

# PNEUMOTHORAX

## (AIR IN THE PLEURAL SPACE, THE SPACE BETWEEN THE CHEST WALL AND THE LUNGS)

### BASICS

#### OVERVIEW

- Air accumulation in the pleural space (the space between the chest wall and the lungs); it is categorized as “traumatic” or “spontaneous” and “closed” or “open”
- “Traumatic” pneumothorax—air accumulates in the pleural space, following some type of trauma (such as being hit by a car)
- “Spontaneous” pneumothorax—air accumulates in the pleural space in the absence of trauma; it is a “closed” pneumothorax; spontaneous pneumothorax is primary if it occurs in the absence of underlying lung disease; secondary if associated with underlying lung disease
- “Closed” pneumothorax—no defects (such as a puncture) in the chest wall
- “Open” pneumothorax—defect (such as a puncture) in the chest wall, resulting in communication of the pleural space (the space between the chest wall and the lungs) with the atmosphere
- “Tension” pneumothorax—air is transferred into the pleural space (the space between the chest wall and the lungs) during inspiration and it becomes trapped, condition creates a one-way transfer of air into the pleural space

#### SIGNALMENT/DESCRIPTION of ANIMAL

##### **Species**

- Dogs and cats

##### **Breed Predilection**

- Spontaneous pneumothorax—more common in large, deep-chested dogs; Siberian huskies may be more susceptible than other dog breeds

#### SIGNS/OBSERVED CHANGES in the ANIMAL

- Traumatic pneumothorax—evidence of recent trauma
- Spontaneous pneumothorax—may have signs of lung disease; usually sudden (acute), but can have a slowly progressive onset
- Rapid breathing (known as “tachypnea”)
- Difficulty breathing (known as “dyspnea”)
- Standing with the elbows away from the body in an attempt to increase lung capacity (known as “orthopnea”)
- Shallow, rapid abdominal breathing common
- Rapid heart rate (known as “tachycardia”)
- Reduced lung sounds near the back—can be difficult to appreciate in animals with severe difficulty breathing

##### **Traumatic Pneumothorax**

- Other signs of trauma, including shock
- May or may not have evidence of chest trauma
- Open pneumothorax—obvious chest-wall trauma present
- Pale gums and other moist tissues of the body (mucous membranes); obvious bluish discoloration of the skin and mucous membranes of the body caused by inadequate oxygen levels in the red-blood cells (known as “cyanosis”) in severe cases
- Air under the skin (known as “subcutaneous emphysema”) in some cases with air in the mediastinum (the mediastinum is the center portion of the chest that contains the heart and other organs [except for the lungs]; condition is known as “pneumomediastinum”) and/or trauma to the windpipe or trachea

#### CAUSES

- Traumatic pneumothorax—blunt trauma; penetrating chest injuries; penetrating injuries to the neck; following medical procedure to tap the chest (known as “thoracocentesis”); following surgical incision into the chest (known as “thoracotomy”); perforation of the esophagus (the tube running from the throat to the stomach); injury to the windpipe (trachea) following endotracheal intubation during anesthesia/surgery
- Spontaneous pneumothorax—condition characterized by enlarged or dilated airspaces (known as “bullous emphysema”) is most common cause in dogs; migrating foreign body in the lung; lung cancer, lung abscess; feline asthma; pneumonia; fungal lung nodules (known as “mycotic pulmonary granulomas”); lung disease caused by parasites (such as *Paragonimus*); blister or bubble-like structures in the lungs (known as “pulmonary bullae”); large air-filled or fluid-filled sacs in the lungs (known as “pulmonary blebs”)

#### RISK FACTORS

- Trauma
- Tapping the chest, to withdraw fluid or air (thoracocentesis)

- Surgical incision into the chest (thoracotomy)
- Overinflating the cuff of endotracheal tube, during anesthesia/surgery
- Lung disease
- Migrating grass awns

## TREATMENT

### HEALTH CARE

- Inpatient care, until air accumulation has stopped or has stabilized
- Animals with breathing difficulty should have the chest tapped (thoracocentesis) to remove a maximal amount of air
- Provide oxygen therapy, until patient is stabilized
- Pain relief (analgesia) with an opioid-type drug, if significant injuries following trauma
- Tapping the chest (thoracocentesis) can be performed with an intravenous catheter attached to an extension set and stopcock or via a butterfly needle; no need to perform thoracocentesis on animal that is not having breathing difficulties; if large open chest wound—cover as cleanly as possible with airtight bandage (use of sterile lubricant/ointment around periphery of wound); must be accompanied by chest-tube placement; will require surgical closure of chest wound, once animal is stable
- Intravenous fluids required in most cases of trauma, but may not be indicated in cases of spontaneous pneumothorax
- Chest-tube maintenance—ensure all connections are air-tight (cable ties are excellent for securing connections); ensure that tube is attached to animal at two points to reduce chance of inadvertent tube removal; clean tube site and change dressing once daily—do not allow animal to chew at chest tube

### ACTIVITY

- Strict rest for at least a week following resolution of pneumothorax, in an effort to minimize the chance of recurrence

### SURGERY

- Establishing an opening into the chest with a tube (known as “tube thoracostomy”)—use if unable to stabilize with tapping the chest (thoracocentesis) or repeated thoracocentesis procedures are required for continued pneumothorax (air in the space between the chest and the lungs); chest-tube placement (under local or general anesthesia)—chest tube is passed into pleural space, and a purse-string suture is placed in the skin and the tube is secured with ‘Roman sandal’ suture pattern; chest X-rays should be performed after chest-tube placement
- If air is accumulating rapidly in the space between the chest wall and lungs (pneumothorax)—use continuous chest-tube suction; if pneumothorax is not severe or is resolving—use intermittent chest-tube aspiration
- In emergency situation of life-threatening tension pneumothorax (in which air is transferred into the pleural space [the space between the chest wall and the lungs] during inspiration and becomes trapped, creating one-way transfer of air into the pleural space)—consider emergency surgical incision into the chest (known as “thoracotomy”) to convert problem to an “open pneumothorax;” animal then can be intubated with an endotracheal tube and breathing can be controlled by an assistant or by a ventilator, until the animal is stabilized
- Open traumatic pneumothorax—surgery as soon as patient is stable
- Closed traumatic pneumothorax—rarely requires surgical intervention
- Spontaneous pneumothorax—early surgical intervention recommended in dogs; exploratory surgical incision into the chest (thoracotomy) often performed to allow visualization of the lungs, to determine location of the air leakage
- Evaluation of the space between the chest wall and lungs with an endoscope (a special lighted instrument; procedure known as “thoracoscopy”—may allow visualization of local lesion; allows instillation of substances to cause formation of scar tissue across the pleural space (the space between the chest wall and the lungs) to eliminate the space where air has been collecting (procedure is known as “pleurodesis”)
- Removal of part or all of a lung may be necessary for localized lesions; traumatic lacerations may be sutured
- Pleurodesis (to cause formation of scar tissue across the pleural space [the space between the chest wall and the lungs] to eliminate the space where air has been collecting) with mechanical abrasion of the pleura (lining of the chest) or instillation of a substance intended to cause inflammation in the pleural space

## FOLLOW-UP CARE

### PATIENT MONITORING

- Breathing rate—increased rate suggests recurrence of pneumothorax (free air in the space between the chest wall and lungs)
- Repeated chest X-rays to attempt to determine amount of air accumulating
- Pulse oximetry (a means of measuring oxygen levels in blood), if breathing room air can help determine oxygenation status; arterial blood gases (measurements of oxygen and carbon dioxide levels in arterial blood) give the best evaluation of oxygenation status, if lung disease is present
- Rate of air removed from chest through the chest tube

### PREVENTIONS AND AVOIDANCE

- Keep pets confined—less likely to be injured

### POSSIBLE COMPLICATIONS

- Death from low levels of oxygen in the blood (known as “hypoxemia”) and impairment of the circulation or heart and blood vessels (known as “cardiovascular compromise”)
- Development of fluid build-up in the lungs following re-expansion of the lungs after tapping the chest (thoracocentesis) to remove air (condition known as “re-expansion pulmonary edema”) in cats
- Incorrect placement of chest tube—injury to other organs of the body, such as lung-lobe laceration, heart puncture, diaphragmatic laceration, liver trauma
- Infection of the lining of the chest (known as “pleural infection”) from tapping the chest (thoracocentesis) or presence of the chest drain

#### **EXPECTED COURSE AND PROGNOSIS**

- Traumatic pneumothorax—if chest trauma is not severe, the prognosis is good with tapping the chest to remove the air (thoracocentesis) and/or chest-drain placement
- Traumatic pneumothorax—with severe chest trauma, patient can deteriorate despite all efforts to stabilize it, usually because of severe bruising of the lungs and/or bleeding into the lungs
- Spontaneous pneumothorax—prognosis depends on underlying cause; if a single, localized lesion can be removed surgically, prognosis is good; if unable to locate lesion or generalized lung disease is present—prognosis is poor; with surgery, recurrence rate is decreased and the time interval before recurrence is increased

#### **KEY POINTS**

- Traumatic pneumothorax—possibility of a chest tube and need for hospitalization; some animals may require surgery
- Spontaneous pneumothorax—recommend early surgical intervention in most cases in dogs; possibility of underlying lung disease that may make resolution challenging and recurrence possible—even with surgical incision into the chest (thoracotomy), the source of the leaking air (pneumothorax) may not be found

