FIRST CONSULT

Spontaneous pneumothorax

Revised: undefined NaN, NaN

Summary

Description

- Air in the space between the visceral pleura and parietal pleura
- Treatment is based on degree of lung collapse and the patient's underlying pulmonary status
- There are two physiologic states of a pneumothorax: simple and tension
- There are two types of spontaneous pneumothorax: primary (no clinically apparent lung disease) and secondary to underlying pulmonary disease (most often chronic obstructive pulmonary disease [COPD])

Synonyms

Immediate action

Immediate action is required if the following signs and/or symptoms indicative of a tension pneumothorax are present:

- Minimal breath sounds on the affected side
- Trachea shifted away from the affected side
- Displaced point of maximal cardiac impulse away from the affected side
- Significant respiratory distress
- Tachycardia
- Tachypnea

- Hypotension
- Cyanosis
- Neck vein distension
- Pulsus paradoxus
- Increase in size of chest on affected side

Emergency treatment of a tension pneumothorax consists of decompressing the chest with a 14- or 16-gauge needle placed in the second intercostal space in the midclavicular line on the affected side while another person calls local emergency medical services for immediate transfer to a hospital (ideally with paramedic support). The point of this maneuver is to convert a tension pneumothorax into a simple pneumothorax. The needle is left in place until a chest tube can be placed. Otherwise the simple pneumothorax can possibly develop tension again.

Other emergency measures include:

- High-flow oxygen
- Establishment of intravenous access
- Cardiac monitoring

Urgent action

If the pneumothorax is not under tension, administer oxygen and establish IV access.

Key points

- Spontaneous pneumothorax occurs without trauma
- Symptoms include pleuritic chest pain, shortness of breath, and dyspnea on exertion
- Diagnosis is typically made by observing a pleural line on chest radiograph

Background

Cardinal features

- Dyspnea (the degree of dyspnea depends on the degree of lung collapse and underlying pulmonary disease)
- Acute onset of pleuritic chest pain on the affected side

- There are two physiologic states of a pneumothorax: simple and tension
- There are two types of spontaneous pneumothorax: primary (no clinically apparent lung disease) and secondary to underlying pulmonary disease (most often COPD)
- Hypoxemia may occur in patients with underlying lung disease, particularly advanced COPD
- Hypotension can occur if a tension pneumothorax develops because the venous return is impeded, and thus cardiac output drops. Although this is more common with a traumatic pneumothorax in the setting of chest trauma or mechanical ventilation, it can develop spontaneously, especially in asthmatic patients
- Physical findings may be subtle with only dyspnea evident (particularly in patients with COPD); in this case, diagnosis is by chest radiograph (sometimes pneumothorax is an unexpected finding)

Causes

Common causes

Common causes include the following:

- Airway diseases: suppurative lung disease (cystic fibrosis , bronchiectasis , status asthmaticus)
- Lung infections that damage lung tissue: tuberculosis , Pneumocystis jiroveciipneumonia , necrotizing pneumonias
- Lung cancer
- Interstitial lung diseases: pulmonary Langerhans cell histiocytosis, sarcoidosis , pulmonary fibrosis, pneumoconiosis (732484)(inorganic dust inhalation: asbestosis, silicosis, coal worker's lung)

The pathophysiology of pneumothorax includes:

- Rupture of subpleural, apical blebs
- Rupture of alveoli
- Tear of pleural adhesions

Note that chest trauma (either blunt or penetrating) can cause pneumothorax, but this is, by definition, not a spontaneous pneumothorax.

Rare causes

- Ehlers-Danlos syndrome
- lymphangioleiomyomatosis
- Marfan syndrome
- Use of inhalational drugs
- Intravenous drug abuse
- Catamenial pneumothorax
- Birt-Hogg-Dubé syndrome

Contributory or predisposing factors

- Height: the alveoli of tall patients are subjected to a greater distending pressure over time, which can lead to subpleural bleb formation. These blebs may rupture
- Smoking: airway inflammation, bronchiolitis, and COPD are more common in patients who smoke and are factors that can increase the risk for pneumothorax

Epidemiology

Incidence and prevalence

Incidence

- At least 20,000 new cases/year of spontaneous pneumothorax in the U.S.
- Primary spontaneous pneumothorax (with no underlying lung disease): men, 7.4/100,000/year; women, 1.2/100,000/year
- Secondary spontaneous pneumothorax (with underlying lung disease): men, 6.3/100,000/year; women, 2/100,000/year
- The incidence of primary spontaneous pneumothorax has been estimated at between 2.5 and 18.0 cases/100,000 people/year

Demographics

Age

- Primary spontaneous pneumothorax peaks in people in their early 20s
- Rarely occurs in people over age 40

- Secondary spontaneous pneumothorax occurs in older patients

Gender

Men are more commonly affected than women.

Genetics

Familial spontaneous pneumothorax is a rare disorder that predisposes to pneumothorax and is associated with a European background.

Codes

ICD-9 code

- 512.0 Spontaneous tension pneumothorax
- 512.1 Iatrogenic pneumothorax
- 512.8 Other spontaneous pneumothorax

Diagnosis

Clinical presentation

- Spontaneous pneumothorax usually develops while a patient is at rest
- Patients present with acute onset pleuritic chest pain (90%) and shortness of breath

Symptoms

Symptoms depend on the size of the pneumothorax (*ie* , the degree of lung collapse) and whether the patient has underlying lung disease. Symptoms of pneumothorax include:

- Acute-onset dyspnea
- Acute-onset pleuritic chest pain
- May have generalized malaise (3%)
- May have a low-grade fever

Signs

Signs depend on the size of the pneumothorax (*ie* , the degree of lung collapse) and whether the patient has underlying lung disease. Signs of pneumothorax include:

- Tachypnea

- Small tidal volume

If greater than 15% pneumothorax, the following signs may be detected:

- Decreased movement of the chest wall (patient may also splint the area due to pleuritic chest pain)
- Hyper-resonance to percussion over the affected area
- Decreased fremitus
- Diminished vesicular breath sounds
- Tachycardia
- Hypoxemia may occur
- Subcutaneous emphysema

Associated disorders

- Pneumomediastinum
- Pleural effusion

Differential diagnosis

Thoracic conditions to be considered in the differential diagnosis of spontaneous pneumothorax include:

- Chronic obstructive pulmonary disease (COPD) exacerbation
- Asthma exacerbation
- Pneumonia
- Pleural effusion
- Pulmonary embolus
- Myocardial infarction
- Pericarditis
- Aortic dissection
- Ruptured aneurysm

- Esophageal rupture
- Mediastinitis

Chest wall conditions to be considered in the differential diagnosis of pneumothorax include:

- Strain
- Contusion
- Herpes zoster

Intra-abdominal conditions to be considered in the differential diagnosis of pneumothorax include:

- Diaphragmatic hernia
- Subdiaphragmatic abscess
- Biliary disease
- Peptic ulcer disease

COPD exacerbation

Because secondary spontaneous pneumothorax is usually associated with COPD , it can be almost impossible to differentiate between COPD exacerbation and secondary spontaneous pneumothorax without a chest radiograph.

Features

- Dyspnea
- SaO_2below baseline (if using pulse oximetry)
- Chest pain
- Tachypnea
- May have increased sputum production (not seen with pneumothorax)

Asthma exacerbation

Asthma (in adults and children) is an inflammatory disease of the airways; serious exacerbation can be life-threatening.

Features

- History of asthma
- Dyspnea
- Shortness of breath
- Wheezing may be present (not typical in pneumothorax)

Pleurisy

Pleurisy is inflammation of the pleura, with exudation into its cavity and upon its surface. It is also called pleuritis.

Features

- Dyspnea
- Sudden onset of pleuritic chest pain
- Tachypnea with decreased tidal volume (panting)
- Pleural friction rub may or may not be heard (pathognomonic if present)
- May be associated with pleural effusion, pulmonary disease or infection, or viral syndrome

Pneumonia

Inflammation of the lungs with consolidation, usually due to infection.

Features

- Fever
- Tachypnea
- Cough
- Pleuritic chest pain
- Dyspnea
- Unilateral diminished breath sounds, egophony, increased tactile fremitus

Pleural effusion

Pleural effusion is an abnormal accumulation of fluid within the pleural space that may represent a local response to disease but is more commonly a manifestation of an underlying systemic illness.

Features

- Unilateral diminished breath sounds
- Decreased tactile fremitus
- The degree of dyspnea depends on the volume of effusion

Pulmonary embolism

A pulmonary embolism is the lodging of an embolus in a vessel, causing obstruction of the pulmonary artery.

Features

- Dyspnea
- Hypoxia
- Chest pain (may or may not be pleuritic)
- Low grade fever

Myocardial infarction

Myocardial infarction is a disorder in which necrosis of heart muscle (myocardium) occurs because of an inadequate supply of oxygen. It is usually caused by a sudden and complete or nearly complete blockade of at least one major epicardial coronary artery.

Features

- Crushing, substernal chest pain
- Pain/discomfort may radiate to arm, neck, jaw, back, shoulders, or abdomen
- Pain is not pleuritic in nature
- Dyspnea may be present

Pericarditis

Pericarditis is an inflammatory or infectious disease of the pericardial sac, which may be acute or chronic.

Features

- Constant pain over the anterior chest
- Pain may radiate to arms and back
- Pain intensifies with inspiration
- Pain is relieved by sitting up and leaning forward
- Pericardial friction rub

Aortic dissection

Aortic dissection is the entry of blood into the intima-media space of the thoracic aorta, with an intimal tear resulting in the creation of a false lumen that may extend in an anterograde or retrograde direction.

Features

- Hypertension or hypotension
- Sharp, tearing chest pain radiating to the back
- Unequal or absent pulses (between upper and lower extremities)
- Widened mediastinum on chest radiograph

Ruptured thoracic aneurysm

A ruptured thoracic aneurysm causes classic signs of cardiac tamponade—hypotension, distended neck veins, and muffled heart sounds—as the heart is compressed by blood filling the pericardial cavity.

Features

- Shock
- Hypoperfusion
- Absent lower extremity pulses

Esophageal rupture

An esophageal rupture occurs when there is a tear in the esophagus, which can be caused by cancer of the esophagus, ingesting corrosive fluids, forceful vomiting, and trauma.

Features

- Chest pain following vomiting or retching
- Retrosternal pain radiating to the back
- Hematemesis

Mediastinitis

Inflammation of the mediastinum.

Features

- Pleuritic chest pain
- Dyspnea may be present
- Swollen neck, throat pain
- Chills/fever, confusion
- Patient's history may reveal a recent upper respiratory tract infection or dental procedure

Chest wall strain

A number of muscles attach to the chest wall and may be strained by overstretching or sudden violent contractions.

Features

Chest pain:

- Worsens with movement
- May increase with inspiration
- May be elicited by palpation in area of greatest discomfort

Chest wall contusion

Contusions, or bruises, are the most frequent injuries to the chest wall.

Features

- Chest pain with palpation over the affected area
- Ecchymoses visible

- History consistent with injury

Herpes zoster

Herpes zoster is a painful unilateral dermatomal eruption, most commonly in the thoracic region, which occurs as a result of reactivation of the varicella zoster (chickenpox) virus.

Features

Chest pain:

- Precedes skin eruption
- Usually localized to the dermatome that will be affected by the skin lesions
- Often sharp, with neuropathic features (burning)

Diaphragmatic hernia

Diaphragmatic hernias are among the most common abnormalities of the gastrointestinal tract. Surgical intervention to prevent potentially lethal complications may be required in those with significant paraesophageal features.

Features

- May be congenital or traumatic
- Bowel sounds replace breath sounds on the affected side

Subdiaphragmatic abscess

Subdiaphragmatic abscess most often produces a sympathetic pleural effusion, a sterile exudate with neutrophils predominating.

Features

- May occur weeks to months after abdominal surgery
- May produce an accompanying pleural effusion
- Location of the abscess may reduce diaphragmatic movement, resulting in dyspnea

Biliary disease

A diverse spectrum of disease affects the biliary system, often presenting with similar clinical signs and symptoms.

Features

- Pain typically in the right upper quadrant
- Nausea and vomiting
- Fever
- Elevated liver function tests

Peptic ulcer disease

Peptic ulcer disease is a chronic ulceration in the gastrointestinal tract lining of the duodenum and stomach.

Features

- Epigastric tenderness
- Tachycardia
- Pallor
- Hypotension

Traumatic pneumothorax

Traumatic pneumothorax occurs in the setting of trauma. This can be major trauma, like a motor vehicle accident, or iatrogenic trauma, like that caused during a line insertion. In both cases, air enters into the pleural space. In tension pneumothorax, the air has no way to escape.

Features

- Traumatic pneumothorax can occur in both blunt and penetrating trauma to the chest
- Indications of chest trauma may include rib fractures, bruises, bullet entrance wounds, and stab wounds
- In a trauma setting there is often associated hemothorax from underlying lung injury
- Most traumatic pneumothoraces should be treated with large bore tube thoracostomy

- However, if the pneumothorax is very small (*ie* , not seen on chest radiograph or smaller than 1.5 cm), chest thoracotomy is usually not indicated unless the patient is receiving mechanical ventilation
- A patient with a large traumatic pneumothorax with continued air leakage or hemoptysis should undergo fiberoptic bronchoscopy to rule out fracture of the trachea or a major bronchus
- Indications for surgical exploration of the chest include a large volume of blood drained with initial chest tube (2 L) or persistently large output of blood (200 cc/h)

Workup

Diagnostic decision

- Diagnostic decisions are typically based on chest radiograph unless there is an obvious tension pneumothorax, in which case the decisions are based on clinical findings. However, therapeutic decisions should be focused on the patient's clinical status (respiratory rate, work of breathing, pain and splinting, oxygen saturation, degree of tachycardia, and complicating diseases such as coronary artery disease or COPD) rather than the measured size of the pneumothorax on chest radiograph. Most pneumothoraces over 20% of the lung volume will need a chest tube for re-expansion, but all should be referred
- Older patients with underlying lung disease such as COPD may not be able to tolerate small pneumothoraces
- Younger, healthy patients can often tolerate larger pneumothoraces with little pulmonary compromise, other than splinting caused by pleuritic pain

Don't miss!

If pneumothorax is considered as a potential differential diagnosis in a patient with pleuritic chest pain and dyspnea, order a chest radiograph, particularly in a smoker or a patient with diagnosed underlying lung disease. One should order an inspiratory and an expiratory radiograph, as an expiratory film accentuates small pneumothoraces.

Questions to ask

Presenting condition

- **What is bothering you most right now?** Patients with pneumothorax may not be able to differentiate between pleuritic chest pain and resultant dyspnea as the chief complaint
- **Did the pain come on quickly or slowly?** The hallmark of pneumothorax is a sudden onset of pleuritic pain
- **What does the pain feel like?** Without the medical professional suggesting terms, if the patient chooses the words 'like a knife' or 'stabbing,' then the pain is more likely to be pleuritic
- **Where is the pain?** Pneumothorax pain is usually limited to the affected side and does not radiate
- **What were you doing when your symptoms started?** Spontaneous pneumothorax typically occurs at rest. Chest wall strains and contusions are typically associated with activity
- **Does anything make the pain better or worse?** Typically, pneumothorax pain increases with a deep breath. In other differential diagnoses, position changes may relieve pain; this will not happen with pneumothorax
- **For how long have you had symptoms?** Some patients do not seek immediate treatment. The incidence of re-expansion pulmonary edema increases for patients who have chest tubes placed 3 or more days after the pneumothorax has occurred. Be careful not to rule out pneumothorax because signs and symptoms have persisted for a few days
- **Have you ever felt like this before?** This may help to differentiate COPD or asthma exacerbation in patients who have had many exacerbations in the past

Contributory or predisposing factors

Do you smoke cigarettes? Have you recently stopped smoking? Smoking increases the risk of spontaneous pneumothorax by more than 20-fold in men and nearly 10-fold in women.

Family history

Have any members of your family had a pneumothorax?Familial spontaneous pneumothorax is a rare predisposing factor for pneumothorax.

Examination

Conduct a directed physical examination:

- **Are breath sounds unequal?** Unequal breath sounds may or may not be present: if sounds are unequal, then this is highly suspicious for pneumothorax; if equal, this does not necessarily mean that pneumothorax is absent
- **Is a pleural friction rub present?** This is pathognomonic for pleurisy, not pneumothorax
- **Is there hyperresonance to percussion over the area of pleuritic pain?** Hyperresonance is consistent with pneumothorax, but may be difficult to discern in patients with COPD and significant air-trapping
- **Does the patient have evidence of a viral syndrome?** Viral syndrome is more likely to be coexistent with pleurisy, not pneumothorax
- **Are the neck veins distended?** Distended neck veins are associated with tension pneumothorax
- **Is the chest wall tender to palpation?** Chest wall tenderness is not commonly found with spontaneous pneumothorax
- **Is crepitus present?** Crepitus is commonly associated with air leak, such as pneumothorax
- **Is tachycardia present?** Though nonspecific, this is the most common physical sign, whereas the rest of the vital signs can be normal

Summary of tests

- Pulse oximetry (581998)is the fifth vital sign for those patients with pulmonary problems. Patients that potentially have a pneumothorax should be monitored with continuous pulse oximetry
- An electrocardiogram (582022)(ECG) can help to evaluate for a cardiac cause of the patient's symptoms
- Chest radiograph (582014)is the investigation of choice to confirm or make the diagnosis of pneumothorax. Sometimes pneumothorax is found on chest radiograph in the absence of symptoms. For critically ill patients who cannot be moved to the radiology department, a portable X-ray machine must be used
- Computed tomography (ZC9C037D_25C_297)(CT scan) may be used to evaluate pulmonary air leaks in critically ill patients and in unusual situations such as

loculated pneumothorax (when air is trapped in a walled-off area of the pleural cavity). It is also sensitive in finding very small pneumothoraces

- Ultrasound (1010742)may be an option for immobile patients who cannot be moved to the medical imaging department for other examinations but is most frequently used in the initial evaluation of trauma patients. A radiologist will interpret results

Order of tests

- Pulse oximetry (581998)
- Electrocardiogram (582022)
- Chest radiograph (582014)
- CT scan (ZC9C037D_25C_297)
- Ultrasound (1010742)

Tests

Tests of function

Pulse oximetry

Description

- This is the fifth vital sign for patients with pulmonary problems and a simple, automated, noninvasive way to measure the percentage of hemoglobin that is saturated with oxygen
- Patients who potentially have a pneumothorax should be monitored with continuous pulse oximetry

Advantages/disadvantages

Advantages: simple, immediate, and accurate.

Normal

Normal is 92% or higher in a patient without COPD. If the patient has COPD, then 90% to 92% may be normal for them.

Abnormal

- Desaturation on exercise by 4 percentage points

- Keep in mind the possibility of a falsely abnormal result

Cause of abnormal result

Hypoxia.

Medications, disorders, and other factors that may alter results

- A reduction in peripheral pulsatile blood flow as a result of peripheral vasoconstriction or peripheral vascular disease can make O_2saturation difficult to measure by pulse oximetry
- Venous congestion may produce venous pulsations resulting in low readings with ear probes
- Carboxyhemoglobin (hemoglobin combined with carbon monoxide) is registered as 90% oxygenated hemoglobin and 10% desaturated hemoglobin, resulting in an overestimation of saturation
- Nail polish may cause falsely low readings, but units are unaffected by jaundice, dark skin, and anemia

Imaging

Chest radiograph

Description

- The investigation of choice to confirm or make the diagnosis of pneumothorax. Sometimes pneumothorax is found on chest radiograph in the absence of symptoms
- Standard upright anteroposterior and lateral views (both inspiratory and expiratory films on the anterior/posterior view) should confirm the diagnosis
- For critically ill patients who cannot be moved to the radiology department, a portable X-ray machine must be used

Advantages/disadvantages

Advantages:

- Provides definitive diagnosis in almost all clinically relevant cases of spontaneous pneumothorax
- Inexpensive and readily available in most centers

- Low-level exposure to radiation

Abnormal

- Typically, lung and vascular markings stop before reaching the peripheral rib margin
- A fine line will be present with air on each side of the line; if the line is caused by a skin fold, air will be visible only on one side
- Air on the lateral or superior side of the pleural line will be darker than air in the lung except in patients with COPD, in whom hyperlucency may be difficult to discern

Cause of abnormal result

Air between the parietal pleura and the visceral pleura.

Medications, disorders, and other factors that may alter results

COPD may make the extrapulmonary air more difficult to discern.

Ultrasound

Description

- This procedure uses 2 to 4 MHz sound waves to image the body and chest cavity through solid tissue windows
- May be an option for immobile patients who cannot be moved to the medical imaging department for other examinations

Advantages/disadvantages

- Advantage: in areas where X-ray machines are not readily available, large pneumothoraces may be visualized. Technique is critical; the patient is in the Trendelenburg position so as to see the air best. The left chest window is through the spleen. The right chest window is through the liver
- Disadvantage: not good for imaging small pneumothoraces

Abnormal

- Looking through the liver window, one is able to see the lower aspect of the right chest, including air along the diaphragm between the pleura

- On the left, looking through the spleen, air will be seen between the pleura

Cause of abnormal result

Air between the parietal pleura and the visceral pleura.

CT scan

Advantages/disadvantages

- Advantage: a CT scan is more accurate in showing small loculated pneumothoraces (as may occur in patients with chronic lung disease such as cystic fibrosis)
- Disadvantage: cannot be used in patients who are not stable

Abnormal

Air seen within the pleural space.

Cause of abnormal result

Pneumothorax.

Special tests

Electrocardiogram

Description

12-lead ECG.

Advantages/disadvantages

Advantages:

- Simple, easy test that can be performed in the office
- Can help to evaluate for a cardiac cause for the patient's symptoms

Abnormal

- Changes that indicate cardiac pathology
- Sinus tachycardia is the most common sign encountered in this disease. Sometimes a rate-dependent right bundle branch block may develop, but the underlying rhythm is still a sinus tachycardia

Clinical pearls

- The CT scan of the chest will identify pneumothoraces that are not picked up by plain chest radiographs
- The pain associated with pneumothoraces is sudden in onset, regionally localized, present both at rest and during exertion, nonradiating, and not relieved by positional change

Consider consult

- Chest tube placement
- Recurrent spontaneous pneumothorax
- Traumatic pneumothorax

Treatment

Goals

- To maintain adequate respiratory function
- To remove air from pleural space or monitor its reabsorption

Therapeutic options

Summary of therapies

General principles of treatment:

- Supplemental oxygen (582060)is believed to hasten the resorption of air from the pleural space
- Watchful waiting is useful if the pneumothorax is small, with the caveat that there is no underlying lung pathology. Monitoring of the patient is needed, including continuous oxygen saturation readings
- Morphine is used for analgesia, sedation, to reduce splinting in painful, stable pneumothorax, or to relieve discomfort after a chest tube has been placed
- Needle/catheter decompression (1896050)of pneumothorax is usually performed by an interventional radiologist, a thoracic surgeon, or a pulmonologist; however, in a hemodynamically unstable patient (generally those with tension pneumothorax), this procedure may be performed by a non-specialist

- Simple aspiration (1137739)with a needle and small-bore catheter can be used after initial observation as an alternative to placing a chest tube for symptomatic patients with enlarging pneumothoraces
- Tube thoracostomy (582088)with insertion of small-bore catheter or traditional chest tube connected to a one-way valve or water seal drainage device to evacuate the pneumothorax
- Video-assisted thoracoscopic surgery (VATS) (1137745)may be an option for treatment of patients with persistent air leak (pneumothorax persisting for more than 4 days). It is also the preferred method for pleurodesis in patients who can tolerate a surgical procedure to prevent recurrence in patients with spontaneous secondary pneumothorax
- Pleurodesis (1137751)is used in the treatment of patients with persistent air leak and also to prevent the recurrence of pneumothorax in patients with spontaneous secondary pneumothorax. It can be performed either surgically, usually by thoracoscopy, or medically, by instilling a sclerosing agent through a chest tube. The therapeutic goal of pleurodesis is to create sufficient pleural inflammation that the visceral pleura adheres to the parietal pleura and prevents recurrent pneumothorax
- Specific treatments are stratified, with the caveat that the patient's condition is paramount. If the patient's pulmonary status is compromised as a result of comorbidities, a more aggressive approach may be indicated

Primary spontaneous pneumothorax (no underlying lung disease)

For a clinically stable patient with a small pneumothorax (less than 3 cm apex-to-cupola distance):

- Administer 100% oxygen
- Observe in the emergency room for 3 to 6 hours with oxygen saturation monitoring
- Discharge if repeat chest radiographs show no progression of the pneumothorax
- Provide explicit instructions for follow-up within 12 to 48 hours for repeat chest radiograph to document resolution of the pneumothorax
- Consider admission if the patient lives far away from definitive care or is likely to be lost to follow-up

- Aspiration of pneumothorax or insertion of a chest tube is not usually appropriate unless pneumothorax is recurrent, and then consideration should be given to pleurodesis
- If pneumothorax enlarges during the observation period, perform the appropriate procedure to evacuate air from the pleural space

For a clinically stable patient with a large pneumothorax (3 cm or more apex-to-cupola distance):

- Perform a procedure to expand the lung. Evacuate the air by simple aspiration, placement of a small-bore catheter (14 French or less), or placement of a 16 to 22 French chest tube
- The catheter or tube may be attached to a one-way valve device or traditional chest drainage unit
- Leave the drainage tube in place until the lung expands against the chest wall and air leaks resolve (repeat the chest radiograph to assess lung expansion)
- If resolution does not occur with use of a one-way valve or water seal, place the tube or catheter to suction
- Hospitalization is usually necessary
- If the patient is unwilling to be hospitalized, discharge is possible with the small-bore tube attached to a one-way valve device if the lung has re-expanded after the evacuation of pleural air (confirmed on chest radiograph); follow-up within 2 days

For a clinically unstable patient with a large pneumothorax (3 cm or more apex-to-cupola distance):

- Hospitalize
- If there is evidence of tension pneumothorax, place a needle in the second intercostal space in the midclavicular line to decompress the chest while preparing for tube thoracostomy
- Insert a chest tube (16-22 French for most patients)
- A small-bore catheter may be used, based on the patient's overall condition
- Attach the tube to a chest drainage device

- A one-way valve device may be used in patients if clinical stability can be obtained with immediate evacuation of the pleural space

Secondary spontaneous pneumothorax (underlying lung disease)

For a clinically stable patient with a small pneumothorax (less than 3 cm apex-to-cupola distance):

- Hospitalize
- Observe or treat with tube thoracostomy, depending on symptoms

For a clinically stable patient with a large pneumothorax (3 cm or more apex-to-cupola distance):

- Hospitalize
- Place a chest tube to re-expand the lung
- Attach the tube to a chest drainage device

For a clinically unstable patient regardless of the size of the pneumothorax:

- Hospitalize
- Place a chest tube to re-expand the lung
- Attach the tube to a chest drainage device

For patients with persistent air leaks:

- Observe for up to 4 days
- For air leaks persisting beyond 4 days, refer for evaluation for surgical repair and possible pleurodesis

Order of therapies

- Oxygen (582060)
- Morphine (1896037)
- Needle/catheter decompression (1896050)
- Simple aspiration (1137739)
- Tube thoracostomy (582088)

- Video-assisted thoracoscopic surgery (VATS) (1137745)
- Pleurodesis (1137751)

Efficacy of therapies

Most patients will have resolution of a spontaneous pneumothorax within 48 hours.

Medications and other therapies

Medications

Oxygen

Dose and dose information

Adult

Inhalation:

- 2 to 4 L/min
- Titrate oxygen delivery as necessary

Contraindications

- Open flames

Cautions

- Any fire or spark is highly dangerous in the presence of increased oxygen concentrations especially when oxygen is used under pressure
- Use oxygen with caution in patients with COPD, whose respiratory drive may depend on hypoxia rather than hypercarbia. These patients may lose their stimulation to breathe if too much oxygen is given. However, no patient should be allowed to desaturate to less than 88% regardless of this concern

Interactions

No known significant interactions. Use of respiratory suppressants and sedatives should be avoided.

Morphine

Pharmacology

Analgesic; mimics endogenous opioids by activating opioid receptors in the central and peripheral nervous system; inhibits release of neurotransmitters and action at postsynaptic neurons, preventing transmission of pain impulses.

Indication

Used for analgesia, sedation, reduce splinting in painful, stable pneumothorax, or to relieve discomfort after a chest tube has been placed.

Prescribing

- Prescription only
- Controlled substance category II: high potential for abuse

Dose and dose information

Adult

Intravenous or intramuscular:

- 2 to 10 mg every 4 hours, when required

Elderly

- Dose selection in the elderly should be cautious, usually starting at the low end of the dosing range. This reflects the greater frequency of decreased hepatic, renal, or cardiac function, and concomitant diseases and medications
- Use caution in the elderly; increased risk of adverse effects; clinically significant tolerance can occur in some elderly patients

Hepatic/renal impairment

- Use caution in patients with hepatic impairment; a dose reduction is necessary; increased risk of coma
- Use caution in patients with moderate-to-severe renal impairment; a dose reduction is necessary

Administration

- Dose should be started low and adjusted according to patient's response and tolerance. Maintain at minimum effective dose

- Doses should be gradually reduced before ceasing therapy after chronic use. Do not stop treatment abruptly; risk of withdrawal syndrome
- Follow parenteral administration guidelines (method and rate of administration) to prevent adverse effects

Contraindications

- Hypersensitivity to morphine or any other component
- Severe respiratory depression or coma
- Gastrointestinal obstruction including paralytic ileus
- Respiratory depression in the absence of resuscitative equipment
- Acute alcoholism
- Bronchial asthma
- Increased intracranial pressure
- Respiratory depression

Cautions

- Reports of respiratory depression. Use caution in debilitated patients and concomitant therapy with other CNS depressants. Use extreme caution in patients with respiratory disorders including chronic obstructive pulmonary disease and asthma
- Respiratory depressant effects of opioids may be exaggerated in the presence of head injuries. Use extreme caution in head injuries or raised intracranial pressure
- May obscure the diagnosis or clinical course of patients with acute abdominal conditions. Avoid in patients with gastrointestinal obstruction
- May cause spasms of the sphincter of Oddi and should be used with caution in patients with biliary tract disease including acute pancreatitis
- Risk of tolerance or psychological and physical dependence with prolonged administration. Dose should be decreased gradually before ceasing therapy to decrease risk of opioid withdrawal syndrome

- Risk of abuse. Use caution in patients with a history of substance misuse
- May cause severe vasodilation and hypotension in patients with compromised ability to maintain blood pressure. Use caution in patients with cardiovascular disorders including arrhythmias and hypotension
- Use caution in patients with hypothyroidism, Addison disease, shock, prostatic hypertrophy, alcoholism, urethral stricture, myasthenia gravis, toxic psychosis, delirium tremens, sickle cell anemia, and pheochromocytoma

Monitor

- Repiratory rate
- Heart rate and blood pressure

Adverse effects

- Common: nausea, vomiting, constipation, sedation, dry mouth, miosis, orthostatic hypotension (more common with intravenous), rash, pruritus
- Rare: respiratory depression (dose-related), seizures, tremor, hallucinations, confusion, arrhythmias, ureteric or biliary spasm, hypothermia, raised intracranial pressure, urinary retention, flushing, elevated LFTs, mood and libido changes, muscle rigidity (high doses or intravenous), euphoria, circulatory collapse, rhabdomyolysis (overdose), injection-site reactions
- Hypersensitivity reactions including anaphylaxis have been reported rarely

Interactions

- Alcohol (enhanced hypotensive and sedative effects)
- Anticholinergics (concomitant use may cause paralytic ileus)
- Anticoagulants (prolonged use may increase INR)
- Antipsychotics (enhanced hypotensive and sedative effects)
- Antivirals (enhanced respiratory and CNS depression)
- Anxiolytics (enhanced sedative effect)

- Carbamazepine (decreased serum opioid level)
- Cimetidine (increased serum opioid level)
- Ciprofloxacin (decreased serum ciprofloxacin level)
- Hypnotics (enhanced sedative effect)
- Metoclopramide (antagonized metoclopramide effect)
- Monoamine oxidase inhibitors (CNS excitation or depression; avoid concomitant use and for 14 days after stopping MAOIs)
- Naloxone (may precipitate opioid withdrawal)
- Selegiline (hyperpyrexia and CNS toxicity)
- Selective serotonin-reuptake inhibitors (enhanced sedative effect and increased risk of CNS toxicity)
- Tricyclic antidepressants (enhanced sedative effect)

Pregnancy and lactation

- Possible association between opioid use in first trimester and fetal inguinal hernia. Caution is required during labor due to risk of neonatal respiratory depression. Withdrawal effects may occur in neonates of dependent mothers
- Compatible in lactation

Pregnancy category

Pregnancy category C.

Patient and caregiver information

- Doses should be gradually reduced before ceasing therapy. Do not stop treatment abruptly; risk of withdrawal syndrome
- May cause dizziness and sedation that impairs mental coordination. If affected do not drive, operate heavy machinery, or participate in hazardous activities
- May cause orthostatic hypotension. Take care when changing from lying-to-sitting or sitting-to-standing positions

- May produce psychological and physical dependence. Consult physician before increasing dose or discontinuing. Dose should be tapered gradually before ceasing therapy to prevent withdrawal syndrome
- Patients should be advised of increased risk of constipation
- May enhance response to other CNS depressants including alcohol. Do not consume alcohol during therapy with this medication
- Report signs and symptoms of respiratory depression to physician immediately
- This medication interacts with others. Consult physician or pharmacist before taking other prescription, complementary (including herbal), or over-the-counter medicines

Surgical therapy

Needle/catheter decompression

Description of operation

- A 14- or 16-gauge needle with overlying catheter (*ie* , Angiocath) is placed in the second intercostal space in the midclavicular line to decompress the chest while preparing for tube thoracostomy. The needle should be oriented perpendicular to the skin (as angling toward the clavicle increases the risk of cannulating the subclavian vein or subcostal vessels). The needle should be inserted just above the third rib in the second intercostal space (instead of just below the second rib) to avoid hitting the subcostal vein/artery/nerve complex. A rush of air is often heard when the needle decompresses the pneumothorax, especially in the setting of a tension pneumothorax. Once proper placement of the needle is confirmed with a rush of air, the needle is removed, leaving the catheter in place
- Keep in mind that the procedure only decompresses a pneumothorax; it is not the definitive therapy. The procedure will usually be performed by a pulmonologist, ER physician, or thoracic surgeon. However, in a hemodynamically unstable patient (generally those with tension pneumothorax), this procedure may be performed by a non-specialist. This procedure is intended to temporarily stabilize an unstable patient until a chest tube can be placed

Risks/benefits

The risks of this procedure are bleeding, infection, and damage to the heart, lungs, and large vessels of the chest. The benefit is the decompression of a pneumothorax or tension pneumothorax in a hemodynamically unstable patient.

Postoperative considerations

Placement of a definitive chest tube, pleural catheter, or one-way valve is mandated after needle/catheter decompression.

Simple aspiration

Description of operation

- An 18-gauge needle with a small-bore catheter (8-9 French) is inserted into the pleural space. The catheter is threaded into the pleural space as the needle is removed. Air is manually removed with a syringe until air can no longer be aspirated
- The catheter is then attached to a one-way valve or three-way stopcock while the patient is observed
- This procedure may be considered after the initial observation period as an alternative to placing a chest tube for symptomatic patients with an enlarging pneumothorax

Risks/benefits

- Any invasive procedure presents a risk for infection and complications of bleeding and air leak. However, this procedure allows the re-expansion of the lung
- Simple aspiration is less likely to be successful than tube thoracostomy in patients with underlying lung disease

Postoperative considerations

- If air is continually aspirated indicating a persistent air leak, the patient will need to be referred for chest tube placement or thoracoscopy
- Hospitalization is usually necessary however if the patient strongly opposes hospitalization the catheter can be attached to a one-way valve and the patient can be discharged home with follow up in 24 to 48 hours

Evidence

Simple aspiration may be as effective as tube thoracostomy for first occurrence of primary spontaneous pneumothorax in hemodynamically stable patients.

- A randomized trial of 137 patients comparing manual aspiration to chest tube drainage for initial spontaneous pneumothorax found no difference in the rate of immediate or 1 week resolution. There was no difference in rate of recurrence in follow-up of 2 years [1] *Level B*
- In a case series of 60 subjects there was no difference in immediate success rate of simple aspiration when compared with intercostal tube drainage in the management of primary spontaneous pneumothorax. There was no significant difference in the early failure rate between the two interventions. Simple aspiration reduced the proportion of patients hospitalized. There was no significant difference between the two interventions with regard to the following outcome measures: duration of hospitalization, number of participants undergoing any procedure for lung pleurodesis within 1 year, and 1-year success rate [2] *Level A*
- In a randomized trial of 48 patients, 23 received needle aspiration and 25 received a mini chest tube (12-F catheter). There were no significant differences in failure rate, admission rate, pain score, satisfaction score, or complication rate. Of note, failure rate was high in both groups, 21 (91%) in the needle aspiration group and 22 (88%) in the mini chest tube group [3] *Level B*

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Tube thoracostomy

Description of operation

An incision is made in the chest wall, blunt dissection is performed, the pleural cavity is entered and a chest tube is passed. Note that this is the preferred technique for a standard chest tube. Mini chest tubes are often placed using the Seldinger technique, but the evidence suggests they are inferior to standard tubes.

Risks/benefits

Any invasive procedure presents a risk for infection and complications of bleeding and air leak. However, this procedure allows the re-expansion of the lung.

Postoperative considerations

Keeping safety in mind, patients should be ambulatory as soon as possible after the procedure.

Evidence

Simple aspiration may be as effective as tube thoracostomy for first occurrence of primary spontaneous pneumothorax in hemodynamically stable patients.

- A randomized trial of 137 patients comparing manual aspiration to chest tube drainage for initial spontaneous pneumothorax found no difference in the rate of immediate or 1 week resolution. There was no difference in rate of recurrence in follow-up of 2 years [1] *Level B*
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- In a meta-analysis that reviewed 212 articles and ultimately included 4, a total of 160 patients were assigned to needle aspiration and 171 were assigned to chest tube drainage. Chest tube drainage was superior to needle aspiration for initial resolution. However, at 1 week the success

rates of the two techniques were equal. Relapse rates were also similar between the two groups [9] *Level A*

- In a randomized trial of 48 patients, 23 received needle aspiration and 25 received a mini chest tube (12-F catheter). There were no significant differences in failure rate, admission rate, pain score, satisfaction score, or complication rate. Of note, failure rate was high in both groups, 21 (91%) in the needle aspiration group and 22 (88%) in the mini chest tube group [10] *Level B*

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Video-assisted thoracoscopic surgery (VATS)

Description of operation

An endoscope is introduced into the pleural space allowing inspection of the pleural surface and collection of fluid and/or tissue samples.This procedure can be used to perform minimally invasive thoracic surgery such as bleb resection or pleurodesis and can also be used to carry out diagnostic biopsy.

Risks/benefits

- Any invasive procedure presents a risk for infection and complications of bleeding and air leak
- Patients must be able to tolerate a surgical procedure with anesthesia and potential single lung ventilation
- Recurrence rate of pneumothorax is lower for patients who undergo thorascopically assisted surgical pleurodesis compared to patients who undergo medical pleurodesis through a chest tube

Postoperative considerations

When video-assisted thoracoscopy is used for pleurodesis in patients with recurrent effusion, postoperative drains are used when drainage becomes minimal and no air leak is present. Serial chest radiographs allow evaluation of results.

Evidence

Video-assisted thoracoscopic surgery is effective to prevent recurrence of spontaneous pneumothorax in patients with a second spontaneous pneumothorax or persistent air leak.

- In two case series of 44 and 109 patients with initial or recurrent primary spontaneous pneumothorax, patients underwent VATS with removal of blebs and bullae followed by pleurodesis. After 18 to 53 months of follow-up, recurrence was limited to 5% [4] , [5] *Level C*
- In a case series, 72 patients with recurrent spontaneous pneumothorax or persistent air leak after chest tube placement underwent VATS with resection of blebs and mechanical pleurodesis. Recurrence was limited to 5.5% after a mean of 42 months of follow-up [6] *Level C*

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Pleurodesis

Description of operation

- This procedure may be performed either surgically or medically. The goal of all forms of pleurodesis is to cause the visceral pleura to adhere to the parietal pleura, obliterating the pleural space and preventing recurrent pneumothorax
- Surgical pleurodesis is performed by mechanical abrasion with gauze or another abrasive through an incision or port in the chest wall to create

adhesions and cause fibrotic symphysis of the parietal and visceral pleurae

- Medical pleurodesis is performed by instilling into the pleural space a pro-inflammatory substance, such as talc, bleomycin, or tetracycline, with the same goal of inflammatory symphysis

Risks/benefits

- Surgical pleurodesis is generally more successful than chemical pleurodesis. However, patients with multiple comorbidities may not be surgical candidates
- The use of talc for chemical pleurodesis is associated with a small risk for acute respiratory distress syndrome, and as a result, other agents are preferred

Postoperative considerations

Pleurodesis is unlikely to be successful in patients in whom the lung remains partially collapsed. It may instead cause thickening of the pleura and complicate future expansion of the lung.

Evidence

Chemical pleurodesis is a reasonable alternative to VATS in patients who decline surgery or who are not good surgical candidates.

- In a randomized, controlled multicenter trial of 229 patients with primary and secondary pneumothorax who required chest tube drainage, instillation of tetracycline for pleurodesis was compared to chest tube drainage alone. Recurrence rate in the control group was significantly higher (40.7%) compared with the pleurodesis group (25%) with a follow-up period of 1 year [7] *Level A*
- In a randomized trial of 89 patients with initial spontaneous pneumothorax, chest tube drainage was compared to chest tube and pleurodesis with instillation of tetracycline or talc. At follow-up of 4 to 6 years, recurrence rate in the talc pleurodesis group was significantly lower (8%) than the tetracycline group (13%) or the chest tube only group (36%) [8] *Level B*

- In a retrospective study of 93 patients treated with chest tube drainage, recurrence rate at approximately 1 year was significantly lower in the patients who underwent pleurodesis with minocycline (12.9%) compared to those who had drainage alone (33%) [9] *Level C*

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Clinical pearls

Let patients assume whatever position is most comfortable for them. Often, a supine position makes it more difficult to breathe.

Never

If for some reason the patient needs to be artificially ventilated with a bag valve mask, then a simple needle decompression in the chest wall will suffice to prevent a tension pneumothorax while bagging the patient. Positive-pressure ventilation such as ventilating a patient with a bag and mask without needle decompression will potentially produce this complication.

Management in special circumstances

Coexisting disease

- Management decisions should be based on the patient's condition, not the size of the pneumothorax
- Patients with COPD and spontaneous pneumothorax may not be able to tolerate even small amounts of extrapulmonary air and may need more aggressive treatment than would a patient with normal lung function

Special patient groups

- Elderly: minor, unrecognized trauma in the elderly can cause pneumothorax from rib fracture

- Catamenial pneumothorax: periodic, recurrent pneumothorax associated with the menstrual cycle, likely secondary to ectopic endometriosis tissue in the lung, may require further investigation and treatment
- Recurrent pneumothorax: patients with recurrent spontaneous pneumothorax warrant an intervention to prevent future recurrences even if the current pneumothorax is small

Patient satisfaction/lifestyle priorities

A patient can be considered for outpatient management with a chest tube if the patient:

- Does not have comorbidities
- Is not cognitively impaired
- Is able to get to the hospital emergency room by ambulance if the condition deteriorates
- Has a telephone and can call for help or call to ask questions of the healthcare provider
- Can return to the hospital or healthcare provider for follow-up

Patients in rural areas, distant from definitive care if a complication occurs, should be admitted.

Patient and caregiver issues

Impact on career, dependants, family, and friends

- If the patient is significantly symptomatic, a short hospital stay may be required for chest tube evacuation of intrapleural air
- Spontaneous pneumothorax is self-limiting

Questions patients ask

Why did this happen to me? Is there anything I could have done to prevent it?Spontaneous pneumothorax is more common in tall people, patients with chronic obstructive pulmonary disease (COPD), bullous lung disease or necrotizing infections, and people who smoke (or have just recently quit). Otherwise, there may be no definitive explanation.

Follow-up

Follow-up will be dictated by the individualized treatment and the presence of any

comorbidities:

- A patient who is stable with a small pneumothorax may be observed for 3 to 6 hours and then sent home, to return within 12 to 48 hours for a repeat chest radiograph
- If a patient is admitted to hospital for chest tube evacuation of the pneumothorax, follow-up may be one week after hospital discharge

Plan for review

The timing for follow-up after treatment will depend on the patient's condition, the size of the pneumothorax, and the presence of any complications or comorbidities. All patients treated for pneumothorax should have follow-up to make sure they have recovered and the pneumothorax has completely resolved.

Ask for advice

Question 1

After diagnosing a small pneumothorax, are there any therapeutic measures that I need to employ other than giving oxygen?

Answer 1

No. Oxygen is usually sufficient if the symptoms are mild. Sometimes it may be necessary to treat the patient's pain with analgesics, but do so with caution in patients with poor respiratory reserves because many analgesics depress respiratory drive.

Question 2

If it is unclear whether there is definitely a pneumothorax on plain anterior/posterior chest radiograph, what other tests or examinations should be used to make the diagnosis?

Answer 2

The patient may have the radiograph retaken with a full expiratory effort. If the radiograph it is still equivocal, then a computed tomography (CT) scan may be employed, especially if there is underlying lung pathology.

Question 3

If the pneumothorax is small and there is no underlying pathology, how long do I have to wait between subsequent films, especially if the patient doesn't want to go to the hospital?

Answer 3

Unfortunately, there are no rigorous studies to answer this question; however, it is general practice to wait 3 to 6 hours.

Summary of evidence

Evidence

Simple aspiration may be as effective as tube thoracostomy for first occurrence of primary spontaneous pneumothorax in hemodynamically stable patients.

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Video-assisted thoracoscopic surgery is effective to prevent recurrence of spontaneous pneumothorax in patients with a second spontaneous pneumothorax or persistent air leak.

- In two case series of 44 and 109 patients with initial or recurrent primary spontaneous pneumothorax, patients underwent VATS with removal of blebs and bullae followed by pleurodesis. After 18 to 53 months of follow-up, recurrence was limited to 5% [4] , [5] *Level C*

- In a case series, 72 patients with recurrent spontaneous pneumothorax or persistent air leak after chest tube placement underwent VATS with resection of blebs and mechanical pleurodesis. Recurrence was limited to 5.5% after a mean of 42 months of follow-up [6] *Level C*

Chemical pleurodesis is a reasonable alternative to VATS in patients who decline surgery or who are not good surgical candidates.

- In a randomized, controlled multicenter trial of 229 patients with primary and secondary pneumothorax who required chest tube drainage, instillation of tetracycline for pleurodesis was compared to chest tube drainage alone. Recurrence rate in the control group was significantly higher (40.7%) compared with the pleurodesis group (25%) with a follow-up period of 1 year [7] *Level A*

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Outcomes

Prognosis

- Patients with chronic obstructive pulmonary disease (COPD) have a 3.5-fold increase in relative mortality when a spontaneous pneumothorax occurs
- Mortality in patients with COPD and spontaneous pneumothorax ranges from 1% to 17%
- Pneumothorax is recurrent in 25% to 50% of patients with spontaneous pneumothorax

Factors affecting prognosis

- Recurrence rates are higher for secondary spontaneous pneumothorax (45%) than primary pneumothorax (35%) over 3 to 5 years

- Recurrence is likely in tall patients, or patients who continue to smoke
- Following one recurrence, the likelihood of a second recurrence is 50%. After a second recurrence, the risk of a third event is approximately 80%

Clinical pearls

- If the patient returns after having been treated via tube thoracostomy with symptoms of fever, repeat the post-treatment chest radiograph. One must entertain the diagnosis of empyema
- Also included in the differential diagnosis is lung abscess or lung cyst. This usually occurs after trauma, developing within the lung parenchyma of an airspace that does not connect with the pleural space, does not drain, and subsequently becomes infected
- In addition, the patient may become symptomatic from a chylothorax, which may not develop immediately but rather may develop 10 days to months afterward
- In general, much can happen after chest tube drainage, including recurrence of the pneumothorax
- A long-term complication of fibrothorax (which develops as a result of clots in the pleural space that could not be non-surgically drained) is a permanent and significant cause of a decrease in functional lung capacity. As stated above, this clot may also serve as a nidus for infection

Progression of disease

Therapeutic failure

If air leak is not resolved, observe for no longer than 4 days, after which thoracoscopy is preferred over limited thoracotomy to seal the leak.

Recurrence

For patients with primary spontaneous pneumothorax:

- Thoracoscopy may be performed to surgically seal the lung in order to prevent recurrence, particularly in patients who scuba dive or fly, in whom a recurrence could be dangerous
- Patients who wish to avoid surgery (or who present with poor surgical risk) may undergo sclerosis of the pleural space with installation of sclerosing agents through the chest tube

- Pleurodesis is unlikely to be successful in patients in whom the lung remains partially collapsed. It may instead cause thickening of the pleura and complicate future expansion of the lung

For patients with secondary spontaneous pneumothorax:

- Intervention to prevent a second pneumothorax is indicated for these patients because a second pneumothorax can be lethal
- Thoracoscopy is preferred, but muscle-sparing axillary thoracotomy may be done. Patients who wish to avoid surgery (or who present with poor surgical risk) may undergo sclerosis of the pleural space with installation of sclerosing agents through the chest tube (doxycycline and talc slurry are preferred; bleomycin is rarely acceptable)
- Some patients with secondary spontaneous pneumothorax, such as those with cystic fibrosis or lymphangioleiomyomatosis, are candidates for lung transplantation. It is preferable not to conduct complete obliteration of the pleural space in those patients who may undergo lung transplantation because the surgery is much more difficult if the lung cannot easily be removed

Deterioration

Patients with borderline pulmonary function at baseline may require mechanical ventilation if spontaneous pneumothorax develops into a bronchopleural fistula and/or leads to respiratory failure.

Clinical complications

- Infection from chest tube placement
- Bleeding related to chest tube insertion procedure
- Persistent air leak or bronchopleural fistula
- Re-expansion pulmonary edema

Consider consult

Refer if the patient develops any respiratory distress, fever, or bleeding of the wound site.

Prevention

There is little that can be done to prevent spontaneous pneumothorax. Smoking is the single controllable risk factor that has been identified.

Primary prevention

Modifiable risk factors

Tobacco

Smoking contributes to weakening of the lung tissue and formation of bullae that can rupture, leading to pneumothorax.

Medication history

Use of intravenous drugs or inhalational drugs can increase the risk of spontaneous pneumothorax.

Resources

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Guidelines

The American College of Chest Physicians (http://www.chestnet.org/accp/)has produced the following:

- Baumann MH, Strange C, Heffner JE, et al; AACP Pneumothorax Consensus Group. Management of spontaneous pneumothorax: an American College of Chest Physicians Delphi consensus statement (http://www.chestjournal.org/cgi/content/full/119/2/590). Chest. 2001;119:590-602

The British Thoracic Society (http://www.brit-thoracic.org.uk/)has produced the following:

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