# Thoracostomy tubes and catheters: Indications and tube selection in adults and children

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## INTRODUCTION

Placement of a thoracostomy tube (diameter ≥16 French) or thoracostomy catheter (diameter ≤14 French) through the chest wall into the pleural cavity is a common procedure to drain air (ie, pneumothorax), simple fluid (ie, effusion), pus (ie, empyema), or blood (ie, hemothorax), or to instill medications into the pleural space (eg, pleurodesis, fibrolysis). Understanding what tube to use for various situations and how to properly place a tube or catheter is important. The days of "one size fits all" no longer exist.

Much of the literature surrounding placement of thoracostomy tubes and catheters has been conducted in adults. Few prospective studies are available in the pediatric population, in part due to the less frequent need for emergency invasive thoracic procedures in children.

The indications for and selection of appropriate thoracostomy tube or catheter are reviewed, making appropriate distinctions between adult and pediatric populations, where important. Specific placement techniques and subsequent management are reviewed separately. (See "Thoracostomy tubes and catheters: Placement techniques and complications" and "Thoracostomy tubes and catheters: Management and removal".)

## INDICATIONS

Thoracostomy tube (diameter ≥16 French) or thoracostomy catheter (diameter ≤14 French) placement may be indicated for a variety of conditions. Different types of tubes (diameter, shape) are selected based on indication. (See 'Tube definitions and types' below and 'Tube sizing' below.)

Some common conditions for thoracostomy tube or catheter placement include:

- Pneumothorax is the most common reason for thoracostomy tube or catheter placement in adult and pediatric populations and appears to be more common among males. This is also true in the neonatal population [1,2].
    - Spontaneous pneumothorax (see "Pneumothorax in adults: Epidemiology and etiology" and "Treatment of secondary spontaneous pneumothorax in adults" and "Spontaneous pneumothorax in children")
    - Traumatic pneumothorax (including occult pneumothorax [ie, pneumothorax identified on computed tomography]) (see "Initial evaluation and management of blunt thoracic trauma in adults", section on 'Pneumothorax' and "Thoracic trauma in children: Initial stabilization and evaluation" and "Identification and management of tracheobronchial injuries due to blunt or penetrating trauma" and "Overview of esophageal perforation due to blunt or penetrating trauma")

- Iatrogenic pneumothorax, most commonly due to central line placement (see "Overview of complications of central venous catheters and their prevention")
- Tension pneumothorax (see "Evaluation of and initial approach to the adult patient with undifferentiated hypotension and shock" and "Advanced cardiac life support (ACLS) in adults" and "Respiratory problems in the post-anesthesia care unit (PACU)")
- Extension of mediastinal air (ie, pneumomediastinum) (see "Diagnosis, management, and prevention of pulmonary barotrauma during invasive mechanical ventilation in adults" and "Spontaneous pneumomediastinum in children and adolescents")
- Air leak following pulmonary resection (see "Overview of pulmonary resection", section on 'Persistent air leak')
- Bronchopleural fistula, postoperative or due to mechanical ventilation (see "Management of persistent air leaks in patients on mechanical ventilation" and "Bronchopleural fistula in adults")

- Hemothorax
  - Chest trauma (blunt or penetrating) (see "Initial evaluation and management of blunt thoracic trauma in adults", section on 'Pneumothorax' and "Thoracic trauma in children: Initial stabilization and evaluation" and "Management of blunt thoracic aortic injury")
  - Postoperative, following thoracic or upper abdominal surgery (see "Overview of pulmonary resection")
  - Nontraumatic cardiac or aortic conditions (see "Acute myocardial infarction: Mechanical complications" and "Overview of acute aortic dissection and other acute aortic syndromes" and "Management of thoracic aortic aneurysm in adults" and "Management of blunt thoracic aortic injury")
- Pleural effusion is another leading diagnosis for which thoracostomy tube or catheter placement may be necessary.
  - Sterile effusion (see "Diagnostic evaluation of a pleural effusion in adults: Initial testing" and "Approach to the neonate with pleural effusions")
  - Infected or inflammatory effusion (ie, empyema, parapneumonic effusion) (see "Management and prognosis of parapneumonic pleural effusion and empyema in adults").

    In the pediatric population, about one-half of children with parapneumonic effusion or empyema can be managed with antibiotics alone [3-6] (see "Management and prognosis of parapneumonic effusion and empyema in children").
  - Malignant effusion (see "Management of malignant pleural effusions")
  - Chylothorax (see "Etiology, clinical presentation, and diagnosis of chylothorax")
  - Other effusion (see "Recognition and management of diaphragmatic injury in adults", section on 'Biliary fistula' and "Boerhaave syndrome: Effort rupture of the esophagus")
- Pleurodesis – Thoracostomy tube or catheter placement also facilitates the instillation of sclerosing agents into the pleural space for the treatment of refractory effusion (see "Management of malignant pleural effusions" and "Management of nonmalignant pleural effusions in adults" and "Chemical pleurodesis" and "Talc pleurodesis" and "Management of chronic pleural effusions in the neonate", section on 'Pleurodesis')

**Relative contraindications** — There are few absolute contraindications to thoracostomy tube (diameter ≥16 French) or catheter (diameter ≤14 French) placement. Transudative pleural effusions due to liver failure generally should not be managed with thoracostomy drainage. Other conditions may require a change in the approach, timing, or type of tube placement.

Conditions that increase bleeding (eg, anticoagulation, coagulopathy) are considered a relative contraindication to thoracostomy tube or catheter placement in both adults and children. This holds true regardless of whether placement is surgical or percutaneous, except in emergency conditions such as the acutely injured patient with severe chest injury in whom massive hemothorax or tension pneumothorax is a concern. For other situations, needle thoracostomy may be a preferred initial option to avoid potential procedure-related bleeding.

Thoracostomy tubes or catheters should not be placed directly at a site with localized skin or soft tissue infection unless there is no other option. A site remote from an area of active infection is best.

For the patient with pleural adhesions, previous pleurodesis, or prior pulmonary surgery, guidance by ultrasound or computed tomography scan without contrast is preferred to blind insertion of a thoracostomy tube or catheter, which can be associated with complications.(See "Thoracostomy tubes and catheters: Placement techniques and complications", section on 'Role of ultrasound or other imaging'.)

## TUBE DEFINITIONS AND TYPES

Thoracostomy tubes and catheters are silicone or polyvinyl chloride tubes that have a radiopaque strip with a gap that serves to mark the most proximal drainage hole (picture 1). Silicone or polyvinyl chloride tubes are preferred over older latex rubber tubes that had fewer drainage holes, were not well seen on chest radiographs, produced more pleural inflammation, and may have been associated with latex allergy. Alternative tubes (eg, Blake drain: 19 French, 24 French) can also be used to drain the pleural cavity, if necessary.

**Diameter** — Traditional thoracostomy tubes are relatively stiff, clear tubes. Larger diameter tubes (≥16 French) require a surgical approach making an incision for placement. We will refer to these as "surgically placed thoracostomy tubes." (See "Thoracostomy tubes and catheters: Placement techniques and complications", section on 'Blunt dissection technique'.)

Smaller diameter (≤14 French) traditional, stiffer tubes and more pliable flexible catheters can be placed over a wire using a Seldinger technique [1]. We will refer to these as "percutaneously placed thoracostomy tubes" or "percutaneously placed thoracostomy catheters." A smaller diameter tube causes less pain compared with a larger diameter tube; however, smaller diameter tubes can become plugged with blood or purulent drainage and more easily obstruct from kinking or bending. Also, while these smaller tubes can often be placed without imaging guidance, for patients with a loculated fluid collection, imaging should be used during placement. (See "Thoracostomy tubes and catheters: Placement techniques and complications", section on 'Seldinger technique' and "Thoracostomy tubes and catheters: Placement techniques and complications", section on 'Role of ultrasound or other imaging'.)

### Shape

- Surgically placed thoracostomy tubes can be straight or angled (picture 2). Angled tubes are often used in postoperative setting to assure placement in the posterior costophrenic sulcus. For bedside placement, straight tubes should be used. Percutaneously placed thoracostomy tubes are also available with a straight or curved tip.
- Specialty thoracostomy catheters (eg, pigtail tip) are available to evacuate pneumothorax and are available as small as 5 Fr. Pigtail catheters can be placed with or without imaging guidance.

## TUBE SIZING

Thoracostomy tubes and catheters are available in a wide range of French (Fr) diameters (diameter in Fr/3 = diameter in millimeters). We generally regard thoracostomy tubes as having a diameter ≥16 Fr, and thoracostomy catheters as having a diameter ≤14 Fr. Thoracostomy tubes and catheters are sized based primarily upon the weight of the patient and the indication for placement (ie, nature of fluid to be drained).

Although the definition of a pediatric patient is generally considered to be based on age alone, for thoracostomy tube or catheter sizing, using weight and height (or length as noted on length-based resuscitation measuring tapes) to determine category (eg, infant, child, preteen, teen) may provide a better match. It is clear some pediatric patients can be treated as adults due to their size; any patient under 18 years of age who is taller than 58 inches (147 cm), or >50 kg can generally be managed as an adult with respect to thoracostomy tube or catheter placement.

Thoracostomy tube or catheter length is standardized and predetermined by the radius of catheter. Regardless of tube or catheter type and diameter, the drainage holes in the tube must be fully inserted into the pleural space to assure proper tube functioning.

Surgically placed thoracostomy tubes range from:

- 24 to 40 Fr for adults and teens (≥13 years; generally >50 kg)
- 16 to 24 Fr for children (1 to 13 years; generally ≤30 kg)
- 12 to 14 Fr for infants (<1 year)

Percutaneously placed thoracostomy tubes and catheters range from 5 to 14 Fr.

- The available data suggest that a small diameter percutaneous thoracostomy tube or catheter (eg, 8 Fr pigtail) is safe and effective in any patient (infants, children, adults) for the treatment of pneumothorax or parapneumonic effusion [2]. (See 'Pneumothorax' below and 'Parapneumonic effusion' below.)

- For infants and children, percutaneous thoracostomy catheters are used more frequently compared with surgically placed thoracostomy tubes or catheters and are available as small as 5 Fr.

Thoracostomy tube or catheter sizing related to patient size and age is shown in the table (table 1). The smallest effective thoracostomy tube or catheter diameter is recommended. Percutaneous thoracostomy tubes or catheters are a reasonable alternative to surgically placed thoracostomy tubes for many indications. In a large case series, percutaneous thoracostomy catheters (ie, pigtail type) were highly effective for pleural serous and chylous effusions, but less effective for blood and air, and least effective for infection (empyema) [3,4]. Percutaneous pigtail catheters also appear to be more effective in infants and younger children. There is concern that small diameter thoracostomy tubes or catheters are more likely to become obstructed due to plugging of blood or purulent debris, or from kinking due to their flexibility. If this occurs, a larger tube will need to be placed. However, in a study evaluating a practice change from larger thoracostomy tubes to 8.5 Fr thoracostomy catheters, the catheters were effective and no blockages occurred [5]. (See 'Pneumothorax' below and 'Hemothorax' below and 'Malignant effusion' below and 'Parapneumonic effusion' below.)

**Specific clinical scenarios** — The general principles for identifying patients who require a thoracostomy tube or catheter are discussed in separate topic reviews. (See 'Indications' above.)

Suggestions for selecting thoracostomy tube or catheter sizing (table 1) are reviewed.

**Pneumothorax** — Initial management is dictated by the severity of the patient's symptoms and the size of the pneumothorax [6]. Once the decision has been made to proceed with evacuation of the pneumothorax, the size of the thoracostomy tube or catheter selected depends upon the likelihood of high-volume air leakage (eg, large pneumothorax, mechanical ventilation, bronchopleural fistula) or presence of concomitant blood (eg, large pleural air-fluid level, trauma mechanism) [6,7].

- For the majority of patients (adults and children) with spontaneous or iatrogenic pneumothorax, a small thoracostomy tube or catheter (8 to 14 Fr) is sufficient because these air leaks are due to alveolar-pleural fistulas [6-8].
- For patients at risk for a large air leak due to bronchial-pleural fistulas (eg, on mechanical ventilation, bronchial dehiscence), we prefer a large thoracostomy tube (eg, 24 Fr in adults).
- For traumatic injury, the size of the thoracostomy tube will depend upon whether there is concomitant effusion or other concerning findings on chest radiography (eg, hemopneumothorax associated with a flail chest). If no effusion is seen, then a small thoracostomy tube or catheter (≤14 Fr) can be used. When there is an effusion, we use a large diameter thoracostomy tube given the potential need to drain blood as well as air). Occasionally, more than one ipsilateral thoracostomy tube or catheter is needed, especially in the patient who requires mechanical ventilation. (See 'Hemothorax' below.)

In the initial management of a pneumothorax alone, suction is not routinely used [6]. Instead, the thoracostomy tube is attached to the drainage system containing a one-way valve mechanism that allows air and fluid to exit but prevents air or fluid from entering the pleural cavity from the outside [6,7]. Valved drainage systems may use underwater seal drainage or a unidirectional flutter valve (eg, Heimlich valve, Pneumostat, ad hoc flutter valve [eg, cut finger of glove]). If the pneumothorax does not resolve with these methods, the valve is removed, and a high-volume, low-pressure system is applied with pressures of -10 to -40 cm $H_2O$, although some suggest that limiting pressures to -10 to -20 cm $H_2O$ may lessen the risk of pulmonary edema [6]. (See "Thoracostomy tubes and catheters: Placement techniques and complications", section on 'Drainage systems'.)

Air leaks can be semi-quantified by noting the number of columns bubbling in the air leak chamber and by noting the timing of the air leak in the respiratory cycle (eg, intermittent one-chamber leak, continuous five-chamber leak, only with cough). The size of the potential air leak cannot be known before putting in the thoracostomy tube or catheter, and the initial tube that is chosen may be too small. Thus, if the pneumothorax does not resolve, the first step is to increase the level of suction, and only if maximal suction fails to resolve the pneumothorax should a second tube be considered. (See "Thoracostomy tubes and catheters: Management and removal", section on 'Classifying air leak'.)

**Tension pneumothorax** — Tension pneumothorax, the development of positive pressure in the pleural space, is a life-threatening emergency that causes hemodynamic compromise and requires immediate decompression. The patient with signs of tension pneumothorax (ie, worsening dyspnea, hypotension, diminished breath sounds on the affected side, distended neck veins, and tracheal deviation away from the affected side) should be treated without waiting for a chest radiograph. Needle thoracostomy should be performed as a lifesaving (albeit temporizing) measure to reduce the intrapleural pressure and restore venous return to the heart. Once the patient is out of immediate danger, a thoracostomy tube or catheter should be placed. If immediately available and appropriate for the clinical situation, a thoracostomy tube or catheter (24 or 28 Fr in adults, appropriately sized tube or catheter in pediatric patients (table 1)) is an alternative for initial decompression. (See "Thoracostomy tubes and catheters: Placement techniques and complications", section on 'Blunt dissection technique' and "Thoracostomy tubes and catheters: Placement techniques and complications", section on 'Needle thoracostomy'.)

**Hemothorax** — Hemothorax is most commonly a result of chest trauma, but hemothorax can also result from nontraumatic conditions (eg, malignancy, pulmonary infarct, anticoagulation, aneurysm rupture) [9]. The goals of thoracostomy tube or catheter placement in acute hemothorax are drainage of fresh blood, measurement of the rate of bleeding, evacuation of any coexisting pneumothorax, and tamponade of the bleeding site by apposition of the pleural surfaces.

In adults, a surgically placed thoracostomy tube (>28 Fr) is required to achieve these goals. In the pediatric patient population, hemothorax should be treated as in adults using an appropriately sized for age and weight or height (or length) (table 1) to evacuate blood and air and monitor the rate of bleeding but also to minimize risk of tube occlusion by kinking or occlusion. Thus, a larger, less flexible tube is indicated compared with other indications. However, as the thoracostomy tube size increases above 32 Fr, there is a diminishing benefit because of increasing patient discomfort [10].

Occasionally, a patient can develop a hemopneumothorax or hydropneumothorax. This can be the result of bleeding or infection that traps the visceral surface of the lung in a fibrin web and prevents its full expansion. Management is individualized. Multiple small tubes or catheters can be inserted usually with the adjunctive administration of a lytic agent to break up the septations. There is a small, but real, risk of hemorrhage with use of lytic agents. In cases of hemopneumothorax, caution should be exercised. Consultation with thoracic or trauma surgery is encouraged, especially if lytic agents are going to be considered. In these cases, we generally prefer to start with a 24 or 28 Fr surgically placed thoracostomy tube in adults, which aids in the evacuation of gelatinous clot, although some single-institution studies have reported similar outcomes using 14 Fr tubes [11,12]. Despite the use of thoracostomy tubes and lytic agents, loculated hemopneumothorax or hydropneumothorax may require operative intervention.

**Malignant effusion** — The management of malignant pleural effusion depends on the patient's symptoms and the rate of re-accumulation after drainage (table 2). (See "Management of malignant pleural effusions", section on 'Initial treatment'.)

The optimal diameter thoracostomy tube or catheter for malignant effusion drainage or pleurodesis is not known. If other methods are inadequate (eg, thoracentesis), a small thoracostomy tube or catheter (8 to 18 Fr) placed under ultrasound, fluoroscopy, or computed tomography (CT) guidance may be sufficient to drain a the effusion or to perform pleurodesis (depending on the viscosity of the sclerosant) [13-18]. Larger thoracostomy tubes may provide better drainage, but smaller thoracostomy tubes or catheters are assumed to be more comfortable and appear to have similar effectiveness for pleurodesis. A multicenter trial compared pleurodesis failure rates and pain scores among 100 adults randomly assigned to a small (12 Fr) or large (24 Fr) tube [19]. Pleurodesis failure rates were similar at three-month follow-up (30 and 24 percent, respectively).

Chronic indwelling catheters are available for outpatient treatment of recurrent malignant effusion, or if the lung does not re-expand sufficiently to achieve pleural-pleural apposition. These catheters come in a kit that includes disposable suction bottles and the appropriate tubing and connectors to access the catheter [20].

**Parapneumonic effusion** — Treatment of parapneumonic effusion may include chest drainage and/or minimally invasive thoracoscopic surgery. (See "Management and prognosis of parapneumonic pleural effusion and empyema in adults" and "Management and prognosis of parapneumonic effusion and empyema in children".)

When thoracostomy tube drainage is selected, for parapneumonic effusion that is amenable to drainage with a single catheter, we prefer initial image-guided placement of a small thoracostomy tube or catheter (10 to 14 Fr in adults, appropriately sized for age and weight or height [or length] (table 1)). A small tube is generally more comfortable for patients, particularly if more than one tube is needed. Flexible thoracostomy (pigtail) catheters appear to be effective in children, especially in younger children and infants. However, if the fluid appears viscous or loculated on ultrasound or

chest CT, a larger thoracostomy tube (16 to 24 Fr in adults, appropriately sized thoracostomy tube by age and weight or height (or length) in pediatric patients) should be used to minimize the risk of occlusion with fibrinous debris. Unsuccessful drainage of an effusion using a small catheter indicates the presence of multiple loculations or very viscous material. Fluid should be obtained and evaluated for culture, cell count, chemical analysis, serology, and other pertinent tests.

**Empyema** — For empyema, thoracostomy tube or catheter drainage is indicated. There may be a role for intrapleural lytic therapy for stage I or II empyema when drainage alone fails [21]. Whether subsequent surgical treatment is likely to be needed depends on the clinical stage of the empyema [22-24]. (See "Management and prognosis of parapneumonic pleural effusion and empyema in adults", section on 'Approach to drainage' and "Management and prognosis of parapneumonic effusion and empyema in children", section on 'Moderate or large simple effusion (not loculated)'.)

- For a stage I empyema (exudate), a 28 Fr or larger thoracostomy tube in adults and an appropriately sized thoracostomy tube by age and weight or height (or length) in pediatric patients (table 1) will be needed to manage the exudate, particularly if there is also debris, but will likely result in a successful clinical outcome. In the pediatric population, a larger thoracostomy tube (eg, 12 to 24 Fr) may be better suited for treatment of empyema, rather than a smaller thoracostomy tube or catheter [25].

- For a stage II empyema (frank pus), a thoracostomy tube is still warranted but may fail. Failure to achieve drainage with a single tube should prompt thoracic surgery consultation for drainage by video-assisted thoracoscopic surgery [26-32].

- For a stage III empyema (organization phase) [33], thoracostomy tube drainage alone will almost assuredly result in treatment failure.

**Use of multiple tubes** — Placement of multiple thoracostomy tubes or catheters into the same hemithorax is generally indicated if a single tube is not accomplishing the desired goal, assuming the initial tube is properly positioned within the chest cavity and is not obstructed. Some surgeons also place two or more thoracostomy tubes following decortication procedures, with the goal of preventing fluid loculations or air collections that would prevent the lung from fully expanding (ie, incomplete pleural-pleural apposition).

Following uncomplicated pulmonary resection, there is no added value for additional tubes [34]. Bilateral thoracostomy tubes or catheters are generally only needed for side-specific indications (each side) that are not directly related to any process in the contralateral chest. An exception would be in patients with traumatic arrest to rule out significant chest pathology as cause of hemodynamic collapse.

## INFORMATION FOR PATIENTS

UpToDate offers two types of patient education materials, "The Basics" and "Beyond the Basics." The Basics patient education pieces are written in plain language, at the 5$^{th}$ to 6$^{th}$ grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10$^{th}$ to 12$^{th}$ grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- Basics topics (see "Patient education: Pneumothorax (collapsed lung) (The Basics)")

## SUMMARY AND RECOMMENDATIONS

- Placement of a thoracostomy tube (diameter ≥16 French [Fr]) or catheter (diameter ≤14 Fr) through the chest wall into the pleural cavity is a common procedure to drain air, simple fluid (ie, effusion), pus (ie, empyema), or blood (ie, hemothorax), or to instill medications into the pleural space (eg, pleurodesis, fibrolysis). (See 'Introduction' above and 'Indications' above.)

- Thoracostomy tubes and catheters are polyvinyl chloride or silastic (silicone) tubes that have a radiopaque strip with a gap that serves to mark the most proximal drainage hole (picture 1). Thoracostomy tubes can be straight or angled (picture 2) and are available in a wide range of diameters. (See 'Tube definitions and types' above.)

- The presence of coagulation abnormalities may alter the approach or timing of thoracostomy tube placement in the absence of emergency indications. Needle thoracostomy may be preferred initially. For patients with pleural adhesions, previous pleurodesis, or prior pulmonary surgery, imaging guidance (eg, ultrasound, computed tomography) is preferred. (See 'Relative contraindications' above.)

- The choice of thoracostomy device, including its size, shape, and insertion site, depends on the indication for placement (ie, the nature of the fluid to be drained). Large, stiff thoracostomy tubes (≥16 Fr) require a surgical approach, making an incision for placement. Small tubes and catheters (≤14 Fr) can be placed percutaneously (ie, over a wire using the Seldinger technique) and cause less pain both during and after placement; however, small diameter thoracostomy tubes or catheters are more likely to become obstructed due to plugging of blood or purulent debris or from kinking due to their flexibility. (See 'Tube definitions and types' above.)

- Thoracostomy tubes or catheters are sized based upon the age and weight or height (or length) of the patient (table 1). For a given indication, the smallest effective tube size available should be used. In the pediatric population, particularly in neonates, a small thoracostomy tube or catheter is appropriate for most indications.

  **In adults**, the following sizes can generally be used (see 'Tube sizing' above):

  - A small diameter thoracostomy catheter (8 Fr) for:

    - Spontaneous or iatrogenic pneumothorax
    - Traumatic pneumothorax without effusion

  - A medium diameter thoracostomy tube or catheter (10 to 24 Fr in adults) for:

    - Parapneumonic effusion
    - Bronchopleural fistula
    - Malignant pleural effusion
    - Pleurodesis

  - A large diameter surgically placed thoracostomy tube (≥24 Fr) for:

    - Hemothorax
    - Empyema

- Following emergency needle thoracostomy for suspected tension pneumothorax, placement of a standard thoracostomy tube or catheter is recommended (24 or 28 Fr in adults, or appropriately sized by age/patient length in pediatric patients) (table 1). Placement of a standard tube is also an alternative initial option for

decompression, rather than needle decompression, when an experienced operator and equipment are available to perform the procedure. (See 'Tension pneumothorax' above.)

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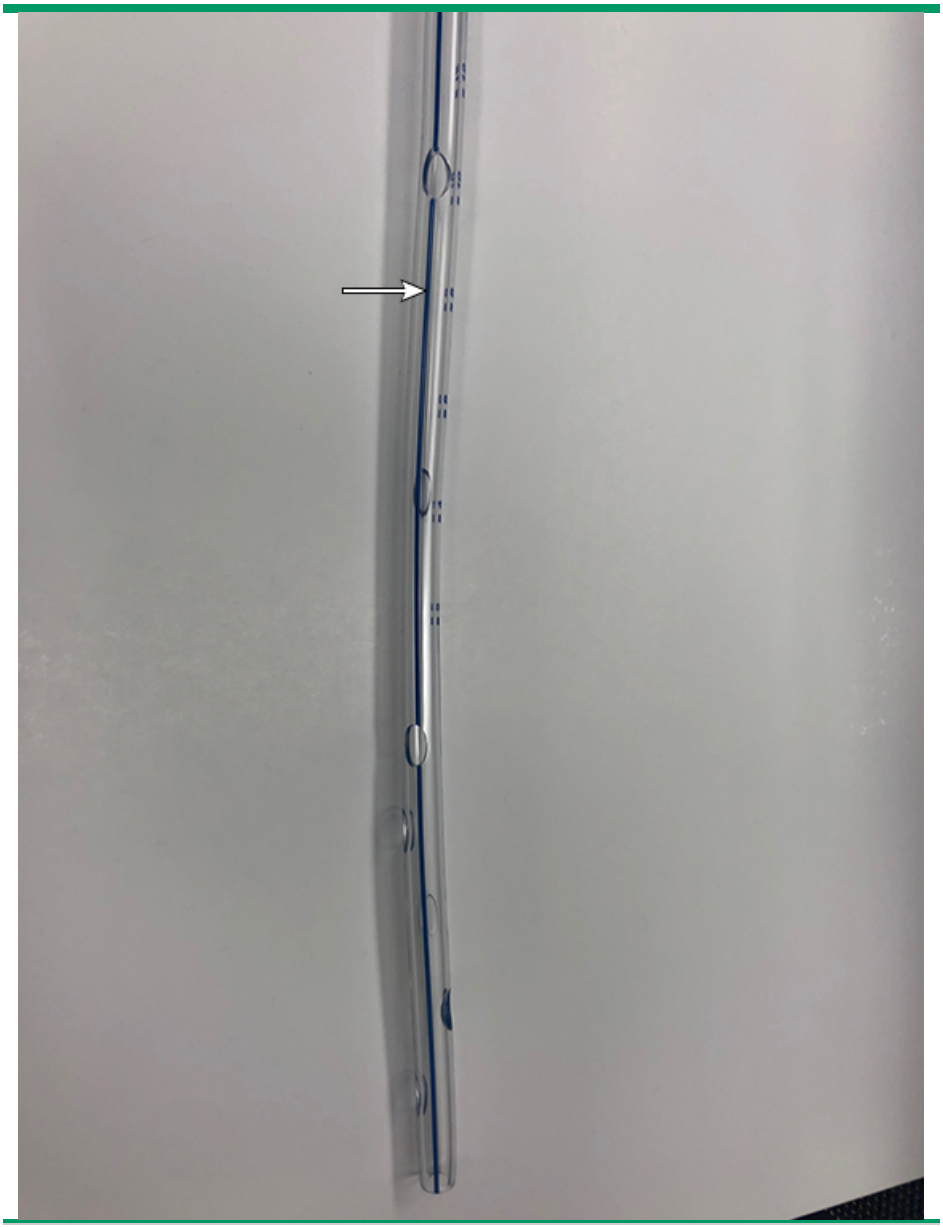
Topic 7816 Version 40.0

## GRAPHICS

### Radio-opaque marking on thoracostomy tube



The radio-opaque marker (arrow) is seen in blue.

Graphic 79934 Version 4.0

**Straight and angled thoracostomy tube**

*Courtesy of Joseph Friedberg, MD.*

Graphic 70103 Version 1.0

**Chest tube sizing in children and adults**

| Patient age | Patient weight | Air | Serous fluid | Pus | Blood |
|---|---|---|---|---|---|
| Neonate/newborn | <11 lbs (<5 kg) | 8 to 14 Fr | 8 to 14 Fr | 8 to 14 Fr | 14 to 20 Fr |
| Infant/child | 11 to 22 lbs (5 to 10 kg) | 8 to 14 Fr | 8 to 14 Fr | 12 to 18 Fr | 18 to 24 Fr |
| | 22 to 33 lbs (10 to 15 kg) | 8 to 14 Fr | 8 to 14 Fr | 12 to 18 Fr | 18 to 24 Fr |
| | 33 to 44 lbs (15 to 20 kg) | 8 to 14 Fr | 8 to 14 Fr | 18 to 24 Fr | 18 to 24 Fr |
| | 44 to 66 lbs (20 to 30 kg) | 8 to 14 Fr | 8 to 14 Fr | 18 to 24 Fr | 18 to 24 Fr |
| Preteen/teen/adult* | >66 lbs (>30 kg) | 8 to 14 Fr (percutaneous preferred)<br>24 Fr (via open) | 8 to 14 Fr (percutaneous preferred)<br>24 Fr (via open) | 24 to 32 Fr | 24 to 36 Fr |

* The size of the tube also takes into account the size of the patient relative to age, as well as body habitus.

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Graphic 117230 Version 1.0

**Management of malignant and paramalignant pleural effusions**

| Option | Comment |
|---|---|
| Observation | For asymptomatic effusions; most will progress and require therapy |
| Therapeutic thoracentesis | Prompt relief of dyspnea; most effusions recur unless underlying tumor responds to chemo- or radiotherapy |
| Chest catheter drainage only | Most effusions will recur after catheter removal |
| Chest catheter drainage with chemical pleurodesis (eg, talc slurry) | Variable response rate with 60 to 90 percent of patients responding to talc pleurodesis |
| Thoracoscopy with talc insufflation | Control of effusion with similar frequency as chest catheter drainage with talc pleurodesis |
| Long-term indwelling pleural catheter | Control of effusion and improved symptoms in most patients. Some patients may experience pleurodesis after two weeks (median 11 weeks) of catheter drainage, which allows catheter removal. |
| Long-term indwelling pleural catheter with talc instillation | Control of effusion and symptoms with successful pleurodesis in 43 percent of patients without hospitalization |
| Pleural abrasion or pleurectomy | Requires thoracoscopy or thoracotomy. Effectively controls effusions in nearly all patients. |
| Pleuroperitoneal shunt | When other options have failed or are not indicated; may be useful for chylothorax |
| Chemotherapy | May be effective in some tumor types, such as breast cancer, lymphoma, and small cell lung cancer |
| Radiotherapy | Mediastinal radiation therapy may be effective in lymphoma and lymphomatous chylothorax |

Graphic 66725 Version 3.0

## Contributor Disclosures

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