THORACOSCOPY: WHAT IS POSSIBLE?
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- Thoracoscopy is feasible in small animal surgery
- Pericardial window, lung lobectomy, correction of persistent aortic arch abnormalities, ligation of thoracic duct, resection of cranial mediastinal mass, and ligation of PDA are possible with thoracoscopy

Thoracoscopy is a minimally invasive technique for viewing the internal structures of the thoracic cavity. The procedure uses a rigid telescope placed through a portal positioned into the thoracic wall in order to examine the contents of the pleural cavity. Small animal thoracoscopy has not only developed into a diagnostic tool but more recently has progressed to become a means for minimally invasive surgical procedures.

PERICARDIAL WINDOW

Creation of a window in the pericardium establishes permanent drainage for patients with pericardial effusion. This technique is performed effectively with minimally invasive technique with greatly reduced operative trauma and postoperative pain. Indications for permanent pericardial drainage include neoplastic effusions, hemorrhage from neoplastic masses, inflammatory disease, and idiopathic effusions. This procedure prevents cardiac tamponade in the future by allowing drainage of pericardial fluid in the pleural space. Results with this procedure are excellent with long-term resolution in cases with idiopathic or inflammatory disease and dramatically improve quality of remaining life in cases with neoplasia.

To perform a pericardial window the patient is placed in dorsal recumbency and a para-xiphoid telescope portal is established. Portals are placed in the left and right 9th to 10th intercostal spaces close to the sternum. All portals are placed ventral to the costochondral junction in the area of the lateral margin of the transverse thoracic muscles. As an alternative, an intercostals approach can also be performed.

With all portals in place the first step of the procedure is to cut the ventral mediastinum off of the sternum to get it out of the visual and manipulative field. It is recommended to explore the cranial mediastinum for lymph node enlargement and biopsy. Biopsy of the lymph node may reveal the diagnosis of mesothelioma of the pericardial that might not be diagnosed on the pericardial window sent for histology.

A site is selected for the pericardial window on the cranial surface of the heart. Babcock forceps are used to pick up a fold of pericardium and Metzenbaum scissors are used to cut into this elevated fold of tissue for initial penetration of the pericardium. This technique minimizes the potential for cardiac damage. The graspers are repositioned to pick up a margin of the initial pericardial incision. Any excess pericardial fluid that has not been previously evacuated and that interferes with visualization is removed with suction. The pericardial incision is extended to remove a patch of pericardium taking care not to damage the phrenic nerves, heart, lungs or great vessels. There is no scientific data to define how much pericardium to remove. The portion removed needs to be large enough to prevent closure of the defect by the healing process and small enough to preclude herniation of the heart through the window. A one inch square patch has been an acceptable size. The removed patch is extracted from the chest through one of the
operative portals and is inspected for size and to define pathology. Samples are submitted for histopathology and if indicated for cultures. Any residual pericardial and pleural fluid is removed with suction and the cavities are irrigated with saline. Operative portal cannulas are removed and the portals closed in layers to achieve an airtight closure. A thoracostomy drain is placed as a routine fashion through the chest wall. Placement of the tube can be controlled with the endoscope.

**PARTIAL LUNG LOBECTOMY**

Lung biopsy for chronic lung disease, excision of lung masses, lung abscesses, emphysematous bullae, or any other localized disease process in the peripheral portions of the lung lobes can be performed quickly and effectively with minimally invasive technique. Partial lung lobectomy can also be performed for diagnostic biopsy of generalized lung disease. For small peripheral lesions and for lung biopsies a loop ligature technique can be used. The tip of the lobe to be removed is positioned through a pretied loop ligature (Endoloop) which is tightened and the ligated portion of the lung is transected and removed. This technique is quick, easy, and saves the significant expense of an endoscopic stapler. Larger or more central lesions require an endoscopic stapling device (Endo GIA) for occlusion and transection of the portion of the lobe to be removed. When performing partial lung lobectomy with an endoscopic stapler the telescope and operative portals are placed, the lung lobe lesion is defined and retracted or elevated as needed, and the endoscopic stapler is placed through an additional portal to provide optimal alignment for application of the stapler. Because of the cost of endoscopic staple cartridges the longest staple cartridges (65mm) are used to minimize the chance of needing to fire two cartridges. A vessel sealant device can be used for small biopsy. Following transection of the lung lobe the excised portion is removed from the chest by enlarging one of the portals to allow passage of the tissue. An endoscopic tissue pouch (Endopouch) can be used to facilitate tissue removal. The transected lung margin is observed for air leakage or bleeding prior to exiting the chest with the telescope. A chest drain is placed at a site away from all portals, operative and telescope cannulas are removed, and the portals are closed.

**LUNG LOBECTOMY**

Complete lung lobectomy can also be performed with minimally invasive technique. Lung lobes with small masses and away from the hilus of the lung can be removed with minimally invasive surgery. Large masses impair visualization of the hilus of the lung and make manipulation of the lung difficult. It is recommended to use one lung ventilation to be able to perform the procedure.

Lateral recumbency with intercostal portal placement is the preferred technique for complete lung lobectomy. One lung ventilation is recommended to increase the amount of space available in the thoracic cavity to manipulate the instruments and the lung mass. A telescope portal and two operative portals are placed with triangulation and the hilus of the lung lobe to be removed is prepared with sharp dissection.

For caudal lung lobes the pulmonary ligament is divided to free the lung lobe for manipulation into position for placement of the endoscopic stapling device. Individual structures of the hilus are not isolated for minimally invasive lung lobectomy and are separated from surrounding structures only enough to place the stapling device. A 45mm to 65mm long stapling cartridge with 3.5mm staples is placed across the hilus of the lobe to be removed through its own additional portal that is placed ventrally and caudally at a location to allow the stapler to be
placed perpendicular to the bronchus and blood vessels. The stapling cartridge must be long enough to include the entire hilus to be stapled. The resected lung lobe is removed from the chest through a small intercostal thoracotomy. Enlarged hilar lymph nodes can be biopsied or removed with minimally invasive technique. If a lymph node is to be dissected and removed for biopsy sharp and blunt dissection are used for lymph node removal with electro surgical assistance and clip application for hemostasis. An endoscopic tissue retrieval pouch facilitates removal of the lung lobe and decreases the potential of seeding neoplastic cells or infection to the chest wall. Prior to removal of the telescope the hilus is observed for air leakage or bleeding. A chest drain is placed at a site away from all portals, the operative and telescope cannulas are removed, and the portals are closed.

**PERSISTANT RIGHT AORTIC ARCH CORRECTION**

Minimally invasive transection of the ligamentum arteriosum in cases with persistent right aortic arch has been shown to be an effective alternative to the open surgical approach.

To perform minimally invasive PRAA correction the patient is placed in right lateral recumbency, the telescope portal is placed in the left 4th or 5th intercostal space at the costochondral junction, and operative portals are placed in the 3rd and 6th or 7th intercostal space at the level of the costochondral junction and at the dorsal end of the 5th intercostal space. A retractor is placed in the 6th or 7th intercostal portal to retract the cranial lung lobe caudally. A stomach tube is placed in the esophagus to improve visualization of the ligamentum arteriosum. A palpation probe is used to further localize the ligamentum arteriosum. The ligamentum arteriosum is dissected with sharp and blunt dissection to isolate it from the pleura and esophagus. Identification of the esophagus during dissection is facilitated by passing a stomach tube or an endoscope. Endoscopic 5mm vascular clips are placed on the isolated ligamentum arteriosum and it is transected between the clips. Any remaining fibers are dissected off of the esophagus and divided and the esophagus is dilated by passage of a balloon dilation catheter or esophageal bougies. A chest tube is placed and the portals are closed. Postoperative dietary management is the same as for open surgical PRAA correction.

**MEDIASTINAL AND PLEURAL MASS EXCISION**

Selected neoplastic, (thymoma) and inflammatory masses can be removed effectively with minimally invasive technique. Masses that are inoperable with minimally invasive technique can be evaluated for open surgical resectability or biopsied and staged for appropriate non surgical treatment. Patient position and portal placement is defined by location of the mass. Cranial mediastinal masses are visualized most effectively in dorsal recumbency with a para-xiphoid telescope portal. Operative portals can be placed with both portals on one side of with bilateral portals. Intercostal space selection for the operative portals again depends on the location and size of the cranial mediastinal mass. Portals are placed as ventrally in the appropriate intercostal spaces as possible without traumatizing the internal thoracic artery. Masses are dissected with sharp and blunt dissection as indicated with ligatures, vascular clip, and electro-surgical assistance for hemostasis.

Patient position and portal placement for approach to pleural masses in locations other than the cranial mediastinum are strictly dependent on the location of the mass.

Other procedures that have been performed under thoracoscopy are PDA ligation, and thoracic duct ligation. The most important benefit from thoracoscopy in small animal surgery is the fast recovery. Since there is no rib retraction during thoracoscopy and limited incision even
to exteriorize a mass, the amount of pain post operatively is significantly reduced when compared to thoracotomy. When performing a thoracoscopy the surgeon has to be ready to convert to a thoracotomy at any time.

References


