PA and further inflation may lead to vessel rupture. In this situation, the catheter should be withdrawn incrementally, until the optimal position is found.
• If maximal balloon inflation fails to result in a PCWP tracing, or does so only after a 2 to 3 second delay, the catheter is probably too proximal. This means that it could slip back into the RV, increasing the risk of arrhythmia and intracardiac damage. In this situation, the catheter should be advanced in small increments, until the optimal position is located.
• Once the desired position is reached, it is essential that the catheter be secured to prevent migration. This can be accomplished by taping the catheter to the skin or locking the introducer hub.
• The length of the catheter (indicated by marks on the catheter at 10 cm intervals) should be documented in the patient’s medical record.
• When catheter is in correct position the syringe is removed from catheter and air in wedging syringe should be expelled and then the syringe then put back on wedging port and left unlocked (see picture below)
• Clean the insertion site of all blood.
• Apply Opsite dressings to sheath site
• Connect the cardiac output injectate syringe to CVP port
• Connect thermistor cable to cardiac output syringe port and temperature cable to temperature port as shown below

![Cardiac output cable](image)

- Wedging syringe with air expelled and tap open

- Confirm the transducer holder with PA and CVP transducers, are level with the 4th intercostal space in the midaxillary line.
- Turn the tap on the cardiac output injectate set “off” to the syringe.
• Connect a pressure cable to the CVP transducer.
• Turn the stopcock on the CVP transducer off to the patient (open to air).
• Select the “0-Zero” soft key. Press “ZERO CVP”
• Once calibrated, turn the CVP transducer stopcock back to the patient and resume tracing.
• Press the alarms limit key on the Philips monitor.
• Press select parameter to highlight the parameter that you want to adjust e.g. PAP
• Use low limit and high limit keys if you wish to adjust the limits.
• You can alter the systolic, diastolic and mean alarm limits individually.
• Leave the PAP trace displayed on the monitor at all times, so that inadvertent wedging of the catheter can be detected. Set PAP alarm as diastolic to alert inadvertent wedging

• Measure the PCWP and attend cardiac output studies.
• Obtain CXR to ensure correct placement – 2cm left of mediastinal border

Monitoring pulmonary artery pressures: Just the facts
Procedure for Pulmonary Artery Wedge

- Ensure the configuration of the PA trace appears normal.
- Ensure the SaO₂ is greater than 90%
- Position the patient supine with the backrest elevated to 45°, unless contraindicated. Whatever position is used, the same position should be adopted for each reading.
- Ensure the PA transducer is positioned level with 4th ICS, midaxillary line, and has been zeroed.
- In the main screen window inflate the balloon and ensure that catheter wedges and large v waves are not seen. If large waves are seen do not proceed to wedge.

Large v waves:
- Are produced by the increase in blood volume entering the atria during the cardiac cycle
- The shape of the v wave is determined by the relationship between pressure and volume in the left atrium
- On the monitor the v wave will be taller than the a wave, followed by an exaggerated y descent that reflects the release of atrial pressure with the opening of the tricuspid or mitral valve
- Most frequent wave abnormality
- Commonly caused by tricuspid and mitral insufficiency due to a large influx of blood into the atrium
- Other causes include ventricular failure, increased pulmonary or systemic resistance and ventricular septal defect
- The importance of recognising a large v wave is being able to obtain an accurate PAWP. The large v wave may be mistaken for the systolic PAP wave. This can be avoided by measuring pressures and waves in relation to the ECG.

Simultaneous electrocardiographic and pulmonary artery occlusion (wedge) pressure tracings from a patient with acute mitral regurgitation. The pulmonary artery occlusion pressure is elevated; mitral regurgitation results in a large 'v' wave followed by a steep 'y' descent

- Go to wedge screen then press Wedge to get into the “required wedge task window”.
- Inflate the balloon slowly and carefully watching the screen for a wedge trace
- The waveform changes from PAP to PAWP and the message “wedging” will appear. Inflate the balloon only for the time required to see end expiration on the screen. Usually 2 respiratory cycles.
- Press store trace.
- Deflate the balloon once a wedge trace is stored. Allow the balloon to deflate passively.
- Disconnect wedge syringe from balloon port, expel air and reattach syringe to port with tap open to the syringe. This prevents any accidental wedging of the catheter.
- See below pictures for examples of wedge trace.
Editing wedge trace:

- Press “edit wedge” soft key to open the next task window.
- A horizontal line (cursor) appears in the PAWP waveform in the position of the mean value for PAWP. A numerical value for PAWP appears on the screen, entitled cursor. If a previous value is stored, it is also shown along with the time.
- Move the cursor up and down using the “cursor” soft keys, if you want to alter the position of the cursor within the PAWP waveform. Wedge should be measured at end expiration. The reason that the PAWP should be measured at end-expiration, because this is when all intrathoracic pressures are equal to atmospheric pressure, regardless of the mode of ventilation.
- Press the hard key “confirm” when the cursor is in the correct position. This will be at end expiration. The chosen value is then stored as PAWP. The numerical value is displayed. (see picture below)
- Ensure that the PAP trace has returned to normal.
- Press “main screen” hard key to return to the main screen.
- Make absolutely certain that the balloon is DEFLATED. Remove the syringe and fully depress the plunger. Reattach the syringe. This will prevent accidental inflation of the balloon and demonstrate that the balloon is deflated.

![Image of wedge trace]

Procedure for Cardiac output studies:

- Observe universal precautions.
- Position the patient supine with the backrest at 45°, unless contraindicated. Whatever position is used, the same position should be adopted for all measurements.
- Ensure the injectate delivery set is connected to the CVP proximal lumen, as described under heading PA Catheter Insertion
- Ensure the monitor is in the PA display screen
- Press the soft key labelled “CO” to enter the measurement task window.
- Draw 10ml 5% glucose into the CO injectate syringe
- Press “Start C O” soft key and wait for the prompt message “Inject now!” to appear on the screen. To ensure the greatest accuracy, use an injectate volume of 10ml.
At the end of the measurement the thermodilution curve, cardiac output and index are displayed and a message will appear "Wait before starting new measurement".

A prompt message "Ready for new measurement!" will then appear on the screen. Press "start C.O" for the next measurement.

Perform 3 measurements ensuring that at least two of them appear accurate curves with similar results for cardiac output.

Edit the curves / measurements (to accept or reject them) by pressing on the waveform. If the waveform turns RED this means it has been deleted. If it is GREEN this means it has been accepted.

Assessing the measurements (CO Studies)

When assessing the accuracy of the measurements for editing consider:-

- The similarity of the values. If most of the values are similar, but one is different (i.e. outside a 0.5L difference), it should not be included in the average. If all values are different, they are uncontrolled error curves or true haemodynamic instability (e.g. arrhythmias).

- Whether the C.O. curve is normal.

The normal curve has:

- A smooth, rapid injection
- A single peak,
- A stable baseline, indicating the return of the blood temperature to near the original. If the curve is irregular, a "curve alter" message will be displayed.
When you have completed accepting / rejecting the measured curves, press “Save CO” to store the average.

Press the soft key labelled “Hemo Calc” to get into the Haemodynamic measurement task window.

If you have pressed the “hemo calc” key, the task window will display all the parameters.

Ensure that all displayed parameters in the task window are accurate as it can greatly alter the cardiac output studies.

Press “Perform calc” for the monitor to do cardiac output calculations. Ensure that the correct height and weight for the patient have been entered.

Press “Print / Record” soft key to obtain a print out of the performed studies.

The “Hemo Review” screen will give a tabular summary of all previous results and can be used for comparison. (see picture below)

On the bottom of the printout sheet ensure that all inotropes and vasodilator / vasopressor agent infusion rates are documented to enable accurate interpretation of the cardiac output calculations.

Close the “Hemo Cal” screen to return to the main screen.

Record C.O. boluses on the ICU flowchart. Ensure that C.O. injectate lines is to be left attached to the CVP line at all times to maintain a closed system to minimise the risk of direct intra-cardiac injection of pathogens.

### Removal of PAC
- Routinely removed Day 1 or as per Registrar’s orders
- Ensure there are no inotropes or fluids running through medication port
- Ensure balloon is deflated
- Position patient supine
- Unlock sheath from PA catheter
- Ask patient to take a deep breath and hold
- Remove catheter gently while watching monitor for arrhythmias. If arrhythmias seen continue to remove catheter as removal can irritate the heart
- Place cap on end of sheath
- Check end of PAC to ensure all intact
- Redress sheath
Indications:

- Haemodynamically unstable patients, who require careful manipulation of preload, afterload and myocardial contractility, e.g.
  - Heart failure
  - Cardiogenic shock
  - Septic shock
- To monitor Cardiovascular function
- To monitor Pulmonary function
- To monitor Haemodynamic function peri, intra and post cardiac surgery
- To aid in assessment of fluid requirements and hemodynamic responses to therapy
- To aid in the selection and delivery of vasopressor and inotrope therapy
- Management of multiorgan failure

Contraindications:

- Coagulation defects
- Tricuspid or pulmonary valve replacements
- Right heart mass / thrombus /tumor
- Tricuspid or pulmonary valve endocarditis
- High risk of dysrhythmias
- Caution with LBBB (5% risk of complete heart block)

Precautions:

**Catheter not wedging**

- Report to Senior Registrar, educator or competent cardiothoracic RN
- Catheter may need to be re floated
- Spontaneous wedging of balloon is a life threatening complication and requires immediate action by a registrar, CNE or a experienced RN who has completed the Pulmonary Artery Catheter competency
- Ensure that the wedging syringe has not been left full of air and accidently been inflated
- Do not attempt to inflate or flush a wedged balloon
- Check pressure scale and waveform
- Check pressure bag and transducer
- Pressures of PA, if systolic and diastolic are similar the catheter is likely to have wedged
- If catheter is wedged ensure balloon is deflated and pull catheter back 1 -2 cms
- Reassess trace
- If still appears wedged withdraw blood from PA distal lumen, if no blood catheter is still wedged. Pull catheter back into right atrium and an experienced Registrar or RN will re-float catheter

**Balloon rupture**

- There should be slight resistance when inflating balloon
- If there is no resistance and no wedge trace assume that the balloon has ruptured and alert Registrar for removal and re-insertion

**Arrhythmias**

- Catheter may have migrated to ventricle
- Notify Registrar catheter may need to be re floated

**Pulmonary infarction**

- Catheter tip wedged for prolonged period or formation of thromboemboli

**Pulmonary artery rupture:**

- Over inflation of balloon while in wedge position
Complications:
- Air embolism
- Bleeding
- Arrhythmias
- Pneumothorax / haemothorax
- Infection
- Venous thrombus
- Pulmonary emboli
- Catheter migration
- Myocardial perforation

5. Clinical Issues:
- Full physical assessment at commencement of each shift
- Zero and level transducers after repositioning
- Ensure correct waveform, scale and values are monitored
- Monitor PA trace AT ALL TIMES
- Document on flow chart catheter length at sheath site. Thick band is 50cm, thin line band 10cm

- Secure catheter to patients chest at lumen site
- Review CXR to check catheter position - 2cm left of mediastinal border
- Document PAP’s hourly
- Set alarms appropriately. Set PAP systolic alarm to a value above the patients wedge value so that spontaneous wedging will be notified
- Never inflate balloon longer than 15 seconds
- Leave balloon syringe with no air and tap open to syringe
- Perform cardiac output studies post op and then 6 hourly or as per Registrar according to titration of inotropes and fluids
- Inspect sheath insertion site for infection and change dressing if oozing or loose otherwise as per protocol
- If unable to wedge catheter, the PAP diastolic pressure can be used as the wedge pressure for performing cardiac output studies.

6. Performance Measures
All incidents are documented using the hospital electronic reporting system: IIMS and managed appropriately by the NUM and staff as directed.
8. References / Links

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