

Pulmonary Artery Catheter Removal in CSICU

Site Applicability

SPH Cardiac Surgery Intensive Care Unit (CSICU)

Practice Level

Specialized:

- *Pulmonary Artery (PA) Catheter removal is a delegated medical function performed by Registered Nurses in CSICU who have undergone the required education and certification.*

Requirements

RNs are not responsible for PA catheter removal in the following instances:

- Transvenous pacing wires in place
- Intracardiac PA catheter knotting

Need to Know

1. The PA catheter allows hemodynamic measurements such as cardiac output, cardiac index, systemic vascular resistance (SVR), pulmonary artery resistance (PVR), central venous pressure (CVP or RA pressure) and pulmonary artery capillary wedge pressure (PCWP or PAW pressure).
2. It also allows measurement of mixed venous oxygen saturation (SVO₂) by either direct or intermittent blood sampling or, use of a specialized pulmonary artery catheter called an oxymetric PA catheter.
3. The critical care nurse is responsible for understanding and interpreting hemodynamic values and waveforms, maintenance and troubleshooting and contraindications to removal of a PA catheter.
4. Patients who have experienced recent myocardial damage are more vulnerable to ventricular fibrillation, and this is particularly true during PA catheter removal. In addition, a higher incidence of ventricular dysrhythmias is associated with a cardiac index of less than 2.55 L/m².
5. If a patient has a right ventricular assist device, the decision to remove the PA catheter must be discussed with the cardiac surgeon.
6. The crash cart with defibrillator must be accessible during removal.
7. PA catheters are removed separately from the introducer sheaths.
8. Pacing TD Catheter can only be removed by CSICU nurses if the patient is not being actively paced. **Pacing wires must be disconnected from PA by physician and pulse generator must be turned off by physician**

Equipment and Supplies

Manufacturer's obturator for sheath introducer, or male cap adapter	Gloves
Dressing tray	Mask
Sterile C&S specimen container (if C&S for PA catheter tip ordered)	Disinfectant/cleaning solution
Sterile scissors (if C&S for PA catheter tip ordered)	Large transparent occlusive dressing

Protocol

Assessment

Pre Procedure

In addition to the standard assessment procedure in a critical care area, **ensure there is a physician order entered in CERNER** for removal of the PA Catheter.

Generally, the PA catheter can be removed when the patient is 8 hours post-op, off all inotropes for 4 hours, stable intrinsic rhythm and has a cardiac index above 2.2.

During Procedure:

Monitor for the following complications:

1. Ventricular Dysrhythmias (may occur due to irritation).
2. Myocardial or valvular (tricuspid, pulmonic or chordae tendineae) damage is most likely due to kinking, knotting or entanglement around the papillary muscle.
3. Venous air embolus (due to air being entrained through PA catheter during intrapleural pressure changes, i.e. respiration).
4. PA perforation (usually associated with longer duration of PA catheter).
5. Thrombosis (increased risk if low CO, heart failure; only sign may be dampened waveform)
Intervention

Ongoing Assessment

1. As per critical care physical assessment protocol. Remain alert for signs or symptoms of potential complications.



Steps

Procedure	Rationale
1. Assess patient, monitor and obtain hemodynamic parameters per unit protocol	
2. Review most recent chest x-ray for position of catheter. Do not remove catheter if it appears to be kinked, knotted or entangled. Notify physician.	
3. Confirm patient ID as per hospital policy and explain the procedure to the patient	To ensure that the procedure is performed on the right patient
4. Collect all necessary supplies	
5. Place patient supine, either flat or in a slight Trendelenburg position	Increases CVP, thereby decreases risk of air embolism
6. Ensure the balloon of the PA catheter deflated prior to removal by removing syringe and aligning gate valve (red line) and observing PA waveform	Allows air to passively escape from balloon and ensures adequate balloon deflation Prevents potential myocardial or valvular damage
7. Stop all infusions using the PA catheter and if required move to another site	Ensures a closed system and prevents air from entering system
8. Prepare site of insertion: <ul style="list-style-type: none">• Turn patient's head away from site• Remove dressings and discard dressing and gloves• Ensure IV is infusing into introducer sidearm• Place a moisture- absorbent pad to insertion site• Unlock sheath from the introducer Instruct patient to take a deep breath and hold it For positive pressure mechanically ventilated patients, withdraw during inspiratory phase of ventilation	To collect any fluid that escapes with removal Increases intrathoracic pressure, thereby reducing risk of air embolus
9. Don new gloves While holding introducer in place with non – dominant hand, gently withdraw PA catheter	

using a steady and continuous motion while observing cardiac rhythm	Smooth motion minimizes ventricular irritation
10. Do not continue to remove catheter if resistance is met. Notify physician STAT	Possible indication that catheter is kinked, knotted, entangled or sutured
11. Inspect catheter tip for integrity and evidence of infection	If signs and symptoms of local or systemic infection, or if C&S of PA catheter tip ordered, cut off distal end of catheter with sterile scissors, place in sterile container, obtain swab of insertion site to be sent to lab for culture
12. Insert manufacturer's obturator once PA catheter removed	Ensures closed system to prevent bleed-back or air embolization
13. Provide site care as per PHC BD-0012-40045 Non-Tunneled Catheter (NT-CVC)- Basic Care and Maintenance (Adult)	
14. Assess and document date, time, ECG rhythm and VS following removal in CERNER	Identifies delayed complications

Interventions:

1. Dysrhythmias

- Continue to withdraw the catheter to terminate the ventricular irritability
- Notify physician for sustained ventricular dysrhythmias and follow procedure for defibrillation OR Emergency Cardioversion
- Consider use of antiarrhythmic agent (***requires physician order**)

2. Myocardial or valvular damage

- Ensure physician has assessed CXR for signs of visible knotting, kinking and assess for presence of transvenous pacemaker
- Do not continue to remove if resistance is felt **Notify physician immediately** prepare for possible removal under fluoroscopy
- Surgery may be required

3. Venous air emboli

- Administration of oxygen
- Turn patient to the left side and place in Trendelenburg to promote displacement of air
- Notify physician immediately: Aspiration of air may be attempted through an intact central line or intracardiac needle (By physician).

4. PA perforation

- Administer oxygen
- Notify MD STAT
- Medical interventions include:
 - Endotracheal intubation, use of high PEEP or surgery may be required

5. Thrombosis

- Anticoagulation therapy may be instituted
- Do not flush catheter
- PA catheter may need to be removed

Documentation**CERNER I View/Lines and Devices**

- Time PA catheter removed
- Patient's condition following removal of PA catheter (use a narrative note where more explanation is needed)
- Any ventricular dysrhythmias observed during procedure
- Any complications encountered during procedure requiring treatment (narrative note where needed)
- Inactivate PA line in CERNER post removal

ECG rhythm strip record

- ECG waveforms if dysrhythmias observed during procedure

Patient and Family Education

1. Brief description of procedure including:
 - Bed is flat or slight Trendelenburg position
 - Removal will occur when patient is holding a deep breath
 - Experience feeling of extra heartbeats may be felt
 - Assure patient that they will be closely monitored during procedure
2. Explain importance of lying still during catheter removal
3. Instruct patient and family to report any bleeding or discomfort at the insertions site after catheter removal

Related Documents

1. [B-00-12-10009](#) - PA Catheter Insertion (Assisting)

2. [B-00-13-10182](#) - PAWP- Minimizing Risk when Obtaining
3. [BD-00-12-40045](#) - Non-Tunneled Central Venous Catheter (NT-CVC)- Basic Care and Maintenance (Adult)

References

1. Weinhouse, G. (2021). Pulmonary artery catheters: Insertion technique in adults. Finlay, G., Parsons, P. (Ed). In UptoDate. Retrieved January 24, 2023
2. Wiegand, D.L. (Ed.). (2017). *AACN procedure manual for high acuity, progressive, and critical care* (7th ed.). St. Louis: Elsevier.

Groups/Persons Consulted:

Cardiothoracic Surgeon

CSICU Staff

Anesthesia SPH CSICU

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