

# Managing chest tubes: Air leaks and unplanned tube removal

Enhanced knowledge of chest tubes helps you cope with dangerous complications.

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**ONCE TREATED** only in high-acuity settings, patients with chest tubes now receive care in inpatient medical-surgical floors, outpatient procedural areas (such as interventional radiology), and other settings. More recently, to help shorten hospital stays and reduce readmissions, patients are being discharged with smaller, more portable chest tubes. This allows them to continue to recover from thoracic surgery at home or, in some cases, to receive palliative care.

A chest tube is indicated when negative pressure in the pleural space is disrupted, as from thoracic surgery or unanticipated trauma. The tube helps restore negative pressure, preventing further respiratory complications. (See *Chest-tube indications*.)

Although they can save lives, chest tubes can pose significant risks unless assessed and managed properly. To help prevent complications, clinicians must be familiar with basic thoracic and pleural anatomy, insertion-site care, dressing changes, and proper chest-tube management. Even then, unanticipated events and complications can occur.

This article can help you feel more confident when caring for patients with chest tubes. It discusses several complications and describes how to prevent and manage prob-

lems during tube removal. (The authors assume readers have basic knowledge about chest-tube function and care.)

## Managing air leaks

Although air leaks commonly resolve without intervention, they must be evaluated fully before

placement of the current tube if it's malpositioned. In some cases, chemical or mechanical pleurodesis may be indicated.

Assess for air leaks at least once per shift and as needed, based on your patient's respiratory status. Start by examining the air-leak detection chamber in the water seal of

the drainage device. An air leak presents as small air bubbles; the amount of bubbling indicates the degree of the leak. If you notice bubbling, determine location of the leak. Leaks can occur outside the patient's body (such as within the drain or tubing connections) or within the patient (for instance, at the tube insertion site or inside the chest cavity).

To determine where the leak is, clamp the tubing as close as possible to the patient. If bubbling continues, suspect a leak in the

tubing or damage to the drainage device (as from inadvertent lowering of the bed onto the drain). Commonly, air leaks occur at the point where the distal end of the tube connects to the drainage device tubing. Check this juncture to ensure it hasn't become loose. Consider using securements, such as plastic fasteners (zip ties), to help prevent accidental disconnection here.

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chest-tube removal to ensure adequate restoration of negative pressure in the pleural space. Prolonged leaks—those lasting more than 5 days after thoracic surgery—are more dangerous than acute leaks. They indicate that negative pressure hasn't been restored and the injury isn't resolving. Such leaks can increase hospital stays and lead to pneumonia, infection, and other complications. The patient may require a long-term chest tube or re-

## Chest-tube indications

Pleural chest tubes commonly are placed to remove air and fluid from the pleural space, thereby restoring normal negative pressures. Mediastinal chest tubes (less common) are inserted after open-heart surgery to allow evacuation of residual blood and fluids. The chart below lists specific indications for chest tubes.

Indication	Description
Chylothorax	Injury to lymphatic drainage system
Hemothorax	Collection of blood in pleural space
Pleural effusion	Exudate or transudate in pleural space
Pneumothorax	Air trapped in pleural space
Postoperative cardiothoracic surgery (mediastinal chest tube)	Done to drain postoperative blood and fluids from mediastinum or restore negative pressure in pleural space

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If bubbling disappears when you clamp the tubing, suspect an air leak at the insertion site or from within the chest wall. Assess the insertion site; if you detect a leak, apply petroleum gauze and a sterile occlusive dressing to seal it off. If the leak persists, suspect it's coming from air remaining in the pleural space (an unresolved pneumothorax), a pleural injury, an exposed tube eyelet, or inappropriate communication between the bronchial and pleural spaces. With a significant internal air leak, you may be able to palpate subcutaneous emphysema or "crackling" under the skin. Whatever its source, an air leak must be addressed and resolved before the chest tube is removed. A large, persistent leak with no evacuation outlet can lead to tension pneumothorax, in turn causing cardiac tamponade—a life-threatening emergency.

### Planned and unplanned chest-tube removal

A chest tube can be discontinued in two ways—planned or unplanned (accidental). Unplanned removal can be considered an emergency, but with quick action you can prevent patient harm.

#### Planned removal

Clinicians use various indicators to

determine when a chest tube is no longer necessary—for instance, if drainage has become minimal and no longer concerning or if an air leak or the initial indication for the chest tube has resolved. If permitted by the state board of nursing or facility policy, clinical nurses with demonstrated competence in removing chest tubes can perform this procedure.

Here are the basic steps of chest-tube removal:

1. Discontinue wall suction from the chest drainage unit. Some literature suggests you should do this at least 24 hours before tube removal to eliminate a possible air leak.

### Managing pain during chest-tube insertion and removal

As you probably know, inserting or removing a chest tube can cause considerable pain. As ordered, premedicate patient before the procedure and then routinely, based on patient complaints and response to pain-management interventions. Perform frequent pain assessment. As needed or ordered, use such techniques as a patient-controlled analgesia pump, a local anesthetic patch or cream, relaxation techniques, and ice packs to aid pain control.

2. To reduce pain caused by chest-tube removal, premedicate your patient as ordered; allow adequate time for the drug to take effect. (See *Managing pain during chest-tube insertion and removal*.)
3. Know that chest-tube removal is a sterile procedure. Gather needed supplies, including a mask, sterile gloves, suture removal kit, petroleum gauze, dry gauze, tape, hazardous waste bag, and disposable pad.
4. Explain the procedure to the patient. Instruct the patient to practice taking deep breaths and holding them. To prevent air from re-entering the pleural space during tube removal, instruct the patient to hold the breath or to hum as you remove the tube.
5. After you've removed the dressing and sutures, clamp the tube. Ask the patient to take one more deep breath and hold it. With one hand, simultaneously remove the tube swiftly and place it on the disposable pad. Keep your other hand at the insertion site, covering the hole. If purse-string sutures are present, tie them off into several square knots. If desired, ask a colleague to hold the sutures while you pull the tube out. If these sutures aren't present, immediately apply an occlusive dressing, such as petroleum gauze. Again, the goal is to prevent air from reentering the pleural space.
6. Dress the site with a dry occlusive dressing and discard the chest tube and drainage device in the hazardous waste bag.
7. Obtain a postremoval chest X-ray if the physician has ordered it or facility protocol requires it. (However, know that increasing evidence no longer supports routine postremoval chest X-rays.)

#### Unplanned removal

In an unplanned chest-tube re-

## Chest-tube complications

The chart below lists chest-tube complications with corresponding nursing interventions.

Complication	Nursing interventions
Incorrect tube placement	<ul style="list-style-type: none"><li>• Confirm proper tube placement with chest X-ray, as ordered.</li></ul>
Infection	<ul style="list-style-type: none"><li>• Monitor for signs and symptoms of infection.</li><li>• Use sterile technique for dressing changes and whenever a break in closed system occurs (for example, when changing the drainage unit).</li></ul>
Occluded chest tube	<ul style="list-style-type: none"><li>• Routinely check tubing for kinking, dependent loops, and obstructions.</li><li>• If occlusion is visible, gently lift tube so gravity can aid drainage, or massage tubing to help loosen clot. Avoid milking or stripping tube, which may harm patient.</li></ul>
Prolonged air leak	<ul style="list-style-type: none"><li>• Identify source of air leak. Confirm that all connections are tight. Apply occlusive dressing at insertion site.</li><li>• Other interventions depend on location of leak—insertion site or inside chest cavity vs. system (drain or tubing connections).</li></ul>
Unplanned or accidental chest-tube removal	<ul style="list-style-type: none"><li>• Immediately ensure air doesn't re-enter pleural space.</li><li>• Monitor patient for signs and symptoms of respiratory distress.</li></ul>

removal, stay calm. With a gloved hand, immediately cover the open insertion site and call for help while staying with the patient. Ask for petroleum gauze to cover the site, along with dry gauze and tape to complete the dressing.

If you didn't witness chest-tube removal and the patient appears to be in respiratory distress, ask him or her to exhale forcefully as you lift your hand off the insertion site. Before the patient's next inhalation, quickly cover the site again. Have the patient repeat this a few times. If you suspect air entered the pleural space before you got to the scene, the patient may be at risk for a tension pneumothorax, which can become life-threatening unless the air is expelled from the pleural space quickly. Notify the practitioner, obtain a chest X-ray, and prepare for possible insertion of a new chest tube.

If you're walking with your patient and the chest tube becomes

dislodged where it connects to the drainage tubing, immediately close off the tubing to air with your gloved hand by crimping it or using a clamp, if readily available. Or place the end of the tube in a bottle of sterile water, creating a water seal. Instruct a colleague to prepare a new sterile chest-drainage collection device, or retrieve a new sterile connector while you safely return the patient to bed. Observe the patient for signs and symptoms of respiratory decline. Then reconnect the chest tube to the new drain and unclamp it.

### Postremoval nursing assessment

Whether chest-tube removal was planned or unplanned, monitor the patient closely for signs and symptoms of respiratory compromise, using such techniques as pulse oximetry (SpO<sub>2</sub>), end-tidal carbon dioxide (ETCO<sub>2</sub>) monitoring, and breath sound auscultation. Monitor the patient's respiratory

rate and effort. A repeat chest X-ray (if indicated) may be done to compare to previous films and evaluate for presence or return of a pneumothorax, an effusion, or other problem.

### Other complications

Other chest-tube complications also can be dangerous. These include extremely high negative pressures within the system caused by aggressive tube stripping, as well as the re-expansion pulmonary edema phenomenon, which results from rapid removal of large amounts of air or fluid. Rarely, inadvertent chest tube misplacement in the liver, spleen, lung, or great vessel can occur on insertion. (See *Chest-tube complications*.)

Enhancing your knowledge of chest tubes and gaining the skills needed to manage them improve your confidence in delivering safe patient care. ★

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