**Disorders of lungs and pleural cavity**

 Cattle frequently experience pulmonary disease; however surgical treatment of the lungs is not commonly indicated.

Cattle have a propensity to develop pleuritis and pulmonary abscesses secondary to penetration of foreign objects from the reticulum. In addition pleuritis may result from an extension of pneumonia, abscesses in the lungs or liver or other penetration trauma.

Pneumothorax can result from penetrating trauma or pulmonary disease. The typically complete mediastinum of cattle usually prevents life threatening consequences.

Wounds can be primarily closed if there is no deeper tissue complication. In case of complications these wounds are left to heal by second intention (open wound healing).

One way valves allows evacuation of pleural air from pleural space and assists normal healing by allowing lung re inflation If the purpose of drains to evacuate air, chest drain catheter should be placed dorsally in the caudal thoracic cavity. While fluids is best drained from more cranial and ventral parts, drains are introduced through thoracic wall from a skin incision placed 1-2 cm caudal of penetration site, caudal aspect of chosen intercostal space. Caudal to each rib to avoid neurovascular structures.

More aggressive approaches to the pleural space are indicated for advanced pleuritis and septic conditions that require lavage therapy of the pleural cavity.

Large bore chest tubes can be placed in the pleural cavity with the affected animal standing by using local anesthesia at the tube placement site. Ultrasonographic guidance has been suggested to avoid trauma to major intrathoracic structures. The 5th and 6th intercostal spaces at the costochondral junction approximately level with the elbow are the most successful sites for tube placement.

After skin incision, a chest tube with trocar can be pushed into pleural space.

A single tube can be used for drainage and lavage; more than one tube may be used with difficult cases

Thoracic exploration is indicated as diagnostic procedure such as charaterization (location, degree of adhesion) of thoracic abscesses by laparoscopy or thoracotomy.

**Anesthetic considerations:**

Thoracoscopy and thoracotomy can be performed in standing or recumbent cattle. Both procedures result in unilateral pneumothorax. Despite decreased ventilation associated with unilateral pneumothorax, standing thoracic procedure are still preferable because lateral recumbence results in poor ventilation of the down side. The mortality rate from general anesthesia is high if the disease process affects a significant portion of the up side lung.

The patient is put in stocks without sedation because sedated cattle tend to lie down and sedation impairs ventilation.

Local anesthesia is applied to the intercostal nerves of the rib to be resected and 2-3 ribs cranial and caudal to intended surgical site, also local infiltration to site of incison.

Preparation should be made for emergency ventilation.

Endotracheal tube for emergency intubation, preparation of mid cervical area for emergency tracheostomy, availability of positive pressure ventilation and gas suction to reverse pneumothorax.

General anesthesia is recommended when extensive debridement is required. Placing the animal in sternal recumbence to optimize ventilation is best. Positive pressure ventilation is needed.

Before any operation, location and extension of lesion should be diagnosed by combination of ultrasound and thoracic radiographs.

Lesions in the cranial aspects of thorax are very difficult to access surgically.

The caudal lung lobes can be reached through a partial rib resection or intercostal approach from the 7th -9th ribs.

The size of lesion and purpose of surgery determine the surgical procedure.

Thoracotomy through intercostal space allows limited manipulation but is good for:-

1. Simple drainage
2. Lavage
3. Limited manual debridement
4. Abscess treatment

Aseptic preparation is needed in all cases.

If intercostal thoracotomy is chosen, the intercostal space should be incised at the cranial aspect of the rib to avoid intercostal neurovascular structure that reside immediately caudal to each rib.

If rib resection technique is used, the incision should be started 20 cm dorsal to the costochondral junction central over the middle of the longitudinal aspect of the rib. The incision can be elongated dorsally if needed. It should not be extended ventrally to the costochondral junction to prevent unintended transection of cranial epigastric vessels.

The incision is extended to the periosteum which is sharply incised. Then elevated by periosteal elevator, wire saw is passed subperiosteally arownd the rib. Often transecting proximal aspect, the rib is resected by dislocating it distally at the costochondral junction insertion, alternatively bone saw or large bone cutter can be used to remove part of the rib.

The periosteum is incised along with parietal pleura to reach thoracic cavity. Mechanical retractors can be used to increase the observable area.

Partial lung lobectomy can be effective in removing solitary abscesses and other types of localized masses. In case of abscesses wounds is left to heal by second intention.

In other cases the incision should partially closed with drainage and lavage enhanced by using drains. Thoracic wall is closed by apposing the pleura and intercostal muscles with the periosteum using no.2 absorbable sutures such as polyglactain 910 in simple continuous pattern. Suction through cannula in the pleural space is used to re inflate the collapsed lung. If general anesthesia is used, positive pressure ventilation during closure will be much easier. Subcutaneous and skin are routinely closed.

Lesion can be allocated by endoscopic examination also surgery can be performed laparoscopically.

**Diaphragmatic hernia**

All are false hernia (no hernia sac) or acquired.

Another condition in cattle that require surgical treatment of the pleural cavity in cattle.

**Causes:**

1. Trauma
2. Dystocia
3. Traumatic reticulo peritonitis

**Clinical signs:**

1. Decrease production
2. Weight loss
3. Dysphagia
4. Colic
5. Bloat
6. Respiratory difficulties

**Diagnosis**

1. On auscultation of the thorax, these are borborygmi sounds.
2. Rectal palpation may reveal forward position of abdominal viscera and an empty feel to the caudal abdomen.
3. Clinical signs
4. Radiography
5. Ultrasonography

**Treatment:**

Surgical operation or salvage

**Approaches**:

1. Ventral midline and caudal rib resection thoracotomy
2. Paramedian
3. Paracostal celiotomy

Rumenotomy has been recommended to empty rumen and reticulum before using recumbent approaches to diaphragm. Diaphragm may be closed by use of absorbable or non-absorbable sutures in simple continuous or continuous mattress pattern are recommended.

Also mesh can be used to repair diaphragmatic defects. (should not be placed in contaminated wound environment )

**Disorders of pericardium**

**Thoracotomy is indicated for:**

1. Drainage and debridement of the pericardium
2. Foreign body removal
3. Surgical manipulation of heart, major vessels and lungs (rarely)

**The operation can be done in**

1. Standing position → local anesthesia
2. Sternal or inclined recumbence → general anesthesia

Reticulas foreign body may enter the thorax from either the left or right side.

Most typical approach to the pericardium is to enter the thorax at the left 5th or 6th intercostal space.

Presurgical ultrasound examination is necessary for DX. Also radiography.

Before draining the pericardium, the surgeon should look for afibrous tract that enters the pericardium caudally. Septic pericarditis is most commonly the result of foreign body penetration from the reticulum. Early identification of the tract is critical for successful removal of the foreign body and successful procedure. Pericardial drainage will be unsuccessful if the foreign body is left in the thorax.

The fibrous tract encircle the foreign body early to prevent its cranial or caudal displacement. The tract is clamped with large clamp to immobilize the foreign body as soon as the tract is identified. The surgeon then incises the fibrous tract with large scissors until the center is identified. Then foreign body is grasped and removed.

The pericardium is sutured to the skin at the incision edge by absorbable or non-absorbable monofilament in an interrupted or continuous pattern. The pericardium is often quite fibrotic and capable of holding suture tension, although sepsis can render it friable to suture.

The pericardium is then incised and drained manually. Depending on type, duration of septic pericarditis, these can be thick caseous purulent exudates. Often drainage, lavage with warm isotonic fluids is used as needed. Because of the postoperative pain and delayed healing, it is best to re inflate the lungs and use drain to manage the pleural space. The pericardial cavity may be left open to drain or be partially closed and managed with drains.

**Postoperatively:**

Continued access and good hygiene practice with repeated lavage is necessary if the resulting wound is left open. Use of chest bandage to cover the wound.

If the foreign body returned into the reticulum during manipulation, rumenotomy to remove foreign body may be necessary at the same time.

It's preferable to delay rumenotomy and place a magnet in the reticulum until surgery of thoracotomy has resolved.

**Cardiovascular disorders**

Affections of cardiovascular system submitted to surgical treatment are not common in cattle.

**Patent ductus arteriosus (PDA):**

Rare congenital malformation in calves it result from the ductus arteriosus (which allows blood to flow from the pulmonary artery to the descending aorta in a fetus by passing the nonfunctional lung) failing to close. Because ductus arteriosus remains patent after birth. Differential blood pressure forces blood from the aorta to reenter the pulmonary circulation through pulmonary artery, this result in left ventricular hypertrophy and possibly failure, as the heart attempts to increase cardiac output to systemic circulation. If pulmonary pressure is elevated, differential blood pressure forces poorly oxygenated blood into systemic circulation through aorta.

**Calves are presented for:**

1. Decreased stamina (endurance)
2. Decreased growth
3. Exercise intolerance

**Diagnosis:**

1. Auscultation reveal holosystolic murmur
2. Angiography or echocardiography confirm diagnosis.

Usually this case is not treated surgically in catle, although there are few articles that refer to surgical treatment in cattle, the calf is treated by ligation of PDA with umbilical tape through the 5th rib left thoracotomy.

Ligation is assisted by thoracoscopy and intra-arterial occlusion devices is now available to close the PDA.