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# Thoracocentesis

**T**horacocentesis is a technique used to remove fluid or air from the pleural space. It can be used as both a diagnostic tool and a therapeutic intervention.

Thoracocentesis aids in the diagnosis of many conditions including:

- Pyothorax
- Hemothorax
- Pneumothorax
- Chylothorax
- Bilothorax (a rare complication following trauma or liver surgery)<sup>1</sup>
- Malignant effusions
- Effusions secondary to primary heart disease.

Since the procedure may need to be performed differently depending on whether a patient presents with either a large or small change in pleural space volume, 2 different techniques are described.

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## What You Will Need

### To obtain a diagnostic sample

- **Cats and small dogs:** 19- to 23-gauge butterfly catheter, 3-way stopcock, 3-ml syringe, and 12- to 20-ml syringe
- **Medium or larger dogs:** 20- to 22-gauge 1.5- to 2.5-inch needle attached to an extension set, 3-way stopcock, 3-ml syringe, and 12- to 20-ml syringe

### To perform therapeutic centesis

- **Cats and small dogs:** 20- to 22-gauge over-the-needle catheter attached to an extension set, 3-way stopcock, and a 20- to 60-ml syringe
- **Medium or larger dogs:** 14- to 16-gauge over-the-needle catheter attached to an extension set, 3-way stopcock, and a 20- to 60-ml syringe

### For sample collection

- EDTA-containing glass tube
- Culturette
- Sterile glass collection tube



## Risks & Contraindications

### Risks

- Iatrogenic pneumothorax
- Hemothorax
- Intercostal artery laceration
- Lung laceration

### Contraindications

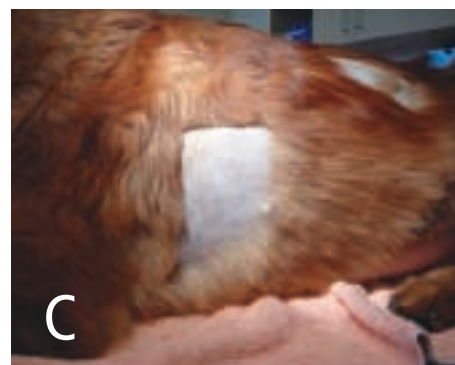
- Severe coagulopathies
- Thrombocytopenia
- Only a small volume of fluid or air present

### PROCEDURE PEARL

List the materials needed for thoracocentesis on an index card. During an emergency situation, your assistant can prepare the necessary supplies while you are evaluating the patient.

**STEP BY STEP THORACOCENTESIS**

**Preparation**



**1** Most patients can be placed in sternal recumbency, which allows fluid to be positioned ventrally and air to be trapped dorsally (**A and B**). However, careful consideration should be given to compromised patients (eg, those with severe effusions or pneumothorax); they may be more comfortable standing, which allows the sternum to move freely and elbows to be abducted to accommodate greater chest excursions.

Sterile technique should be used. Shave the hair over the proposed site of puncture, keeping a 3-inch square area around the site (**C**). Disinfect the area with an iodophor- or chlorhexidine-containing antiseptic. For pneumothorax, aspirate between the 7th and 9th intercostal spaces in the dorsal third of the thoracic cavity. For fluid, aspirate between the 7th and 8th intercostal spaces in the ventral third of the thoracic cavity. (You will need to take care to avoid lacerating the internal thoracic artery that runs craniocaudally near the costochondral junction.)

**PROCEDURE PEARL**

If inexperienced, clip a much larger area of hair (generally from both sides of the chest wall): if you don't obtain an adequate sample from one site on the chest wall, this wide area allows you to move easily to a different rib space or another site.

**Sedation**

Sedation can be used in fractious patients, but the procedure is generally well tolerated with or without a local block. Opioids (see below) or an opioid/benzodiazepine combination (low end of opioid dose range with either diazepam [0.2 mg/kg IV] or midazolam [0.1 mg/kg IV]) can typically be administered safely to patients that require sedation. The opioid and benzodiazepine should be administered in separate syringes.

**Opioid doses**

- **Oxymorphone:** Dogs & cats—0.02 mg/kg SC or IM
- **Buprenorphine:** Dogs & cats—0.005 to 0.02 mg/kg SC or IM
- **Hydromorphone:** Dogs & cats—0.05 to 0.1 mg/kg SC or IM
- **Butorphanol:** Dogs & cats—0.2 to 0.4 mg/kg SC or IM

EDTA = ethylenediamine tetraacetic acid

## Local Block Application

**2** For diagnostic thoracocentesis, I apply a local block, but for most patients that need therapeutic thoracocentesis, local block application should be skipped in the interest of alleviating respiratory distress immediately.

Selecting the appropriate length and gauge needle attached to a syringe, draw up the necessary amount of lidocaine based on the patient's size (2 to 8 mg/kg maximum total infiltrative dose; 0.2 ml of 2% lidocaine should be more than sufficient for an average-sized cat and the maximum feline dose should not exceed 2 mg/kg).

Insert the needle through the skin and intercostal muscles, perpendicular to the body wall, being careful to avoid the caudal aspect of the rib in front of the selected intercostal space.

Slow down as you approach the parietal pleura and alternate a small amount of positive and negative pressure on the plunger of the syringe while advancing the needle toward the pleural space.

Once pleural fluid or gas is obtained, note the depth of the needle, then withdraw it. Infuse the local anesthetic as you withdraw the needle through the intercostals and the skin.

### PROCEDURE PEARL

Make sure the catheter and needle system stay firmly together while advancing the system through the chest wall into the pleural space.

### PROCEDURE PEARL

Ultrasound can be used to find small pockets of effusion and may be a great adjunct to diagnostic thoracocentesis.



## Diagnostic Thoracocentesis

**3** Grasp the appropriate collection set and rest part of your hand or several fingers against the animal's lateral thoracic wall. This will help stabilize your hand in the event of sudden patient movement and decrease the incidence of iatrogenic trauma to the underlying lung.

Insert the needle perpendicular to the skin and advance it to the appropriate depth as was previously noted when infusing the local anesthetic (A). As you advance the needle, apply a small amount of negative pressure using a 3-ml syringe. Once fluid is obtained, reorient the bevel of the needle ventrally or laterally so that it sits parallel to the thoracic wall. This will prevent laceration of the lungs.

Collect fluid into EDTA and red-topped tubes for analysis. Once the fluid sample has been obtained, attach a length of extension tubing, 3-way stopcock, and large (12- to 20-ml) syringe to evacuate as much fluid from the thorax as is possible (B). Occasionally, pieces of fibrin, pleural tissue, or blood clots may obstruct the system. If this occurs, apply a small amount of positive pressure to the syringe plunger to clear the tip of the needle. Alternatively, apply a smaller syringe to the system to decrease excessive suction at the catheter tip. Ideally, no more than 5 cm of negative pressure should be applied to the syringe to avoid this complication.

Once you have obtained an appropriate sample, withdraw the needle parallel to the chest wall, but take care to avoid the caudal aspect of the rib. Record the total volume of material removed. Postprocedural radiographs are recommended.

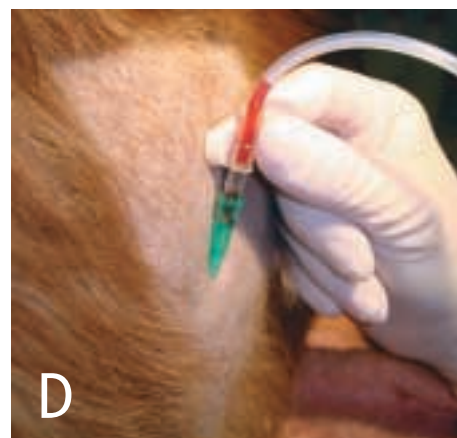
### PROCEDURE PEARL

Many patients have pleural space diseases detected on chest radiographs, which can also be a great help in determining where to perform a diagnostic thoracocentesis. Keep in mind that fluid and air can shift, however, since lateral radiographs are taken in lateral recumbency.

### PROCEDURE PEARL

Place the thumbnail of your nondominant hand over the caudal aspect of the rib in front of the intercostal space you selected to act as a landmark and also to remind you to stay away from the intercostal vessels that run along the caudal aspect of the rib.

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## Therapeutic Thoracocentesis

**4** Patients needing this procedure are typically dyspneic and may present with loss of airway sounds in the chest, dullness (fluid) or tympany (gas) upon percussion of the chest wall, rapid shallow respirations, and unwillingness to lie down. A quick ultrasound of the chest may give you useful information and locate pockets of thoracic effusion with minimal stress to the patient. Chest radiographs are the best way to evaluate the extent of pleural disease, but they may take valuable time (ultimately resulting in patient demise). Please use your best clinical judgment when deciding your course of action with these patients.

To begin, grasp the over-the-needle system. Rest your other hand or several fingers com-

fortably against the thoracic wall. Grasp the shaft of the catheter near the tip with the thumb and index finger of your nondominant hand.

Have an assistant connect the extension set with the 3-way stopcock and syringe to the end of the needle. Insert the needle/catheter system through the skin and intercostal muscles perpendicular to the thoracic wall (A).

Advance the needle to the predetermined depth (Step 2) or until you typically feel a "pop," which indicates puncture of the pleura (B). Have an assistant apply 1 to 4 mm of negative pressure on the plunger of a 20- to 60-ml syringe as you advance the needle into the pleural space. Once fluid or air is aspirated, advance the needle 3 to 5 mm further into the pleural space; then direct the bevel of the needle or catheter parallel to the thoracic wall to avoid lacerating the underlying lung.

Push the catheter off the needle in the direction that you want to aspirate (C); then remove the needle and reattach the extension set system to the end of the catheter. The tip of the needle or catheter can be moved dorsally to remove air, and ventrally to remove fluid (D).

### PROCEDURE PEARL

If the catheter does not advance smoothly, you may not have it completely in the pleural space. Back the system out and hold it perpendicular to the chest wall. Advance the system under minimal suction until fluid or gas is obtained. This time advance the system just a little further into the chest so the tip is completely in the pleural space. Redirect and advance the catheter portion. If this doesn't work, then you may have barbed the tip on the way in. Remove the whole system and begin again with a new system.

### PROCEDURE PEARL

If you start to obtain frothy material at any time during the procedure, you should withdraw the system quickly. Frothy material may indicate a punctured lung lobe and air in the chest.

As described in the previous section, collect appropriate samples, drain the chest, and then remove the catheter carefully. Record the volume of material obtained and take postprocedural thoracic radiographs. ■

See Aids & Resources, back page, for references, contacts, and appendices.

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