

Surgical Affections of The Respiratory System

The respiratory system conducts air to and from the lungs thus permitting gaseous exchange across alveolar surfaces. Various disorders may interfere with this function and call for surgical correction.

Affections of the nasal cavity

1-Epistaxis

Epistaxis means bleeding from the nose. The distinguishing characteristic feature of epistaxis is the pure blood from the nostrils. If the blood is frothy it is usually from the lungs, and if it contains food particles it is probably from the stomach.

Etiology:

Trauma: As caused by a kick, a foreign body, parasite, stomach tube, laryngoscope or rhinoscope.

Tumours:

Of the nasal cavity as angioma, carcinoma or melano sarcoma may be a cause of epistaxis.

During the course of some infectious diseases as glanders, anthrax, infectious anaemia & canine distemper.

Poisoning:

As noticed in cases of mercury or phosphorous poisoning.

Severe rise in blood pressure:

As in cases of racing horses or horses used for hunting.

Treatment:

Vary and depend upon the source and severity of the haemorrhage:

Removal of the cause.

Raising the head of the animal.

Application of ice bags on the fore head.

When the bleeding is severe it is necessary to pack one nostril with a long piece of gauze to which a long enough suture material is attached. The gauze is packed by means of a stomach tube. The pack is removed after 24 hours. If the bleeding is bilateral it is necessary to perform tracheotomy before packing the two nostrils.

Injection of 5 gm of sodium citrate dissolved in 20 ml distilled water intravenously.

2-Parasites of the nasal cavity

Parasites of the nasal cavity in dogs and sheep cause inflammation of the mucous membrane resulting in a purulent discharge from the nostrils. The parasite found in sheep is the larvae of *oestrus ovis* and that of the dog is the *liguatula rhinaria*.

Treatment:

Trephining of the nasal cavities and extraction of the parasites.

3- Fracture of the nasal bones

Fracture of the nasal bones and septum nasi are mostly caused by a kick or from injury by barbed wire.

Symptoms:

The presence of injury with bleeding from the nose. The nose is usually deformed. The nostrils become mostly narrow i.e. stenosis of the nasal openings resulting in dyspnea.

Treatment:

Removal of the splinters of bone reached and elevation of the depressed parts. When necessary trephining is made. When there is dyspnea tracheotomy is indicated.

4- Tumours of the nostrils

Nasal tumours are mostly common in horses. One of the most common is the polypoid fibromata which occasionally occur just inside the anterior nares. They may be multiple interfering with breathing and causing a respiratory noise. When bilateral they cause more or less dyspnea. Cavernous angiomas of the septum nasi are rarely found. They tend to be usually ulcerated causing bleeding from the nose which can not be stopped.

Carcinomas and sarcomas of the nose are mostly secondary to tumours of the alveoli, orbital cavity or turbinate bones. They usually cause bleeding from the nose, thickening of the nasal bones and are characterized by severe swelling of the corresponding lymph nodes.

Treatment:

Polypoid fibromata must be removed surgically with the scalpel (total extirpation), or when impossible, with the ecraseur. It may be necessary to incise the nostril to make a space for the operation. Sometimes when there is severe dyspnea it may be necessary to make tracheotomy. Cavernous angiomas of the septum nasi are incurable. Sarcomas and carcinomas are also incurable.

5- Atheroma

A sebaceous cyst found in the false nostril of the horse. It develops between the mucous membrane lining the false nostril deeply and the skin superficially. Atheromas may occur unilaterally or bilaterally. They vary in size from that of a small pigeon egg to as large as a tennis ball. The content vary. It may be watery or thick, oily and gray material.

Symptoms:

The presence of the swelling in the false nostril.

When the atheroma is large, it may interfere with the air flow producing a respiratory nasal noise.

Treatment:

Aspiration of the content is transitory in effect, and the cyst will later again fill up with fluid.

Complete removal of the cyst without its opening. The area of operation is clipped, shaved, and prepped for aseptic surgery. S-shaped skin incision is made through the skin only; this will expose the wall of the cyst. The skin is reflected widely from the cyst by blunt dissection or by fingers until it is completely separated. Then the skin is closed but drainage is established into the false nostril until the skin healed.

Affection of the sinuses

Empyema of the sinuses and sinusitis

Sinusitis means inflammation of the sinuses. Empyema of the sinuses is the purulent inflammation of the sinuses and accumulation of pus in them. The frontal sinus is most commonly affected in cattle and the maxillary sinus in horses.

Etiology:

Purulent catarrh of the respiratory passages as the result of strangles is one of the causes.

One of the most important causes of empyema of the maxillary sinus of horses is the diseases of the teeth (alveolar periostitis and fracture of the teeth). In the course of alveolar periostitis the thin plate of bone which separates the alveolus of the tooth from the maxillary sinus is damaged by means of the purulent discharge so that a communication between the mouth and the sinus is established. Through this passage food particles can pass to the maxillary sinus. Therefore it is very necessary to examine the teeth in every case of empyema of the maxillary sinus.

Fractures of the bone of the face:

In these cases a spicule of bone may fall into the sinus and act as a foreign body.

New growths of the sinuses such as sarcoma and carcinoma are possible causes of pus in the sinuses.

Symptoms:

unilateral swelling of the affected sinus.

Muco-purulent discharge from the nostril of the affected side (very offensive in odour in cases of alveolar periostitis). Discharge sometimes streaked with blood and more copious during and after exercise.

Dull sound in bone percussion, indicating a sinus filled with fluid.

Epiphora on the affected side as a result of pressure induced by the affected sinus on the nasolacrimal duct leading to its stenosis or obstruction.

Sometimes the submaxillary lymph gland is swollen.

In cattle sometimes there is a brain disturbance as a result of pressure exerted by swelling on the calvarium.

Treatment:

Cases of purulent sinusitis successfully treated by penicillin. Under infiltration anaesthesia over the sinus. A skin incision 2 cm long is made and the desired sinus is perforated by means of a drill. Through this opening inject 30 - 40 ml

watery penicillin solution. The injection is repeated daily until the secretion from the nose stops. After about 3 - 5 injections the secretion usually stops.

Empyema of the sinuses, It must be opened again and wined.

Frontal sinus in equine:

Take a line connects the middle parts of the roots of the supraorbital processes and bisect it by another is treated as quickly as possible by trephining of the affected sinus. Then its irrigation with a mild antiseptic as potassium permanganate or H₂O₂ . It is very important to make a counter opening in the nasal cavity for draining the exudate to the outside. The treatment needs usually a long time about 2 months. When the trephine opening becomes narrow as the result of granulation tissue formation vertical median line. Operate in one of the inferior angles.

Suprior maxillary sinus in equine:

About 3 - 4 cm upwards from the lower edge of the facial crest and 2 cm inward.

Inferior maxillary sinus in equine:

About 2 cm inward from the lower end of the facial crest. A circular incision of the skin is made slightly larger than the crown of the trephine machine. The periostium is quartered, scraped and folded under the surrounding tissues. Insert the central pin in the center of the prepared area and work the instrument with contineous rotatory movements until the resistant is overcommmed. The disc of bone is removed from the crown of the trephine machine. The septum between the frontal sinus and nasal cavity is breaked by the finger and also the septum between the inferior and superior maxillary sinus. Irrigation is performed at first by boiled water until it comes clear and then by potassium permingnate 1/1000 or H₂O₂ 1 - 4 %.

In cattle:

Postorbital part of the frontal sinus:

4 cm from the posterior edge of the orbital cavity and just dorsal to the temporal canthus.

The medial portion of the frontal sinus :

The opening is posterior to a line passing through the center of the bony orbit and 2 cm from the midline.

The turbinate portion of the frontal sinus:

Can be located by passing the thumb and forefinger up the nasal bones to just posterior to where the bone starts to diverge; here a trephine opening is made.

Maxillary sinus in cattle:

Just dorsal and posterior to facial tubercle.

New growths in the sinuses

Sarcomas, carcinomas and actinomycomas have been found in horses and cattle. Malignant tumours of the frontal sinus occur either primarily or secondary to tumours of the maxillary sinus or the orbital cavity. Carcinomas originate from the epithelium of the mouth cavity (hard palate or the alveoli of teeth). Sarcomas usually originate from the periosteum. These tumours usually infiltrate in the surrounding tissue causing damage to the bones. Sometimes they fill the sinus all together and open to the outside. When they reach the nasal cavity they may cause dyspnea. When they originate from the tooth they loosen it and there will be difficulty in mastication.

Treatment:

Sarcomas and carsenomas are incurable, although they can be removed by trephyning, but because of their infiltration in the neighbouring structures, it will be impossible to remove all affected structures. Therefore affected animals can be used for mild work until they die. When there is dyspnea, tracheotomy can be done. Actinomycotic growths of cattle can be treated by iodine injections.

Affections of the larynx

Laryngeal hemiplegia roaring

Characterized by an inspiratory dyspnea due to an inability of the lumen of the larynx to dilate sufficiently during inspiration. The inability of the larynx to dilate results from the relaxation and atrophy i.e. paralysis of the intrinsic muscles of the larynx.

The intrinsic muscles of the larynx are supplied by the recurrent laryngeal nerve, a branch of the vagus (10th cerebral nerve).

The condition affects horses from 3 - 6 years and in 95 % on the left side.

Causes:

The pressure of the aorta when the pulse is strong in young horses during exercise (95 % on the left side).

Injuries from injections.

Pressure from an abscess or tumour along the course of the nerve.

Mechanical pressure from the string during operation.

Respiratory diseases associated by enlargement of the bronchial lymph nodes as infectious bronchitis.

Infectious disease, as a complication of strangles and influenza or as a complication of otitis media and tonsillitis.

Plant poisoning or lead intoxication.

Symptoms:

Whistling sound during inspiration. In slight cases the sound heard well after long exercise. In severe cases the sound can be heard during normal inspiration. In exercise dyspnea may ensue and the animal fall down.

Differential diagnosis:

Respiratory sound similar to those as in cases of roaring can be heard in the following conditions.

Fracture of the nasal or maxillary bone.

Empyema of the sinuses.

Retention cysts of the salivary glands (neck cyst).

Inflammation of the parotid salivary gland (parotiditis).

Oedema of the mucous membrane of the pharynx.

Tumours of the mucous membrane of the pharynx.

Deformity of the tracheal ring.
Fracture or collapse of the tracheal ring.
Guttural pouch infection.

These cases can be differentiated from roaring by:

1. Clinical symptoms.
2. Laryngo-scope.
3. The sound is heard during inspiration and expiration.

In normal condition the left and right arytenoid cartilage should dilate simultaneously and equally and completely exposing the laryngeal opening. In affected cases the arytenoid cartilage has little or no lateral movements during inspiration. Vocal cords appears shorter and vibrated during inspiration.

Treatment:

Many procedures have been attempted to alleviate the condition including:

Ventriculectomy.

Cordectomy.

Ventriculo-cordectomy.

Soft palate resection.

Arytenoidectomy.

Attempts to reconstructing the nerve supply of the intrinsic muscles.

Non of the previous surgical procedures is always successful.

Laryngeal ventriculectomy:

It is the removal of the mucous membrane from the laryngeal succules.

Preoperative technique:

The seat of operation is the ventral aspect of the larynx. The surgical site extend from the 6th tracheal ring anterior to the laryngeal opening and laterally to the masseter muscle. The area should be clipped and shaved and prepared for aseptic operation.

Anaesthesia:

The operation can be done in a standing position using local anaesthesia. Or can be done in recumbant position under local infiltration anaesthesia or narcosis.

Operative technique:

An incision is made through the skin and subcutaneous tissues from the first tracheal ring to the anterior aspect of the larynx.

The sternohyoid and omohyoid muscles are dissected through it.

The cricothyroid notch is palpated and identified as a triangle bounded posteriorly by body of the cricoid cartilage, laterally by the wings of the thyroid cartilage. The notch contains the cricothyroid ligament.

An incision is made in the cricothyroid ligament extending anteriorly to the thyroid cartilage and posteriorly to the cricoid cartilage. The incision is widened by a wound dilator.

A blattenberg burr is inserted into the affected laryngeal saccule and engaged into the mucous membrane of the saccule is relieved through the lateral ventricular opening.

A long forceps is inserted into the sac and clamped the mucous membrane of the saccule between its jaws.

A curved scissor is then passed deep and the mucous membrane of the saccule should excised.

The mucous membrane is placed over the thumb to determine whether enough has been removed.

The ventricle opening can be sutured by 00 catgut or may left without suturing allowing it to granulate closed and permitting the arytenoid cartilage to adhere laterally to the medial face of the thyroid cartilage.

Soft palate may be simply trimmed by a soisser.

When the left side is involved operation was done in this side only. But when the right side is affected both succules are removed.

The cricothyroid ligament is sutured and subcutaneous tissue and skin is sutured.

Tracheostomy is indicated in oedema of the larynx.

Antitetanic serum and antibiotic are indicated for 4 days.

Affection of Trachea

***Tracheal Stenosis**

Tracheal stenosis is a narrowing or stricture of the tracheal lumen:

- It may arise as a congenital deformity or secondary to trauma.
- It can occur as a complication of tracheotomy.
- Inspiratory noise and dyspnea may be present.
- Tracheal resection and anastomosis may be performed if the affected segment is short.

Clinical signs

Mild tracheal stenosis may produce no overt clinical signs, but inspiratory dyspnea and an adventitious respiratory noise may be produced with more severe lesions, especially at exercise.

Diagnosis

The level of stenosis may be detected by palpation and auscultation. Confirmation of the luminal distortion is achieved by endoscopy and radiography.

Treatment

Only narrow stricture bands may be treated by tracheal resection and anastomosis; but even so, the tension in the repaired incision is such that recurrence of the cicatrix is common. Longer segments of tracheal distortion may be treated by the application of an external prosthesis against which the collapsed cartilage rings are conformed. The prognosis for successful repair of acquired tracheal stenoses is guarded.

***Tracheal Wound**

Wounds to the trachea may be open or closed. Open wounds can result in fever, respiratory distress, subcutaneous emphysema, and cellulitis. Treatment involves debridement of the wound edges and creation of a pathway for drainage. Healing by secondary intention is usually preferable to attempted primary closure. Closed wounds are caused by blunt trauma. These result in a rupture or tear of the trachea without any overlying wound. Severe subcutaneous emphysema and edema occur rapidly, and there may be stridor associated with obstruction of the airway by the wound edges. A seroma may be present at the level of the injury. Diagnosis is determined by endoscopic and radiographic examination. Treatment with pressure bandages, combined with antibiotic and anti-inflammatory medication, is often successful. Primary closure of the tracheal wound can be performed in some cases. The prognosis for tracheal wounds is usually good, provided that appropriate treatment is instituted early. Failure to diagnose and treat the tracheal wound may result in life-threatening pneumomediastinum and pneumothorax as the emphysema tracks down the neck into the chest. Tracheal stenosis may result after large tracheal wounds.

***Tracheo-bronchial foreign body**

The most common form of foreign body that can lodge in the distal trachea and bronchial tree is thorned twigs or brambles. The thorns act as barbs that allow the foreign body to progress distally but prevent it from being coughed up. Clinical signs include a chronic cough and malodorous breath. A mucopurulent nasal discharge may be present

Diagnosis is confirmed by endoscopic examination. Treatment involves removal of the foreign body, usually using a snare passed through the endoscope (Fig. 13.3). Alternatively, a distal cervical tracheotomy may be made to allow insertion of grasping forceps or a snare. The foreign body may break up as it

is being removed (Fig. 13.4), and several separate procedures may be necessary to remove all of the foreign material. Broad spectrum antibiotic therapy should be administered postoperatively.

***Tracheotomy**

Tracheotomy is performed to gain access to the tracheal lumen to remove obstructions, collect specimens, or facilitate airflow. The tracheal incision may be closed or allowed to heal by secondary intention. Approach the cervical trachea through a ventral cervical midline incision. Extend the incision from the larynx to the sternum as needed to allow adequate exposure. Separate the sternohyoid muscles along their midline and retract them laterally. Dissect the peritracheal connective tissue from the ventral surface of the trachea at the proposed tracheotomy site. Take care to prevent traumatizing the recurrent laryngeal nerves, carotid artery, jugular vein, thyroid vessels, or esophagus. Immobilize the trachea between the thumb and forefinger. Make a horizontal or vertical incision through the wall of the trachea. Place cartilage-encircling sutures around adjacent cartilages to separate the edges and allow lumen inspection or tube insertion. Suction blood, secretions, and debris from the tracheal lumen. After completion of the procedure, appose the tracheal edges with simple interrupted 3-0 or 4-0 polypropylene sutures. To close the tracheal incision, place sutures through the annular ligaments encircling adjacent cartilages or through the annular ligaments only. Lavage the surgical site with saline. Appose the sternohyoid muscles in a simple continuous pattern with 3-0 or 4-0 absorbable suture (e.g., polydioxanone, polyglyconate, or polyglactin 910). Appose the subcutaneous tissues and skin routinely.

***Tracheostomy**

Tracheostomy allows air to enter the trachea distal to the nose, mouth, nasopharynx, and larynx. A tracheotomy is performed to insert a tube (temporary tracheostomy) or create a stoma (permanent tracheostomy) to facilitate airflow. A nonreactive tube that is no larger than one half the size of the trachea should be selected. Cuffed or cannulated autoclavable silicone, silver, or nylon tubes are recommended. Polyvinyl chloride and red rubber tubes are irritating and should be avoided. If the animal is to be placed on a respirator, a cuffed tube is necessary.

****Temporary tracheostomy.**

A temporary tracheostomy is most commonly performed to provide an alternate airflow route during surgery or as an emergency procedure in severely dyspneic patients. Tube tracheostomies usually are maintained for a short time.

**** Permanent tracheostomy.**

Permanent tracheostomy is the creation of a stoma in the ventral tracheal wall by suturing tracheal mucosa to skin. Tracheostomas are maintained for life or until the stoma is surgically closed. Tracheostomy tubes are not needed to maintain lumen patency after this procedure. Permanent tracheostomies are recommended for animals with upper respiratory obstructions causing moderate to severe respiratory distress (e.g., laryngeal collapse and nasal neoplasia) that cannot be successfully treated by other methods. Owners should be warned that these animals must be restricted from swimming and that vocalization is diminished or absent after this procedure. Furthermore, ongoing care of the site to keep it clean will be necessary

Thoracic Surgery

Definition

Thoracic surgery is the repair of organs located in the thorax, or chest. The thoracic cavity lies between the neck and the diaphragm, and contains the heart and lungs (cardiopulmonary system), the esophagus, trachea, pleura, mediastinum, chest wall, and diaphragm.

Purpose

Thoracic surgery repairs diseased or injured organs and tissues in the thoracic cavity. General thoracic surgery deals specifically with disorders of the lungs and esophagus. Cardiothoracic surgery also encompasses disorders of the heart and pericardium. Blunt chest trauma, reflux esophagitis, esophageal cancer, lung transplantation, lung cancer, and emphysema are just a few of the many clinical indications for thoracic surgery.

Precautions

Patients who have blood-clotting problems (coagulopathies), and who have had previous standard thoracic surgery may not be good candidates for video-assisted thoracic surgery (VATS). Because VATS requires the collapse of one lung, potential patients should have adequate respiratory function to maintain oxygenation during the procedure.

Description

Thoracic surgery is usually performed by a surgeon who specializes in either general thoracic surgery or cardiothoracic surgery. The patient is placed under

general anesthesia and endotracheally intubated for the procedure. The procedure followed varies according to the purpose of the surgery. An incision that opens the chest (thoracotomy) is frequently performed to give the surgeon access to the thoracic cavity. Commonly, the incision is made beginning on the back under the shoulder blade and extends in a curved arc under the arm to the front of the chest. The muscles are cut, and the ribs are spread with a retractor. The surgeon may also choose to open the chest through an incision down the breastbone, or sternum (sternotomy). Once the repair, replacement, or removal of the organ being operated on is complete, a chest tube is inserted between the ribs to drain the wound and reexpand the lung.

Video-assisted thoracic surgery (VATS) is a minimally invasive surgical technique that uses a thoracic endoscope (thoracoscope) to allow the surgeon to view the chest cavity. A lung is collapsed and 3-4 small incisions, or access ports, are made to facilitate insertion of the thoracoscope and the surgical instruments. During the procedure, the surgeon views the inside of the pleural space on a video monitor. The thoracoscope may be extracted and inserted through a different incision site as needed. When the surgical procedure is complete, the surgeon expands the lung and inserts a chest tube in one of the incision sites. The remaining incisions are sealed with adhesive.

The thoracic surgeon may also use a mediastinoscope or a bronchoscope to explore the thoracic cavity. Mediastinoscopy allows visualization of the mediastinum, the cavity located between the lungs. The bronchoscope enables the surgeon to view the larynx, trachea, and bronchi. These instruments may be used in a separate diagnostic procedure prior to thoracic surgery, or during the surgery itself.

Thoracic wound

Bite wounds of the chest wall in small dogs can extend into the thorax and can be associated with severe damage to chest wall muscles, ribs, and lungs. Two major problems associated with the management of these wounds are lack of sufficient muscle tissue for chest wall reconstruction, and difficulty draining the extensive dead space created in the chest wall. We describe a simple method to overcome these problems. The bite wound areas were surgically explored and all devitalized soft tissue was debrided. The pleural cavity was explored, intrathoracic injuries repaired, and a thoracic drainage tube was placed. Ribs in the injured area were stabilized in anatomic position by means of heavy gauge sutures passed around pairs of adjacent ribs, thus creating a scaffolding for soft tissues. Viable muscle and subcutaneous tissues were apposed as much as possible and the skin closed over the defect. Eleven small dogs were treated using this technique. All dogs had

severe injuries to the thoracic wall muscles and eight dogs had multiple rib fractures. There was no evidence of chest wall instability in any of the dogs after surgery. Nine dogs survived the injury and were reevaluated 3 to 32 months after surgery. All were clinically normal. One dog developed wound infection and pyothorax, caused by insufficient debridement of injured muscle tissue, and died 10 days after surgery. A second dog died 24 hours postoperatively of undetermined causes.

Complication of of thoracic wound

1-Pneumothorax

Pneumothorax in the great Dane involved in a motor-vehicle accident

Pneumothorax is a pathological condition in which air accumulates within the thoracic cavity.

This disease must be distinguished from the presence of fluid (i.e. hemothorax, chylothorax or pyothorax), some of which may occur contiguous with pneumothorax.

This condition may develop insidiously or as an acute emergency case, depending on the underlying etiology.

Most dogs with pneumothorax present with acute respiratory distress and other symptoms may be correlated with underlying pathologies unrelated to pneumothorax.

In dogs, there are many causes, including:

- Chest Trauma - resulting in flail chest, or open abdominal wounds with diaphragmatic rupture
- Post-anaesthesia
- Neoplasia - causing penetration of the trachea, bronchi or bronchioles due to growth of neoplastic tissue
- Chronic respiratory disease - resulting in pulmonary bulla rupture
- Idiopathic spontaneous pneumothorax

2-Hemothorax

From Dog

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Hemothorax refers to the presence of frank blood in the thorax.

In dogs, this is commonly associated with:

- Acute chest trauma
- Anticoagulant rodenticides
- Aneurysm
- Hemorrhagic pneumonia associated with *Streptococcus equi subsp. zooepidemicus*
- *Spirocerca lupi* granuloma rupture
- *Angiostrongylus vasorum*

These cases should be treated as medical emergencies and usually require chest drainage, with transfusion or autotransfusion if applicable

Hemothorax needs to be distinguished from pyothorax or chylothorax.

3-collapse of lung

A collapsed lung is the deflation of some or all of a lung, resulting in difficulty breathing, chest pain, and low oxygen in the blood (hypoxia). Collapsed lung can refer to a pneumothorax, an accumulation of air in the chest that prevents the lungs from expanding fully, or to atelectasis, deflation of the tiny air sacs (alveoli) within the lungs.

4- pleurisy

5- penetrating wound

Treatment

1-The cure can be carried out at home, if the dog's condition is not too serious and it is having its food normally. The veterinary doctor will ideally give stress on the optimal hydration by the application of the fluid therapy. dog may also have to undergo airway humidification using a vaporizer. Opening the delicate bronchial

tubes by giving medicines such as terbutaline, theophylline or albuterol is also necessary. In the treatment for pneumonia, gentle taps are given to the wall of the chest of your dog to assist the process of coughing. The antitussive drugs however, are not recommended for suppressing the reflexes of the cough in the dogs. The treatment involves solving the problem of breathing difficulty due to oxygen shortage by giving supplemental oxygen. Hospitalization might be required in many cases and giving humidified oxygen is also very essential. Removal of external elements which are supposed to be the root causes of pneumonia in dogs, can be done with a surgical procedure which is also a part of the treatment of pneumonia. The antibiotic treatment should be given after taking into consideration the dog health at that particular point of time and the suggestions of the veterinarians. Nebulizers, which actually contain antibiotic medicines, are also used as they help to provide the necessary moisture.

2-Intercostal Thoracotomy

- exposure of a defined region of the thorax
 - good to excellent access to structures in the immediate area of thoracotomy
 - access to structures not in the immediate area is limited
 - complications rare, as long as airtight watertight seal obtained.
- Good exposure to heart base, mainstem bronchi, great vessels, structures in dorsal aspect of thorax
- Site may be 3rd to 10th intercostal space, right or left, depending on structures to be exposed
- lateral thoracic radiographs may be helpful in determining site for thoracotomy.
 - Cranial abdominal structures can be exposed with a combination of intercostal thoracotomy and diaphragmatic incision

Approach:

Skin incision parallel to intercostal space from costovertebral junction to sternum
Cutaneous trunci
Latissimus dorsi incised across its muscle fibers parallel to the skin incision
Intercostal spaces can easily be counted at this point. 5th rib is usually recognized because it marks the end of the muscular portion of the scalenus muscle and the beginning of the external abdominal oblique.
Sclenus or External Abdominal Oblique incised
Serratus Ventralis is separated between muscle bellies. Some muscle attachment can be elevated from rib as necessary

Intercostal muscles incised in the middle of the intercostal space.

Avoid intercostal vessels and nerve

Pleura is bluntly punctured and incised with scissors

Positive Pressure ventilation must be initiated once thorax is open (open pneumothorax)

Incision may be extended ventrally past costo-chondral junction to internal thoracic artery and dorsally to tubercle of the rib.

- Finochetto retractors used to spread ribs

Closure:

Intercostal thoracostomy tube placed (20 french for most dogs, 14 french for cats) through dorsocaudal

thoracic wall caudal to the thoracotomy

Heavy gauge sutures (0 or 1 PDS or Prolene) interrupted circumcostal sutures placed around the ribs cranial and caudal to incision.

Coordinate suture passage with ventilation to avoid trauma to lungs

Avoid damage to intercostal vessels (caudal border of rib)

Pre-place all sutures

Helpful to have an assistant approximate incision with more dorsal suture while surgeon ties more ventral sutures.

Bupivacaine local blocks can be placed 2-3 ribs cranially and caudally at this point.

Nerve sits along caudal border of rib. Remember to place block as dorsally as possible.

Muscle layers closed individually with simple continuous absorbable sutures of appropriate size

Skin closed in standard fashion

Diaphragmatic hernia

Diaphragmatic hernia in a dog, showing radiographic evidence of loss of integrity of the diaphragm, and presence of abdominal contents in the thoracic cavity.

Diaphragmatic hernia is usually a trauma-associated condition but occasionally occurs as a congenital condition.

Congenital diaphragmatic hernias occur as a consequence of failure of the pleuroperitoneal folds to fuse with other parts of the developing diaphragm (particularly the septum transversum) or as a result of an incomplete closure of the pleuroperitoneal canals on the ventral part of the diaphragm. In human medicine, congenital diaphragmatic hernias have been linked to vitamin A deficiency, and intra-uterine exposure to NSAIDs and nitrofen herbicide.

In more rarer cases, diaphragmatic hernia in dogs may occur as a result of intrauterine fetal injury or from the congenital disease situs inversus totalis.

The most frequent places for congenital hernias are the sterno-costal triangle and the lumbocostal triangle.

In dogs, peritoneopericardial diaphragmatic hernia is the most common type of congenital defect of the diaphragm and pericardium.

The pleural cavity may contain the liver, intestines, spleen and stomach, depending on the extent of the diaphragmatic hernia.

In most cases the herniated viscera are located within a hernial sac in the pleural space, surrounded by parietal diaphragmatic pleura and sometimes by peritoneum. This type of hernia, due to the presence of the hernial sac, is called a true hernia. In addition to hernias of the ventral diaphragm, a second group of congenital diaphragmatic hernias consists of esophageal hiatal hernias and sliding perivascular hernias (of the opening of the aorta and the jejunal vein on the side of the cauda).

Esophageal hiatus hernias, frequently reported in the dog, can result in secondary mega esophagus as well as pleural effusion due to compromised perfusion of the gastric vasculature.

Acquired diaphragmatic hernias usually develop as a consequence of acute trauma, pregnancy or invasion of retroperitoneal lipomas or sarcomas through the hypaxial musculature.

Clinically affected dogs usually present with dyspnea, regurgitation, muffled heart sounds and borborygmi on auscultation and in severe cases, acute shock due to vascular compromise. In chronic cases, more nonspecific symptoms may also be evident such as anorexia, lethargy and weight loss.

Abdominal palpation of the dog may reveal an 'empty' feel to the abdomen, although this depends on the severity of herniation. With traumatic herniation, there may be also be a history of recent trauma, particularly motor vehicle accident.

Diagnosis is usually based on radiographic or CT imaging, which may show the diaphragmatic defect, the presence of visceral organs within the chest cavity, pulmonary edema, cardiomegaly or cardiac tamponade. At least two radiographs, at different angles, are usually required for a valid diagnosis since some radiographic signs are not visible in a single view. The location of the stomach axis and the displacement of tracheal and bronchial segments may assist in establishing a diagnosis.

Barium meal radiographs may show delayed emptying of intestinal loops within the thoracic cavity.

A differential diagnosis would include hiatal hernia, megaesophagus or gastroesophageal intussusception.

Treatment usually involves various methods of reconstructive surgery using rectus abdominis muscle or connective tissue pedicle flaps or appositional suture placements. A midline laparotomy approach is usually required although some dogs necessitate a median sternotomy, particularly in large herniations. With chronic herniations, adhesions of the lungs or diaphragm to the herniated organs may be necessary to permit reduction of the hernia. Some difficult cases require resection of portions of the lungs, liver, or intestine.

Postoperative complications are usually transient, particularly pneumothorax. Spontaneous lung lobe torsion has been noted as a complication of hernia repair in some dogs.

With hiatal hernias, closure of the diaphragmatic hernia is usually accompanied with esophagopexy and tube gastropexy to minimize recurrence.

Early surgical correction in cases of congenital hernias are usually curative. With traumatic diaphragmatic hernias, early surgical intervention is essential to prevent hepatic, gastric or intestinal torsion and is usually associated with good perioperative survival rates.

Fracture of ribs and sternum

Isolated fractures of the ribs are rare. More commonly, these fractures are found in conjunction with other fractures (legs, pelvis, spine) and are a result of trauma (motor vehicle accident). There are usually no potential long-term effects from these fractures.

Trauma to the chest wall can be associated with severe respiratory (breathing) difficulty. In addition to rib fractures, dogs can have "pulmonary contusion" (lung trauma), "pneumothorax" (free air within the chest cavity causing a collapsed lung), and "flail chest" (abnormal movement of the chest wall when multiple rib fractures are present).

Diagnosis

No laboratory tests are required to make the diagnosis, but other diagnostic tests may include:

- Thorough medical history and physical examination
- Chest radiographs (X-rays) to evaluate the extent of injury to the lungs, determine if pneumothorax is present and to visualize the rib fracture(s).
- Complete orthopedic examination to rule out other fractures or injuries

Treatment

Emergency care for concurrent problems caused by the trauma is paramount. After stabilization, additional treatment may include:

- Treatment of concurrent fractures and soft-tissue injuries
- Most rib fractures are managed without any treatment. The chest wall cannot be immobilized and rib fractures generally heal well on their own

-Occasionally, the individual fractures may be surgically repaired with pins and/or wires

-When multiple rib fractures are present, leading to a "flail chest," the freely moving section of the chest wall usually must be stabilized so the animal can breathe properly. This involves attaching the ribs within the free segment to a large splint placed on the surface of the skin. The ribs are attached to the splint with suture material placed through the splint and around each rib.

-Injectable analgesics (pain medications) may be given to your pet while he is being treated in the hospital and may be continued orally once the dog is discharged from the hospital.

Causes the Fracture of Sternum

Most of the time, a bruised, cracked or fractured sternum results from blunt chest trauma. Ribs or sternum injuries could occur while playing contact sports or as a result of physical assault. Motor vehicle accidents wherein the chest forcefully hits against the steering wheel is also one of the most common causes of rib or sternum injuries. Cardiopulmonary resuscitation (CPR), which is performed to revive a person suffering from a cardiac arrest, can also cause bruised or cracked sternum. One is likely to suffer from pain and discomfort in case of mild injuries that cause a bruised sternum. Under these circumstances, use of painkillers, application of warm compresses and rest will surely help in speeding up the recovery. However, surgical intervention may be needed if a severe impact causes a displaced sternal fracture. Surgery might become a necessity if the sternum is pushed further into the chest cavity. For people suffering from conditions such as osteoarthritis or osteoporosis, slight trauma to the chest can also cause a fracture.

Rib Resection Thoracotomy

two minor advantages over intercostal:

1-somewhat increased exposure

2-potentially fewer adhesions

Increased time necessary to complete the approach

Less secure closure

Approach the same as intercostal for exposure of the thoracic wall

Periosteum of rib to be excised is elevated from the midlateral surface
Rib excised with micro-sagittal saw or bone cutter
Variation is the “Rib Pivot” which relies on the costo-chondral junction. Dorsal aspect of rib transected and rib (or multiple ribs) is pivoted out of the surgery area, rather than be excised. Useful for removal of large masses from thoracic cavity.
Closure accomplished with interrupted mattress sutures preplaced in medial and lateral edges of incised periosteum for rib resection. Closure for rib pivot is by interrupted heavy gauge suture placed through pre-drilled holes above and below cut.

Median Sternotomy

Only approach that provides access to entire thoracic cavity. Usually approach of choice for exploratory thoracotomy.
Association with excessive morbidity is unjustified
Can be extended with midline laparotomy to explore both thorax and abdomen or into the cervical region by combining with a ventral cervical approach.
Access to structures in dorsal aspect of thorax (great vessels, hilus of bronchi, thoracic duct is more difficult, but not impossible in large chested dogs with this approach.
Skin and subcutaneous tissues incised along ventral midline over the sternum
Pectoral musculature is elevated to expose midline of sternum
Midline sternotomy performed with oscillating saw. Avoid trauma to intrathoracic structures. Avoid internal thoracic arteries proximally.
Leave either manubrium or xiphoid intact to add approximation and closure.
Manubrium difficult to incise with saw, bone snips or Mayo scissors useful

Closure:

Thoracostomy tube placed from a subcostral position lateral to midline or through a small hole in diaphragm just dorsal to manubrium (easier)
Stable closure important to avoid post-operative pain. Heavy gauge monofilament suture or orthopedic wire

is placed around each sternabrae