

PROCEDURE

71

Pericardial Catheter Management

PURPOSE: An indwelling pericardial catheter allows for the slow and complete evacuation of a pericardial effusion. The catheter also allows for the infusion of medications such as antibiotics or chemotherapeutic agents into the pericardial space.

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PREREQUISITE NURSING KNOWLEDGE

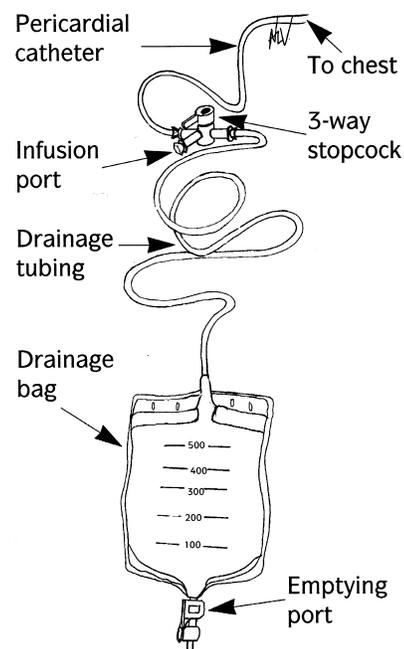
- Understanding of the anatomy and physiology of the cardiovascular system, principles of cardiac conduction, electrocardiogram (ECG) lead placement, basic dysrhythmia interpretation, and electrical safety is required.
- Understanding of sterile technique is necessary.
- Advanced cardiac life support knowledge and skills are necessary.
- Collection of fluid in the pericardial space is termed pericardial effusion.
- The pericardial space normally contains 15 to 50 mL of fluid.¹ Injury of the pericardium causes increased production of pericardial fluid, formation of fibrin, and cellular proliferation.² Causes of pericardial effusion are numerous and include infection, malignant neoplasms, autoimmune disorders, kidney failure, heart failure, acute myocardial infarction, trauma, radiation exposure, inflammatory disorders, and myxedema.^{1,3} Pericardial effusion may also be medication induced, idiopathic, or a complication of invasive procedures.
- Pericardiocentesis is an effective treatment for pericardial effusion (see Procedure 40). An indwelling pericardial catheter may be left in place following pericardiocentesis to drain excess pericardial fluid.
- The pericardial catheter may be connected to a closed drainage system (Fig. 71–1).
- The pericardial catheter may also be left in place to allow installation of certain medications, (ie, nonabsorbable corticosteroid or antineoplastic agents) depending on the patient's underlying disease state.¹
- The indwelling pericardial catheter should usually be removed within 24 to 48 hours after placement to avoid the risk of infection and iatrogenic pericarditis.⁴ However, the indwelling pericardial catheter may be left in place for longer periods of time to ensure resolution of pericardial effusion and cardiac tamponade.^{1,2} Pericardial catheters are usually removed when the total amount of drainage has decreased to less than 25 to 30 mL over 24 hours.⁵ To date, research-based evidence does not exist that defines the timing of pericardial catheter removal.

EQUIPMENT

- Pericardial catheter
- Sterile gloves
- Sterile isotonic normal saline for irrigation
- Syringes
- Alcohol pads or swabsticks
- Povidine-iodine pads or swabsticks
- Sterile 4 × 4 gauze
- Occlusive dressing
- Tape
- Three-way stopcock
- Drainage tubing
- Pericardial drainage bag

PATIENT AND FAMILY EDUCATION

- Explain the need for the indwelling pericardial catheter and the reason for insertion. ➔ **Rationale:** Teaching de-



■ ● **FIGURE 71–1.** Indwelling pericardial catheter system. (From Hammel WJ. Care of patients with an indwelling pericardial catheter. *Crit Care Nurse*. 1998; 18(5):40–45.)

creases patient and family anxiety; meets patient and family needs for information.

- Explain the need for frequent monitoring in the intensive care unit while the pericardial catheter remains in place. **➤Rationale:** Decreases patient and family anxiety; meets patient and family needs for information.
- Explain that the catheter may be uncomfortable and cause some discomfort at the insertion site, possibly with inspiration, and that pain medication will be administered to promote comfort. **➤Rationale:** Facilitates effective pain management; decreases patient and family anxiety.

PATIENT ASSESSMENT AND PREPARATION

Patient Assessment

- Assess cardiovascular and hemodynamic status: heart rate, blood pressure (BP), respiratory rate, pulmonary artery pressure (PAP), pulmonary artery wedge pressure (PAWP), right atrial pressure (RAP), cardiac output (CO), cardiac index (CI), heart sounds, and peripheral

pulses. **➤Rationale:** Establish patient's baseline for future comparison.

- Assess for dyspnea, tachypnea, tachycardia, muffled heart sounds, precordial dullness to percussion, impaired consciousness; hypotension (systolic BP less than 100 mm Hg or decreased from patient's baseline); increased jugular venous pressure; pulsus paradoxus (inspiratory fall in systolic BP) greater than 12 to 15 mm Hg; equalization of RAP, PAWP, and pulmonary artery diastolic pressure, low CO/CI.³ **➤Rationale:** Assesses for signs and symptoms of cardiac tamponade.

Patient Preparation

- Ensure that the patient and family understand preprocedural teaching. Answer questions as they arise and reinforce information as needed. **➤Rationale:** Evaluates and reinforces understanding of previously taught information.
- Administer analgesia or anxiolytic before the pericardial catheter insertion. **➤Rationale:** Facilitates pain management and reduces anxiety.

Procedure for Pericardial Catheter Management

Steps	Rationale	Special Considerations
1. Wash hands.	Reduces transmission of microorganisms; standard precautions.	
2. Assist the physician with the pericardiocentesis (see Procedure 40).	The pericardial catheter is inserted by the physician during the pericardiocentesis.	The pericardial catheter may also be inserted in the operating room or in a special procedure environment (cardiac catheterization laboratory, interventional laboratory, etc.).
3. Determine that connections between the pericardial catheter, tubing, stopcock, and drainage bag are tight.	Ensures that the integrity of the system is intact.	
4. Observe the drainage of pericardial fluid.	Ensures pericardial catheter patency.	Pericardial fluid is commonly straw-colored, serous drainage. An echocardiogram is performed after the pericardiocentesis to assess for reaccumulation of pericardial fluid.
5. Place drainage tubing and drainage bag lower than the catheter insertion point.	Promotes drainage and prevents catheter blockage.	
6. Empty the pericardial drainage bag at least every 8 hours. <ul style="list-style-type: none"> A. Wash hands, and don gloves. B. Turn stopcock off to the patient. C. Open the emptying port. D. Empty the pericardial drainage into a collection container. E. Measure the amount of drainage. 	Prevents pneumopericardium.	
7. If a drainage bag is not in use, aspirate the pericardial fluid every 4 to 6 hours or as clinically indicated through a three-way stopcock using sterile technique. ⁴ <ul style="list-style-type: none"> A. Wash hands, and don sterile gloves. 	Removes excess pericardial fluid; ensures catheter patency.	Follow institutional standards regarding personnel permitted to aspirate pericardial catheters (eg, registered nurse, physician).
	Reduces the transmission of microorganisms; standard precautions. Prepares for aseptic technique.	

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Procedure for Pericardial Catheter Management *Continued*

Steps	Rationale	Special Considerations
B. Remove the cap from the three-way stopcock.		
C. Clean the infusion port of the three-way stopcock with an alcohol swab.	Decreases the risk of infection.	
D. Attach a sterile, 60-mL syringe to the three-way stopcock.	Connects to the port for pericardial fluid removal.	
E. Turn the stopcock on to the syringe and patient.	Permits removal of pericardial fluid.	
F. Gently aspirate pericardial fluid.	Gentle removal is necessary to avoid pericardial injury.	Pericardial fluid samples may be collected for selected diagnostic tests (eg, protein, glucose; hematocrit, white blood cell count; bacterial or fungal culture).
G. Measure the amount of drainage.	Needed for assessing and recording output.	
H. After each fluid withdrawal, flush the pericardial catheter with 2.0 to 5.0 mL of sterile normal saline.	Clears pericardial catheter and maintains catheter patency.	Monitor vital signs and ECG while flushing the pericardial catheter.
I. Return the three-way stopcock off to the infusion port.	Maintains closed system; prevents pneumopericardium.	
J. Place a new sterile cap on the infusion port.	Maintains asepsis.	
K. Discard drainage and used supplies, and wash hands.	Reduces transmission of microorganisms; standard precautions.	
Managing Pericardial Catheter Blockage		
1. Determine if the drainage system is lower than the insertion point and reposition if needed.	Facilitates drainage.	
2. Assess if there is an external mechanical cause of pericardial catheter blockage and, if present, correct. Consider:	Relieves mechanical obstruction to flow of pericardial fluid.	
A. Correct tubing kinks.		
B. Remove tubing that may be compressed under the patient.		
C. Turn the patient.		
3. Assess for tubing disconnection and, if loosened, reconnect.	Ensures intact pericardial drainage system.	
4. Determine if the stopcock is in the incorrect position and, if needed, correct the position.	Facilitates pericardial fluid collection.	
5. If the above steps do not relieve the catheter blockage, then:	Attempts to relieve blockage.	Follow institutional standards regarding personnel permitted to aspirate pericardial catheters (eg, registered nurse or physician).
A. Wash hands, and apply sterile gloves.	Reduces transmission of microorganisms; standard precautions. Prepares for aseptic technique.	
B. Turn the stopcock off to the drainage bag.	Decreases the risk of infection.	
C. Remove the cap from the stopcock.		
D. Clean the infusion port of the stopcock with an alcohol swab.		
E. Flush the pericardial catheter with 2.0 to 5.0 mL of heparinized normal saline, as prescribed (eg, 30 units of heparin per mL of normal saline).	Attempts to improve pericardial catheter patency. Heparinized saline may be used if the drainage is serous or fibrous in consistency. ⁵	Monitor vital signs and ECG while flushing the pericardial catheter.

Procedure for Pericardial Catheter Management *Continued*

Steps	Rationale	Special Considerations
F. Turn the stopcock off to the infusion port.	Allows drainage of flush solution and pericardial fluid.	Deduct flush solution from measurement of pericardial drainage.
G. Determine if pericardial fluid is draining.		
6. If the above measures do not remove the catheter blockage, consider changing the pericardial drainage tubing.		
7. If measures do not remove the catheter blockage, notify the physician.		

Care of the Pericardial Catheter Insertion Site

1. Wash hands, and don gloves.	Reduces transmission of microorganisms; standard precautions.	
2. Remove dressing.	Prepares for site care.	
3. Assess the catheter, insertion site, suture, and surrounding skin.	Assess for signs of infection, catheter dislodgment, leakage, or loose sutures.	
4. Remove and discard gloves and put on a sterile pair of gloves.	Maintains aseptic technique.	
5. Beginning at the insertion site, using concentric circles, cleanse the catheter and skin around the insertion site with alcohol pads or swabsticks.	Debrides the skin and removes moisture.	
6. Cleanse the catheter and skin with providone pads or swabsticks as described in the previous step and allow to dry.	Reduces the rate of recolonization of skin microflora.	
7. Apply sterile, occlusive dressing.	Provides a sterile environment.	
8. Label dressing with date, time, and initials.	Identifies last dressing change.	
9. Discard used supplies, and wash hands.	Reduces the transmission of microorganisms; standard precautions.	

Infusion of Medications Through Pericardial Catheters

1. Wash hands, and don sterile gloves.	Reduces the transmission of microorganisms; standard precautions. Prepares for aseptic technique.	
2. Review physician prescription for type and amount of medication, rate of infusion, and length of dwell time.	Ensures the accuracy of medication administration.	
3. Cleanse the infusion port of the stopcock with an alcohol pad or swabstick.	Decreases risk of infection.	
4. Connect the medication or solution (via tubing or syringe) to the infusion port of the stopcock.	Prepares for infusion.	Infusion of medication into the pericardial space may cause iatrogenic cardiac tamponade.
5. Turn the stopcock off to the pericardial drainage bag.	Prevents installation of medication into drainage bag.	
6. Infuse the medication or solution slowly as per physician prescription.	Provides treatment of underlying pathology.	Assess patient closely for pain as the medication or solution is administered into the pericardial space. Stop the infusion if chest pain similar to anginal pain develops or if the patient develops signs or symptoms of cardiac tamponade.

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Procedure for Pericardial Catheter Management *Continued*

Steps	Rationale	Special Considerations
7. If the medication is to dwell in the pericardial space before the reestablishment of pericardial drainage:		
A. Flush the pericardial catheter with 2.0 to 5.0 mL of sterile normal saline.	Ensures that the medication is instilled in the pericardial space and does not lie in the catheter.	
B. Turn the stopcock off to the patient.	Allows the medication or solution to dwell in the pericardial space.	
C. Follow dwell time as prescribed.	Maintains medication in the pericardial space.	
D. After the dwell time is complete, turn the stopcock off to the infusion port.	Allows pericardial drainage collection to resume.	
8. Measure the amount of the solution infused and the drainage collected.	Ensure that the volume of drainage collected is equal to or greater than the volume of solution instilled.	

Expected Outcomes	Unexpected Outcomes
<ul style="list-style-type: none"> • Patent pericardial drainage system • Resolution of pericardial effusion • Hemodynamic stability • Free of infection • Free of pain and discomfort • Medications administered as prescribed 	<ul style="list-style-type: none"> • Infection • Pain • Catheter blockage • Reaccumulation of pericardial fluid • Cardiac tamponade • Dysrhythmias

Patient Monitoring and Care

Patient Monitoring and Care	Rationale	Reportable Conditions
1. Perform systematic cardiovascular and hemodynamic assessments every 60 minutes and as patient status requires.	Monitors for cardiac tamponade and pericardial catheter-related problems.	<p><i>These conditions must be reported if they persist despite nursing interventions.</i></p> <ul style="list-style-type: none"> • Signs of cardiac tamponade³; dyspnea, tachypnea, tachycardia, hypotension, increased jugular venous pressure, pulsus paradoxus, muffled heart sounds, precordial dullness to percussion, altered level of consciousness; equalization of RAP, PAP diastolic, PAWP; CI less than 2.5 L per minute; dysrhythmias
2. Assess patency of the pericardial catheter drainage system every hour and as needed.	Pericardial catheter blockage may predispose the patient to reaccumulation of pericardial fluid that may lead to cardiac tamponade.	<ul style="list-style-type: none"> • Cessation of pericardial drainage • Signs and symptoms of cardiac tamponade
3. Assess the amount and type of fluid draining from the pericardial catheter hourly and as needed.	Monitors type and amount of pericardial fluid drainage.	<ul style="list-style-type: none"> • Change in amount or color of pericardial drainage from patient's baseline
4. Change the pericardial dressing every 24 hours and when the dressing becomes damp, loosened, or soiled.	Provides an opportunity to assess for signs and symptoms of infection. Infective pericarditis is associated with high mortality and morbidity rates. ^{3,4}	<ul style="list-style-type: none"> • Elevated WBCs • Elevated temperature, greater than 38.5°C • Signs and symptoms of infection at insertion site (pain, erythema, drainage)

Patient Monitoring and Care *Continued*

Patient Monitoring and Care	Rationale	Reportable Conditions
5. Change the pericardial tubing and drainage bag every 72 hours. ²	Reduces the incidence of infection.	
6. Assess and manage patient pain/discomfort.	The patient may experience chest pain or pleuritic type pain while the pericardial catheter is in place.	<ul style="list-style-type: none"> • Inadequate pain relief with analgesics
7. Identify parameters that demonstrate clinical readiness for removal of the indwelling pericardial catheter.	Facilitates early removal of the pericardial catheter; decreases infection risk.	<ul style="list-style-type: none"> • Pericardial drainage less than 25 to 30 mL over the previous 24 hours • Hemodynamic stability as evidenced by systolic BP greater than 100 mm Hg, CI greater than 2.5 L/min, no pulsus paradoxus, no equalization of RAP, PAP diastolic, PAWP • Absence of pericardial effusion demonstrated on two-dimensional (2-D) echo

Documentation

Documentation should include the following:

- Patient and family education
- Patient toleration of indwelling pericardial catheter
- Pericardial catheter insertion site assessment
- Dressing changes, tubing changes, drainage bag changes
- Amount of pericardial drainage each shift, including net volumes when catheter is flushed or medications infused
- Volumes of injectate or aspirate
- Characteristics of pericardial drainage: color, consistency, and any changes
- Hemodynamic status
- Pain associated with indwelling pericardial catheter
- Occurrence of unexpected outcomes
- Nursing interventions

References

1. Lorell BH. Pericardial disease. In: *Heart Disease: A Textbook of Cardiovascular Medicine*. 5th ed. Philadelphia, Pa: W.B. Saunders, 1997:1478–1534.
2. Hamel WJ. Care of patients with an indwelling pericardial catheter. *Crit Care Nurse*. October 1998; 18:40–45.
3. Freed M, Grines C. Pericardial disease: In: *Essentials of Cardiovascular Medicine*. Birmingham, Mi: Physician's Press; 1994:417–427.
4. Lorell BH, Grossman W. Restrictive cardiomyopathy and cardiac tamponade. In: *Cardiac Catheterization, Angiography,*

and Intervention. 5th ed. Baltimore, Md: Williams & Wilkins; 1995:801–823.

5. Tsang TS, Freeman WK, Sinak LJ, Seward, JB. Echocardiographically guided pericardiocentesis: evolution and state-of-the-art technique. *Mayo Clin Proc*. July 1998; 73:647–652.

Additional Reading

- Drummond JB, Seward JB, Tsang TS, Hayes SN, Miller FA. Outpatient two-dimensional echocardiography-guided pericardiocentesis. *J Am Soc Echocardiogr*. May 1998; 11:433–435.