Lungs

SURGICAL APPROACHES

Intercostal Thoracotomy

Intercostal thoracotomy is employed when exposure to a specifc region of the thoracic cavity is needed.

This approach provides good access to thoracic structures in the immediate area of the thoracotomy

A lateral thoracic radiograph also can help determine the intercostal space that best exposes a desired thoracic structure.
Because the hilus of the lungs is located between the fourth or ffth intercostal space, however, most intercostal thoracotomies for lung lobectomy are performed at one of those spaces.

Median Sternotomy

Median sternotomy is the only thoracic approach that allows access to the entire thoracic cavity and therefore is indicated when exploration of the thoracic cavity is necessary.

For surgery of the lungs, this approach **is preferred when pulmonary bullae or blebs are suspected**.

SPECIFIC CONDITIONS

Bullae, and Blebs

Lung **bullae and blebs** (pseudocysts) are similar to cysts; however, they have no epithelial lining.

Bullae and blebs are described as large blisters with fibrous walls. Bullae are large air spaces that develop within the lung parenchyma,
and blebs are small accumulations of air between the parenchyma and visceral pleura

These cavities develop from traumatic rupture and coalescence of alveoli and are frequently secondary to obstructive lung disease.

Bronchoesophageal Fistulas

Congenital tracheoesophageal and bronchoesophageal fstulas are result from foreign bodies wedged into the esophagus.

Perforation or pressure necrosis from the foreign body, usually a bone, induces formation of a fistula between the esophagus and lung parenchyma or an airway. Saliva and food can then get access to the airway of a lung lobe and induce pneumonia.

Dogs with bronchoesophageal fstulas present with weight loss, increased temperature, and **cough associated with eating.**

Lung Laceration

Blunt or penetrating trauma to the thoracic cavity can induce lung laceration and subsequent pneumothorax.

Trauma also results in lung contusions that aggravate the clinical presentation of the patient.

Rupture of the pulmonary visceral pleura secondary to blunt trauma commonly occurs **because of rib fractures**.

Ends of fractured ribs lacerate parenchyma and bronchi as they are depressed medially by the impact.

Surgical Treatment

If intra pleural air does not resorb in 3 to 4 days, surgery is indicated.

The patient should be stabilized before any surgery is attempted .

Median sternotomy is the preferred approach to permit inspection of the entire thoracic cavity and each lung lobe.

Air leaks can be detected by flooding the chest with warm sterile saline and watching for bubbles during positive-pressure ventilation. Some lacerations may not leak continuously; use of intermittent elevated pressure in the airway will increase the chance of leak detection while the lungs are submerged.

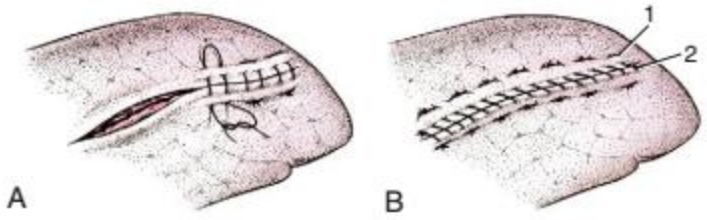

Figure 103-12 Lung lobe laceration. **A,** Superficial laceration closed with an interrupted Lembert suture pattern. **B,** Deep laceration closed with a hemostatic mattress sutures *(1)* and a simple continuous suture *(2)* to appose tissue margins. (From Slatter DH, editor: Textbook of small animal surgery, ed 3, Philadelphia, 2003, Saunders/Elsevier.)

SURGICAL TECHNIQUES

Partial Lobectomy

Partial lobectomy of the distal two thirds or less of a lung lobe can be performed for diagnostic biopsy or removal of isolated disease, such as **nonresponsive lung abscesses, cysts or bullae, small tumors, and severe lacerations**.

The lobe to be resected can be approached with an intercostal thoracotomy, median sternotomy, thoracoscopy, or keyhole technique.

If the affected area is near the apex of a lung lobe, a simple wedge or distal lobe amputation is performed.

The area of the lung lobe to be removed is identified, and a pair of crushing forceps is placed across the lobe at the resection level If a wedge is taken out, two pairs of forceps are used to outline it.

A continuous overlapping hemostatic– pneumostatic suture (3-0 or 4-0 absorbable suture) is placed 4 to 5 mm proximal to the forceps. The suture is tied at its beginning and at its end so that adequate tissue compression is achieved, and a suture tag 8 to 10 cm long is left at each side of the lobe to facilitate manipulation of the lung. The lung lobe is incised on the proximal side of the forceps, leaving a narrow strip of uninjured lung distal to the compressing suture.

The edge of the lung incision is oversewn with a very closely spaced simple continuous pattern of absorbable suture (4-0 or 5-0). After the lobe has been returned to the thoracic cavity, the sutured sites are tested for leakage: the thoracic cavity is flled with warm sterile saline until the incision is covered, the lungs are inflated, and the suture site is examined.

Leaks are closed with simple interrupted or cruciate sutures of similar material.
During partial lobectomy in the proximal third of the lobe, relatively large bronchi and blood vessels are encountered.
These are ligated individually with suture ligatures (fxation ligatures) to reduce hemorrhage or air leak, and the lung edge is sutured as previously described. If the major blood supply or airway is damaged during this procedure, a complete lung lobectomy is performed.

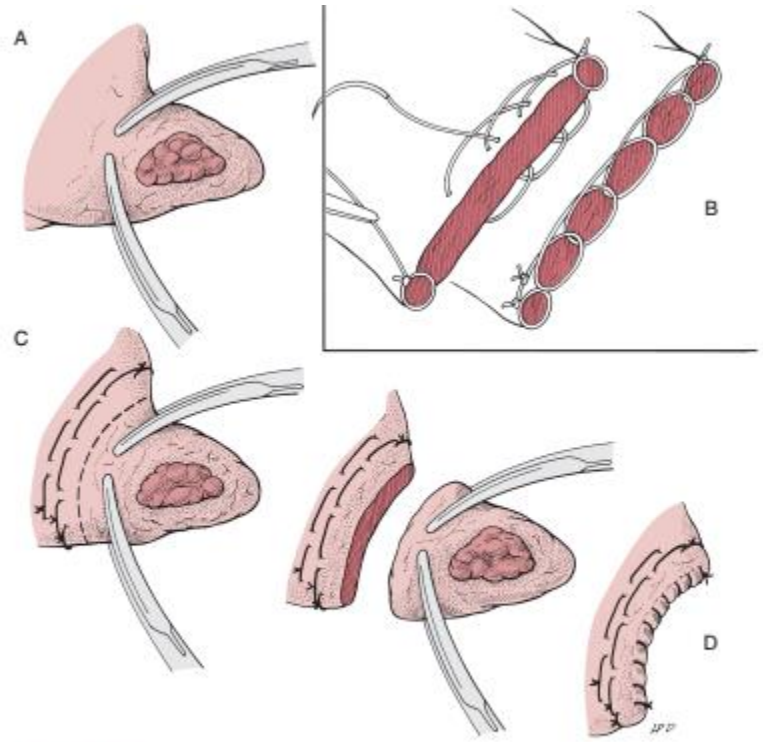

Figure 103-14 Partial lung lobectomy. A, Crushing forceps are placed proximal to the lesion. B, One or two rows of a hemostatic continuous overlapping suture is placed 2 mm proximal to the forceps. C, Abnormal lung is excised distal to the overlapping suture, and the transection site is oversewn with a simple continuous pattern (D). (From Fossum TW (ed): Small animal surgery, ed 3, St Louis, 2007, Mosby/Elsevier.)

Total Lung Lobectomy

The preferred open surgical approach for total lung lobectomy is through a lateral intercostal thoracotomy. Lung lobectomy is more complicated through a median sternotomy; however, this approach is more appropriate if lung lobes must be removed from both sides of the thorax or exploration of the pleural space is required.

During caudal lung lobectomy, the pulmonary ligament, an avascular pleural fold that extends from the caudal edge of the hilus to the mediastinal pleura, must be transected to mobilize the lobe

Suture Ligation

1- Unaffected lung lobes are packed out of the way with moist laparotomy sponges, and pulmonary vessels and the lobar bronchus are identified.

2- The arterial supply to the lobe is approached first to control blood flow to the lobe, preventing congestion and reducing the chance of severe arterial hemorrhage as the hilar dissection is made.

3- The pulmonary artery is exposed by sharp and blunt dissection until its circumference is clear of pleural and perivascular tissue .
4- Right-angle forceps assist in dissecting the blind side. The artery is triple ligated with two encircling sutures and one trans fixation.

5- A simple ligature of 2-0 or 3-0 absorbable or nonabsorbable suture is tied at the proximal end of the artery near its branch point, taking care not to encroach on the lumen of the parent vessel.

6- A similar suture is placed distal to the point at which the artery is transected. A trans fixing suture is tied 1 mm distal to the proximal suture to prevent suture migration.

7- The artery is transected between the two distal sutures. The author prefers nonabsorbable sutures for pulmonary vessel ligation.
8- The lobe is retracted dorsally, and the pulmonary vein is approached on the ventral side of the bronchus. As dissection is extended around the pulmonary vein, care is taken to prevent laceration of this delicate vessel.

9- Sharp dissection (scissors) combined with gentle blunt dissection with forceps is needed to isolate the vein. The vein is ligated with 3-0 absorbable or nonabsorbable suture using two or three encircling ligatures or two encircling and one transfxing ligatures.
10- Care should be used to ensure that the venous drainage from other lung lobes has not been incorporated in the ligatures.

The bronchial suture line is tested for air leaks by flooding the thorax with warm sterile saline and while the animal is ventilated to 25 to 30 cm H2O pressure. Additional sutures may be placed to close major leaks. Small suture hole leaks are closed by suturing surrounding pleural and subpleural tissue over the end of the bronchus and vessel stumps.

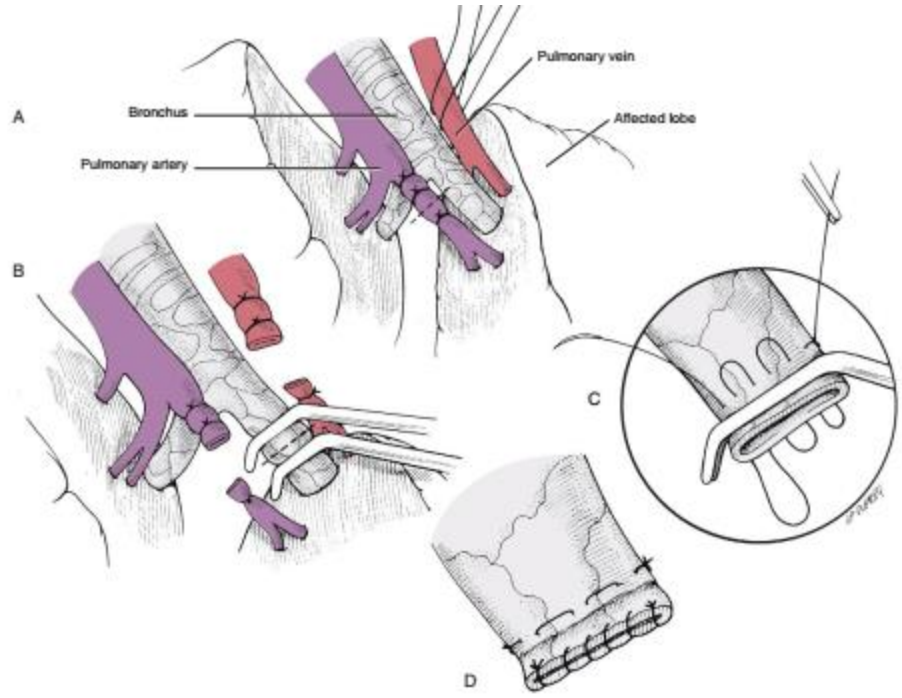

Figure 103-16 Lung lobectomy. A, The artery supplying the lung lobe is triple ligated, with the central ligature being a transfixation type. B, The vein is double or triple ligated and transected. The bronchus is isolated and clamped distal to the vessel ends. C, The clamped bronchus is collapsed with preplaced interrupted horizontal mattress sutures. D, The bronchus is transected, and its end is oversewn with a simple continuous suture pattern. (From Fossum TW (ed): Small animal surgery, ed 3, St Louis, 2007, Mosby/Elsevier.)