

## CHAPTER 19

# Fine Needle Aspirates

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**F**ine needle aspiration (FNA) is an extremely useful technique that is easily performed in the clinical setting. FNA provides samples for both cytological analysis and microbiological culture and is a valuable tool in the diagnosis of many intrathoracic disease processes. Although the procedure is commonly used to obtain samples from discrete thoracic wall and mediastinal masses, FNA is also indicated to characterize pulmonary nodules and mass lesions, as well as diffuse diseases of the pulmonary interstitium.

Fine needle aspiration is usually performed after prior diagnostic tests (generally thoracic radiographs or ultrasound) have identified intrathoracic disease. The yield of FNA is high, with published reports in the veterinary literature documenting that a diagnostic sample is obtained in approximately 90% of cases with intrathoracic disease.<sup>1-4</sup> These results are consistent regardless of the type of lesion or the method used in performing the procedure. Because it is relatively noninvasive, FNA may be performed in lieu of (or in conjunction with) needle core biopsy or surgical biopsy of mass lesions. In addition, the procedure may also supplement transtracheal, endotracheal, or bronchoalveolar lavage in animals with regional, diffuse, or disseminated pulmonary interstitial disease.

In addition to excellent diagnostic yield, the diagnostic accuracy of fine needle aspiration is also high in animals with intrathoracic disease. In a study of ultrasound guided aspiration of focal pulmonary parenchymal lesions, sensitivities of 88% for carcinoma and 83% for blastomycosis were documented.<sup>4</sup> The specificity and positive predictive value of FNA for both disease processes was 100%.<sup>4</sup> Similar results have also been reported with fluoroscopically guided aspirates and with blind aspiration of animals with diffuse interstitial disease.<sup>1,3</sup>

### *Indications*

Fine needle aspiration is indicated for characterization of mediastinal and thoracic wall masses, solitary or multiple discrete pulmonary nodules or masses, and regional or diffuse interstitial disease of the pulmonary parenchyma. FNA may be used to obtain valuable diagnostic and prognostic information, especially in patients that may not tolerate more invasive diagnostic tests.

### *Contraindications*

The most important contraindications to performing fine needle aspiration are coagulopathy (especially in cases of thrombocytopenia or thrombocytopathia), pulmonary hypertension, and the presence of pulmonary bullae.<sup>1,4,5</sup> Other contraindications to FNA include the inability to adequately visualize discrete lesions, inadequate sedation or analgesia, and the inability to manage postprocedure complications. Significant respiratory distress and poor clinical condition have been correlated with higher complication rates and unfavorable outcomes and thus are also relative contraindications to FNA for patients in this category.<sup>3</sup>

### *Choice of Site for FNA*

The specific approach and procedure chosen for FNA depends on the type of lesion (mass lesion versus diffuse disease), location of the lesion (central versus peripheral), and unique characteristics (tractable versus fractious, stable versus compromised) of a given patient. For animals with discrete masses or lung consolidation, ultrasonography, fluoroscopy, or computed tomography may be used to visualize the lesion while performing the procedure. Ultrasonography, in particular, is an extremely valuable tool in performing fine needle aspiration. Ultrasound guidance allows for precise localization of the needle and for the identification and avoidance of vascular structures. In addition, a practiced ultrasonographer can perform FNA rapidly and with a minimal amount of patient manipulation or discomfort.

When the use of ultrasound is limited (e.g., the presence of aerated lung tissue or air in the pleural cavity between the lesion and the ultrasound transducer), alternate techniques are indicated. Fluoroscopy is simple to perform and allows visualization of the entire thoracic cavity. Computed tomography (CT) also allows precise visualization of the entire thorax and the needle path, although CT-guided aspiration is generally more expensive and technically difficult to perform.

Finally, in animals with regional, diffuse or disseminated pulmonary parenchymal disease, a blind aspiration technique may be employed to acquire a representative sample for analysis. The site of aspiration depends on the regions affected, with care taken to avoid

cardiac and vascular structures. In animals with diffuse disease, the caudal lung lobes may be aspirated by introducing the needle in the seventh to ninth intercostal space at a level two thirds of the distance from the costochondral junction to the vertebral bodies.<sup>3,5</sup>

## *Instrumentation and Technique*

Fine needle aspiration is performed with 20- to 25-gauge needles of varying lengths, although 22-gauge, 1½-inch needles are most often used. Deeper lesions may be sampled using a 22-gauge 2½-inch, 3½-inch, or 5-inch spinal needle without a stylet. Other materials necessary for FNA include 6-ml or 12-ml syringes, extension tubing, and glass slides to prepare specimens for cytology. Transport media for fungal or bacterial culture should also be available when appropriate.

A variety of techniques for ultrasound-guided fine needle aspiration have been described in the recent veterinary literature.<sup>2,4,6</sup> Other reports document techniques for fluoroscopic and CT guidance, as well as blind techniques used in aspirating intrathoracic lesions.<sup>1,3,5,7</sup> In practice, the technique used for fine needle aspiration is similar regardless of the type of lesion or method used for visualization.

After the lesion to be aspirated has been identified, the least traumatic needle approach is determined, facilitated if possible by real-time ultrasound, fluoroscopy, or computed tomography. Sedation or general anesthesia is administered, depending on the technique and the temperament and clinical status of the patient. The patient is placed in sternal or lateral recumbency and the skin overlying the lesion is clipped and aseptically prepared. The needle, attached either directly or via a short extension set to a 6- to 12-ml syringe, is introduced through the skin and is advanced into the lesion. Imaging techniques allow precise localization of the needle within the lesion to be aspirated. If general anesthesia is employed, ventilation may be briefly suspended to minimize motion during the procedure. Once within the lesion, negative pressure is applied two to five times as a sample is obtained. Following release of negative pressure, the needle is withdrawn. The syringe is removed from the needle or extension set, filled with air, and then reattached. The sample is expelled onto a glass slide, and smears are made as quickly as possible. Alternatively, the sample may be prepared and submitted for microbiological culture.

One or two aspirates are performed for each lesion, although the quality of the samples obtained may dictate the number of aspirates performed. One of the drawbacks of the negative pressure aspiration technique is excessive sample hemodilution. An alternate technique has been described to prevent this occurrence.<sup>6</sup> With this technique, the attached syringe is prefilled with air. Once the needle is introduced, no negative pressure is applied. Rather, the needle is rapidly moved back and forth within the lesion five to ten times and then withdrawn. The sample, which has collected within the needle lumen, is then expelled onto a glass slide or microbiological culturette.

## *Complications and Postprocedure Management*

Reported complications resulting from intrathoracic fine needle aspiration in veterinary patients include pneumothorax, hemothorax, intrapulmonary hemorrhage, and hemoptysis. In general, however, significant complications are unusual. This is especially true for ultrasound-guided aspiration, with two studies reporting clinically recognizable complication rates of 0%.<sup>2,4</sup> Complication rates of 17% for fluoroscopic-guided aspiration and 43% for blind aspiration were noted in two separate studies, and these tended to be seen in animals with diffuse or disseminated disease processes.<sup>1,3</sup>

Potential complications from fine needle aspiration may be minimized by careful screening for conditions that place patients at additional risk (e.g., pulmonary bullae, coagulopathy, or pulmonary hypertension). A ruptured pulmonary bulla, for example, may lead to the development of tension pneumothorax. Coagulopathy and pulmonary hypertension both predispose patients to bleeding complications. Although fine needle aspiration may generally be performed with minimal physical or chemical restraint, excessive patient motion may lead to inadvertent damage to intrathoracic structures. Therefore judicious use of sedation, analgesia, or anesthesia should be considered to maximize patient comfort and safety during the procedure. In addition, general anesthesia and assisted ventilation may be required in animals with significant respiratory distress. This is also the case if fluoroscopic or CT visualization is necessary to aspirate nonperipheral lesions. In these situations, control of ventilation is essential to ensure adequate targeting of the lesion and to minimize the potential for damage to normal structures.

Patient management following FNA depends on the presence and magnitude of complications stemming from the procedure. Certainly, all animals should be closely monitored for tachypnea, dyspnea, cough, hemoptysis, or deterioration of hemodynamic status following FNA. In addition, packed cell volume and total solids should be rechecked immediately postprocedure and 2 hours later. Pulse oximetry or, ideally, arterial blood gas analysis are indicated to assess pulmonary function. Ideally, chest radiographs could be obtained immediately after the procedure and repeated several hours later, but the decision to perform radiography may be based on changes in physical examination or clinical parameters.

Once identified, appropriate management of any problems following fine needle aspiration is essential. Although many instances of pneumothorax following FNA are subclinical and self-limiting, thoracocentesis is indicated if significant pneumothorax is identified. Rare cases require repeat thoracocentesis or the placement of a chest tube for continuous evacuation of the pleural space. Similarly, animals with bleeding complications may require transfusion of blood products or pleural drainage in severe cases. Patients with compromised pulmonary function should receive supplemental oxygen, and mechanical ventilation must be considered in

cases of ventilatory or respiratory failure. Although these potential complications may be serious or even life threatening, it should be noted that the large majority of patients have no clinically significant complications following FNA of intrathoracic lesions.

## Conclusion

Samples obtained by fine needle aspiration are ideal for cytopathological evaluation, as well as for microbiological culture. In this way, FNA is extremely useful in the characterization of mediastinal, thoracic wall, and pulmonary parenchymal disease processes of various etiologies.<sup>1,2,4,5,8</sup> Because of its low cost, high yield, and relative simplicity, FNA should be considered a first-line procedure that provides valuable diagnostic and prognostic information that can then be used to guide further diagnostic and therapeutic strategies for patients with intrathoracic disease.

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# CHAPTER 20

# Thoracocentesis

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## Background and Definition

Greek word elements define thoracocentesis, or thoracocentesis, as the act of *puncture and aspiration of the thorax*. The pleural space is a potential space, which in the normal animal contains a few milliliters of serous fluid and has a negative pressure.

In different disease states, fluid can accumulate in the pleural space and the retrieval of this fluid can be of great diagnostic and therapeutic aid. Early identification of the disease process and adequate therapy can improve outcome; drainage of large amounts of pleural fluid can improve dyspnea, pulmonary mechanics, and in some instances hemodynamics. Air retrieval from a significant pneumothorax can have the same benefits.

## Indications

In the guidelines published by the American Thoracic Society in 1988, indications to perform thoracocentesis include (1) the presence of any undiagnosed pleural effusion

and (2) therapeutic thoracocentesis to relieve respiratory signs caused by a large effusion.<sup>1</sup> When the etiology of the effusion can be reasonably deduced by the clinical presentation and the patient is not dyspneic, the procedure may be postponed and the response to therapy followed.<sup>1</sup>

Analysis of fluid collected by thoracocentesis can be of great benefit to a patient whose diagnosis is not confirmed. In a study of 82 human patients with pleural effusions undergoing diagnostic thoracocentesis, the procedure yielded improvement in the diagnosis and/or treatment in 56% and a change in the presumptive prethoracocentesis diagnosis in 45% of patients.<sup>2</sup> In another human study of 78 thoracocentesis procedures, pleural fluid analysis was judged to be clinically useful in 92% of the cases, but a definitive diagnosis was achieved in only 18%.<sup>3</sup> In most cases, pleural fluid analysis finds its utility in supporting a presumptive diagnosis.<sup>1</sup>

In a dyspneic animal, respiratory compromise can arise from the upper airways, lower airways, pleural space, pulmonary parenchyma, chest wall, or from neurological or metabolic causes. Historical findings (e.g., previous heart disease, trauma, bite wounds, or neopla-