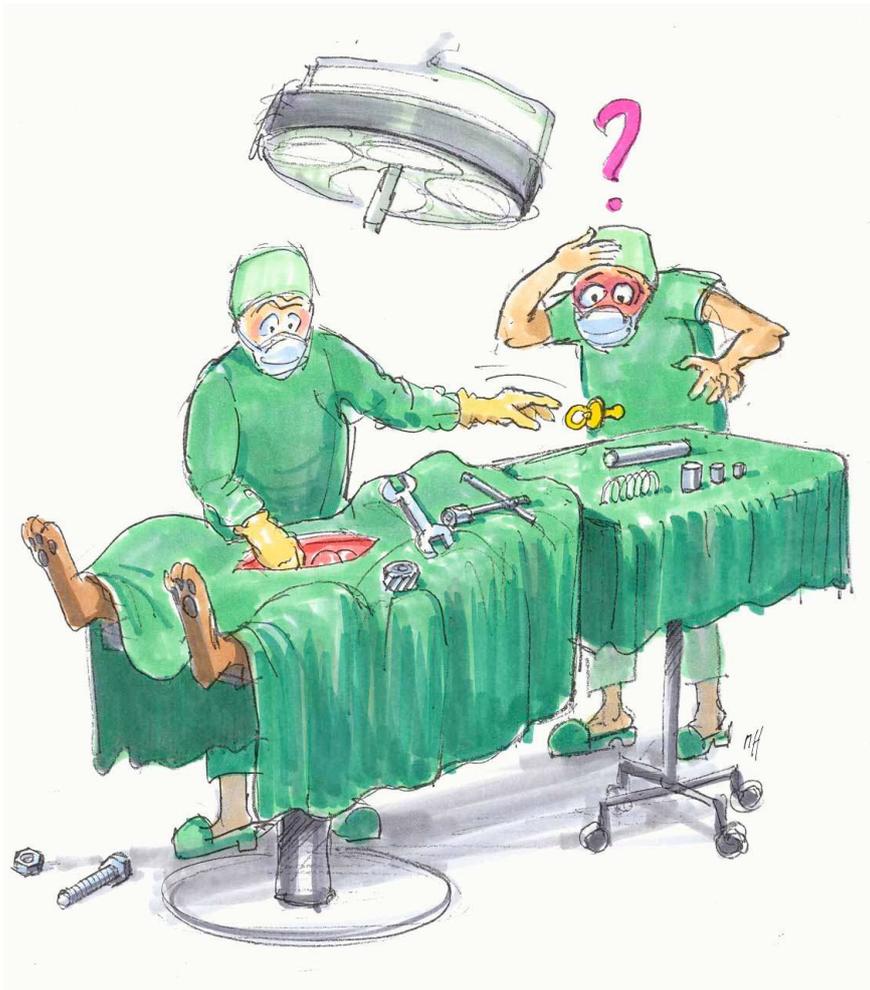




University Zurich
Small Animal Surgery Clinic

Small animal soft tissue surgery

Special orthopedic procedures



3rd Continuing Education Course for Japan Small
Animal Surgeons at the Small Animal Surgery Clinic,
University of Zurich, Switzerland
August 22 – 27, 2002

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Impressum

This handout was written by the assistants of the small animal surgery clinic. Editing work was done by Dr. D. Koch, corrections by Prof. P.M. Montavon. First edition, 2002. copyright University Zurich, 2002.

Program overview

22.08.	0900	Welcome, goal of the course	Montavon
	0915	Seminar prostate	Bass
	1000	Penile approach	Bass
		Diversion techniques for prostate	
	1100	Cystotomy and implantation of ectopic ureters	Arnold
	1200	Pyelolithotomy	Dennler
	1245	Lunch	
	1345	Liver surgery, cholestasis, cholecystoduodenostomy	Guerrero
	1500	Break	
	1520	Seminar on perineal hernia	Haas
	1600	Colopexy, vaspexy and cystopexy Closure of the abdomen	Haas
	1645	Obturatorius flap	Voss
	1730	End of the day, apero	
23.08.	0815	Seminar on upper airway obstruction	Koch
	0900	Stenotic nares	Koch
	0930	Break	
	1000	Resection of an overlong soft palate	Koch
	1030	Tie back for laryngeal paralysis	Koch
	1130	Lunch	
	1245	Seminar on chest trauma	Keller
	1330	Thoracocentesis, thoraxdrainage and transtracheal intubation	Keller
	1500	Break	
	1515	Thoracotomy and lobectomy	Keller
	1600	Procedure of choice	Koch
1700	End of the day		
24.8.	0815	Instruments (regular sets, special orthopedic sets)	Voss
	1100	Seminar on otitis	Dennler
	1200	Lunch	
	1300	Afternoon program	Koch
25.8.	All day	Recreation in western Switzerland	Montavon
26.8.	0815	Bulla osteotomy	Dennler
	0900	Ablation	Dennler
	0945	Break	
	1000	Stomatology	Koch
	1115	Perineal urethrostomy	Voss
	1230	Lunch	
	1330	Endocrinology seminar	Haas
	1430	Thyreductomy	Haas
	1530	Break	
	1545	Skin course 2	Schwandt
1730	End of the day		
27.8.	0815	Seminar on cruciate ligament rupture	Tepic/Montavon
	0900	TPLO modified	Damur / Koch
	1100	Tibial tuberosity advancement	Montavon
	1230	Break	
	1330	<i>Zurich cementless</i> hip prosthesis	Montavon
	1700	Assessment of radiographs	Montavon
	1730	End of the course	
	1930	Farewell dinner	

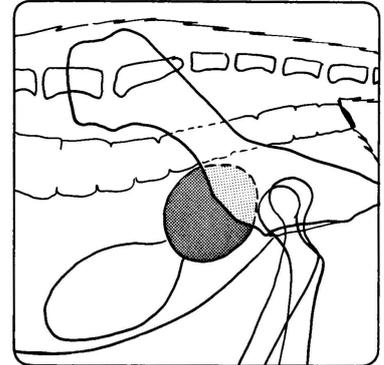
Seminar prostate gland

Martin Bass, Dr. med. vet.

Example 1: German Shepherd, 6 years old, male

Clinical signs:

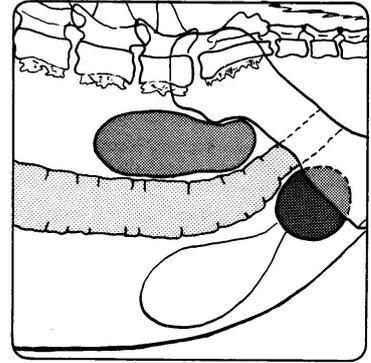
- Fever, anorexia, depression
- Vomiting
- Urethral discharge
- Rear limb weakness



Example 2: Samojede, 9 years old, castrated male

Clinical signs:

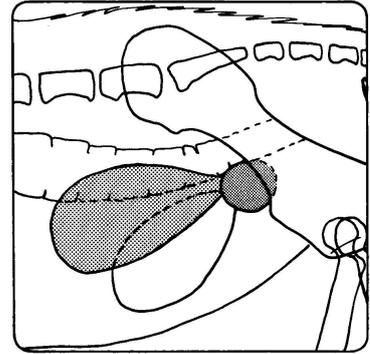
- Anorexia, weight loss, depression
- Dysuria
- Urethral discharge
- Rear limb weakness



Example 3: Doberman pinscher, 5 years old, male

Clinical signs:

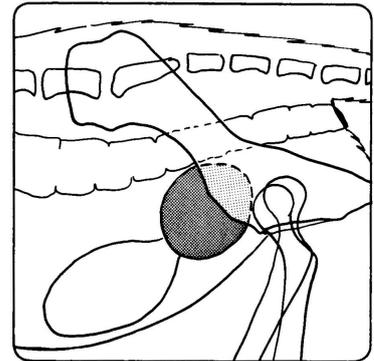
- Abdominal distension
- Dysuria
- Rectal tenesmus



Example 4: Labrador Retriever, 8 years old, male

Clinical signs:

- Urethral discharge
- Rectal tenesmus
- Hematuria



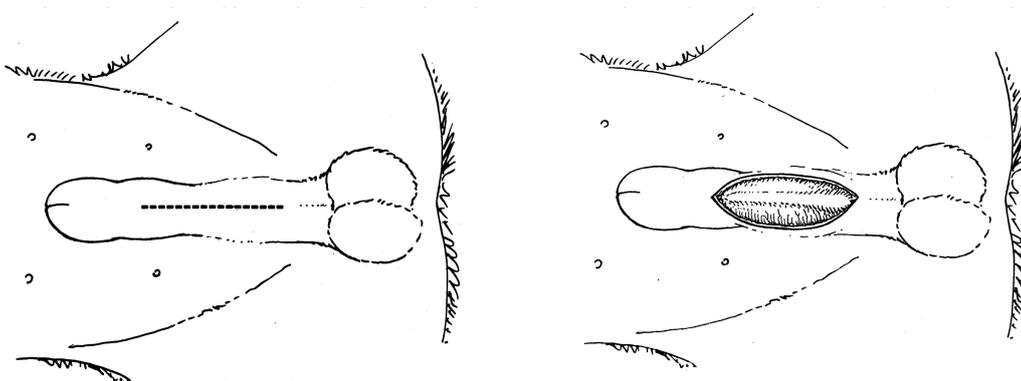
Penile approach, diversion techniques for prostate

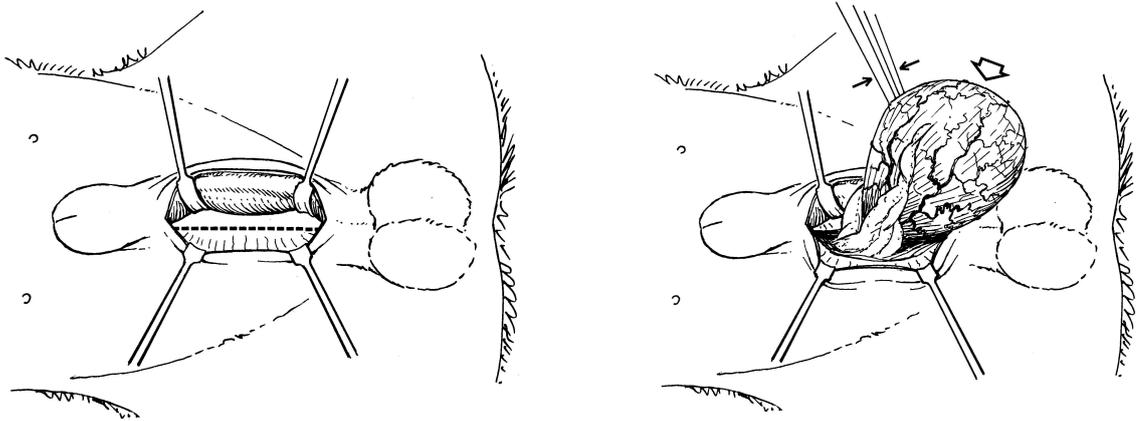
Martin Bass, Dr. med. vet.

Prostate disease includes hyperplasia, infection, cysts, abscesses and cancer. Severe diseases of cysts, abscesses and cancer are treated by excisional and partial prostatectomies, marsupialization, drainage by Penrose drains, closed-suction drains and peritoneal omentalization. All prostatic disease, except cancer can be prevented by castration during the first year of life. Castration, as a treatment of prostatic disease reduces hyperplasia and the potential for persistent infections. Despite castration, prostatic abscesses can persist and present later as clinical problems. When prostatic disease develops, castration is recommended in all patients except those with prostatic cancer. The terminal prognosis for prostatic cancer mandates an attempt to early diagnosis.

Prostatic abscesses and cysts are difficult to treat. Surgery is required, and treatment is frequently complicated by disease recurrence, incontinence, infection, sepsis, and even death. Closed-suction drains have been successfully used to drain noninfected cysts, patient with abscesses and cysts can be adequately treated using peritoneal omentalization. The omentum can be used as a 'physiologic drain', source of vascularization and lymphatic supply. Additionally, the omentum creates adhesions at the operative site, thereby minimizing the risk of visceral adhesions. All fluid-filled pockets must be explored and adequately drained. Before omentalization of paraprostatic cysts, the cysts should be excised as much as possible without damaging the urethra or the neurovascular supply.

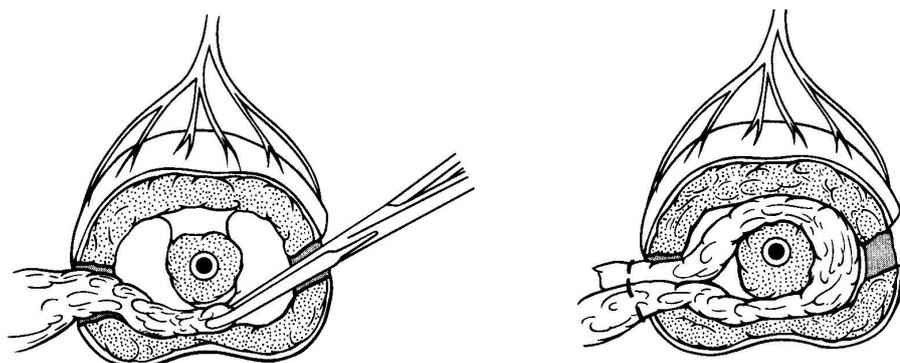
A caudal celiotomy is performed. If you choose a penile approach, you can prevent ligation and dissection of the caudal superficial epigastric artery and vein. The skin and subcutaneous tissue incision is done on the midline of the penis. The penis will be retracted and the linea alba incised.





The caudal abdomen is then explored and the prostate gland packed off the remainder of the abdomen with moist laparotomy sponges. Stab incisions are made bilaterally in the lateral aspects of the prostate gland, and fluid or pus is removed by suction to minimize abdominal contamination. All abscess loculations within the parenchyma are explored and are broken down by digital exploration. The prostatic urethra is carefully preserved and can be identified by palpation of a previously placed urethral catheter. A penrose drain may be temporarily placed around the prostatic urethra within the parenchyma to help elevate the gland and to facilitate irrigation of the abscess cavities with warm saline. The omentum is passed periurethral and anchored to itself with absorbable mattress sutures outside the prostate gland. Instead of the omentum, a closed-suction drain (blake drain) can be placed into the prostate gland. A paramedian stab incision is made in the abdominal wall for exiting the drain.

The celiotomy wounds are closed routinely and castration is performed. Dogs should receive broad-spectrum antibiotic therapy perioperatively, but this therapy does not need to be extended postoperatively unless complications occur such as major contamination of the abdominal cavity before or during the surgical procedure.



Canine ureteral ectopia

Susi Arnold, PD Dr. med. vet.

Ureteral ectopia is a rare condition in the dog but it is the most common cause of urinary incontinence in juvenile dogs.

Ureteral ectopia is a congenital abnormality. One or both ureters do not enter the urinary bladder at the normal site. The terminal ureter may be within the bladder wall (intramural) or separated from the bladder wall (extramural) and discharge into the urethra, the vagina or the uterus. In dogs ectopic ureters usually are intramural (in cats usually extramural) and enter the urethra.

Other abnormalities are present in many cases of which hydro-ureter either alone or in combination with hydronephrosis is the most frequent. Additional common findings include urinary tract infection and hypoplasia of the bladder.

Breed and sex disposition

9 out of 10 dog with ectopic ureters are bitches and there is a breed disposition for Labrador Retrievers and Golden Retrievers in the UK; for Siberian Husky, Newfoundland, Bulldog, West Highland White terriers, Fox terriers and Skye terriers in North America.

Clinical signs

Usually the dogs are presented to a Veterinarian at a young age. As soon as they are house-trained, the owner will notice that the dog is dripping urine without taking the appropriate position for urinating. But, there are dogs with ectopic ureters which become not incontinent until an advanced age. In particular male dogs can reach the age of 9 years until they become incontinent. Therefore ureteral ectopia must be considered in the differential diagnosis of urinary incontinence in dogs of all ages.

Diagnosis

A diagnosis is made by means of a combined contrast study: An intravenous urography and urethrocytography. Ectopic ureteral orifices can also be recognised by endoscopy in the anesthetized dog.

Treatment

Ureteronephrectomy (in cases with severe hydronephrosis)

Extravesicular transplantation (tunneling technique)

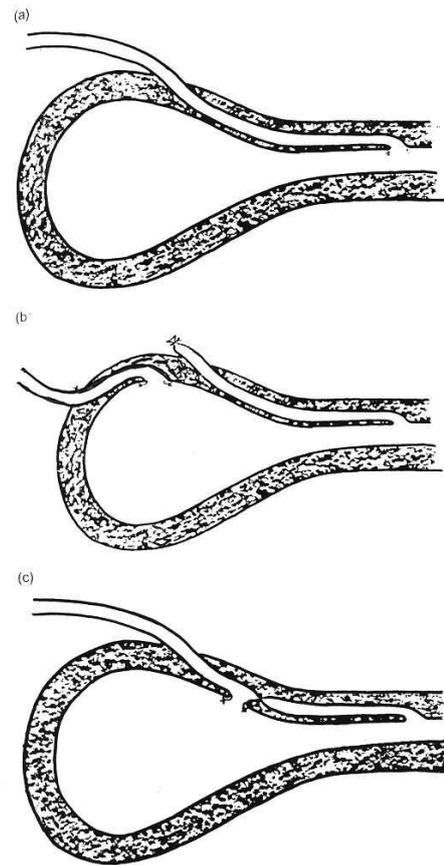
Intravesicular transplantation (stomatization technique)

If the ectopic ureter is within the bladder wall the intravesicular transplantation technique is the most suitable method.

Complications

After a ureteronephrectomy rarely complications occur. After extravesicular technique hydronephrosis requiring a second procedure (ureteronephrectomy) is the most common complication, occurring in 10 % of the cases. After the intravesicular technique transient dysuria is noted in 15 % of the patients.

- a) Schematic representation of the course of an intramural ectopic ureter with a urethral termination;
- b) Schematic representation of the extravesicular ureteral transplantation technique. The ureter is ligated, sectioned and tunnelled through the bladder wall;
- c) Schematic representation of the intravesicular ureteral transplantation technique. The ureter is stomatised into the bladder lumen and ligated distal to the stoma.



Prognosis

40 to 67 % of the dogs with ectopic ureters remain incontinent in spite of successful surgery. Hypothetical explanations include the presence of concurrent sphincter mechanism incompetence, reduced bladder capacity and interference of the ectopic remnant with urethral closure function. Female sex and normal upper urinary tract morphology increase the risk of persisting incontinence, while male sex and hydronephrosis / ureteral dilation decrease the risk.

References

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Pyelolithotomy

Renate Dennler, Dr. med. vet. FVH

Calculi may form anywhere along a dog's urinary tract, but the kidneys are involved in only 4 per cent. Clinical signs of nephrolithiasis are often lacking, but depression, anorexia, hematuria, and flank pain may be noted. Bilateral renal calculi can reduce renal function to such a degree that signs of uremia can occur. If renal function is already depressed, surgical removal of the calculi may prevent further deterioration of the kidney and may be lifesaving.

The best access to the kidney is via a long ventral midline abdominal incision.

If renal calculi have resulted in dilation of the proximal ureter and renal. This approach avoids trauma to the renal parenchyma.

As the kidney is viewed in its normal position when a ventral midline approach is made, the renal pelvis and proximal ureter are hidden by the renal vessels. The kidney is dissected free of its peritoneal attachments and rotated medially, exposing the renal pelvis and proximal ureter. An incision is made over the renal pelvis and the calculi are removed. The renal pelvis is flushed and a catheter is passed into the bladder through the ureter to ensure patency.

The incision is closed with a 4/0 or 5/0 absorbable suture in a continuous pattern.

If the renal pelvis and proximal ureter are not dilated, this technique is not attempted.

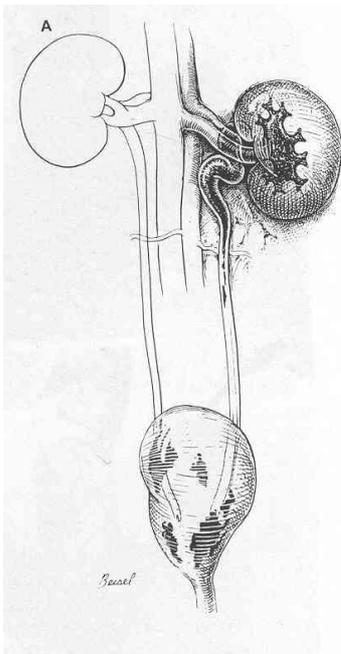


Fig 1: Normal position of the kidneys in the abdominal cavity. The renal pelvis is hidden by the renal vessels.

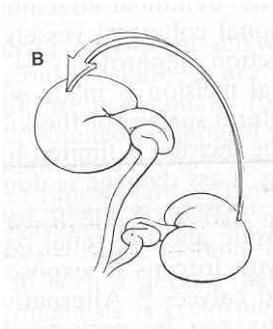


Fig 2: Flipping the kidney towards medial for a better view of the renal pelvis.

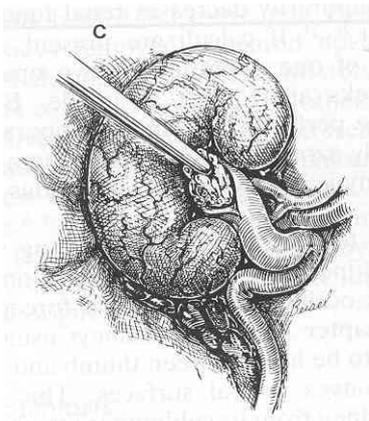


Fig 3: Incision in the dilated renal pelvis and removal of calculi.

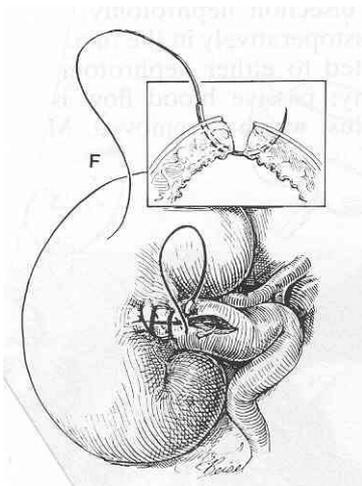


Fig 4: Closure of the renal pelvis with a continuous absorbable suture.

Liver surgery

Tomas Guerrero, med. vet.

1. Partial and total lobectomy

1.1 Indications

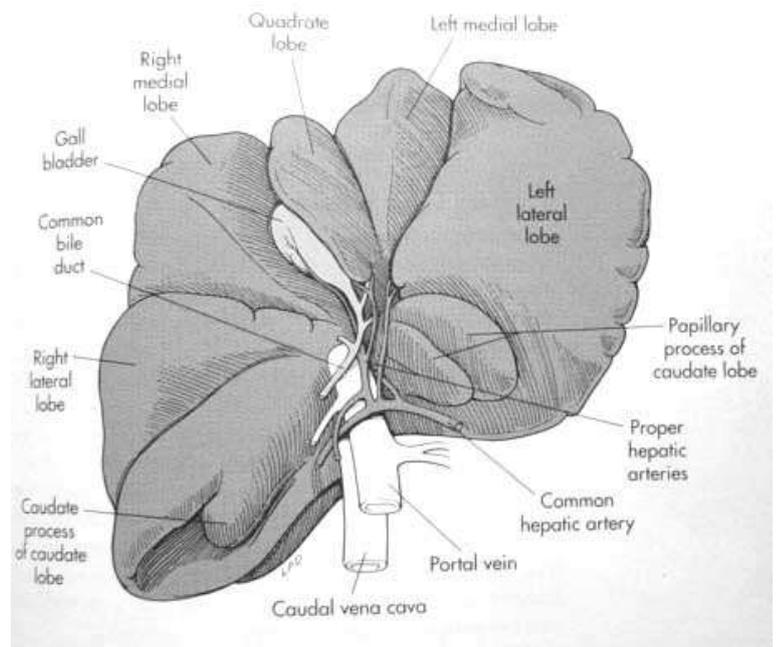
Hepatomas, secondary malignant tumors, granulomas, severe trauma, abscess, and arteriovenous fistulas are indications to perform a partial or total lobectomy.

1.2 Anatomy:

The liver is located in the cranial abdominal area, related to the diaphragm through the parietal surface and to the stomach, duodenum, right kidney, and right lobe of the pancreas through its visceral surface.

Deep fissures that converge in the portal fissure divide the liver in six lobes. The gallbladder is contained between the quadrate lobe and the right medial lobe.

The portal vena and the hepatic artery, both contained in the hepatoduodenal ligament, provide the blood supply of the liver.



1.3 Surgical techniques:

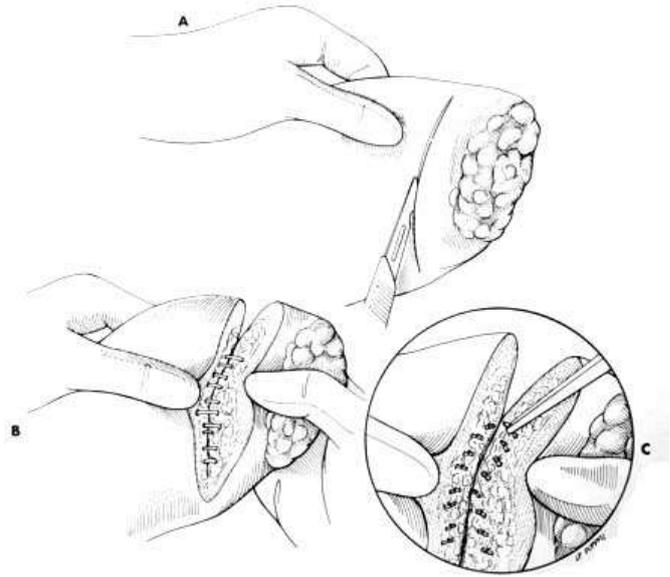
The proper friability of the liver makes surgery difficult to perform and control of hemostasis can be a challenge in hepatic surgery.

In the cases of small hemorrhages, they can be controlled by direct pressure on the area. Severe hemorrhage can be controlled inserting the index finger in the epiploic foramen and compressing between it and the thumb the hepatic artery and portal vena (Pringle maneuver). This can be done for 15 minutes without affecting the hepatic stroma.

1.3.1 Partial lobectomy:

1. Midline celiotomy
2. Exploration of the abdomen

3. Localization of the affected part of the liver.
4. Sharply incise the liver capsule in the selected area.
5. Using the fingers, or the blunt end of the scalpel fracture the hepatic parenchyma and localize the vessels.
6. Ligate large vessels and cauter small ones.
7. Before closing the abdomen control hemostasis.



Partial lobectomy can also be performed using TA stapling of the appropriate size (30, 55, or 90 mm)

1.3.2 Complete lobectomy:

This technique is performed when a large amount of liver has to be removed. Is a less technical demanding surgery than a partial lobectomy, and involve less loose of blood.

Left lobes can be more easily removed because they are more pedunculated. After blunt dissection, an encircling ligature can be placed and the lobe removed.

With the other lobes, carefully blunt dissection is performed around the caudal vena cava and hepatic venas. The corresponding vessels are ligated and the lobe is removed

2. Surgery of the biliary tract

2.1 Introduction

Surgery in the biliar tract is uncommon in the veterinary practice, but is mandatory when the biliar tract is ruptured. It is also necessary when an obstruction in the biliar tract that cannot be medically treated produces cholestasis

Intraluminal or extraluminal lesions may produce obstruction of the biliary tract.

Causes of biliary tract obstruction are:

- Neoplasia of the surrounding organs
- Pancreatic disease.
- Cholelithiasis.
- Choledocolithiasis
- Inspissated bile.
- Parasites

Rupture in the extrahepatic biliary tract can be produced by blunt abdominal trauma or be secondary to cholecystitis and/or obstruction. In the cases of trauma, normally the common bile duct or the cystic duct is affected. Ascending infections from the duodenum, or hematogenous disseminated infections can produce necrotizing cholecystitis.

The patency of the common bile duct is evaluated by gently expressing the gallbladder. In case of doubt, a duodenotomy or a cholecystotomy can be performed and the common bile duct catheterized and flushed.

Antibiotics should be always given in biliary surgery. Selected antibiotics are those that are excreted in active form in the bile (amoxicillin, cefazolin, and enrofloxacin are the most commons).

The goals of surgery in the extrahepatic biliar tract are:

- Restore the patency of the bile in the duodenum.
- Avoid bile leakage into the abdominal cavity.

2.2 Surgical anatomy:

The gallbladder lies in the fossa vesicae felleae, between the right medial lobe and the quadrate lobe of the liver. A fundus, a body and a neck compose it. It contains approximately 15 ml of bile in a medium size dog.

From the neck it is continued by the cystic duct. The 3-5 hepatic ducts coming from the hepatic lobes joint the cystic duct and conform the common bile duct.

The common bile duct empties into the descending duodenum on the mayor duodenal papilla 5 to 8 cm from the pylorus.

The cystic artery from the hepatic artery provides the blood supply to the gallbladder.

2.3 Surgical techniques:

2.3.1 Cholecystectomy

Cholecystectomy is performed in the cases of neoplasia, necrotizing cholecystitis, stones, and other causes that produce irreparable damage to the gallbladder.

Before performing it is mandatory to confirm the patency of the common bile ductus!!

- 1- Expose the gallbladder
- 2- Place Babcock forceps or stay sutures in the fundus of the gallbladder.
- 3- Inject saline solution between the hepatic fossa and the gallbladder to allow better visualization of the surgical plane.
- 4- Incise the peritoneum visceral between the gallbladder and the liver.

- 5- Applying traction to the forceps or sutures, free the gallbladder from the liver using blunt and sharp dissection.
- 6- Double ligate the cystic duct and artery before the junction with the common bile duct and transect them.
- 5- If necessary, to identify and confirm the patency of the common bile duct, perform a small enterotomy, localize the papilla duodenal, place a small rubber tube into the duct and flush it.

Cholecystotomy can be performed to remove gallstones, inspissated contents, or to perform a tube exploration of the hepatic and common bile ducts, but normally a cholecystectomy is carried out.

Due to the small size of the common bile duct in the dog and the cat and to the risk of postoperative strictures, choledochotomies are seldom performed (only in the case of chronic obstruction/dilatation).

In the case of obstructions due to stones or fibrosis in the area of the sphincter of Oddi, an sphincterotomy can be carried out.

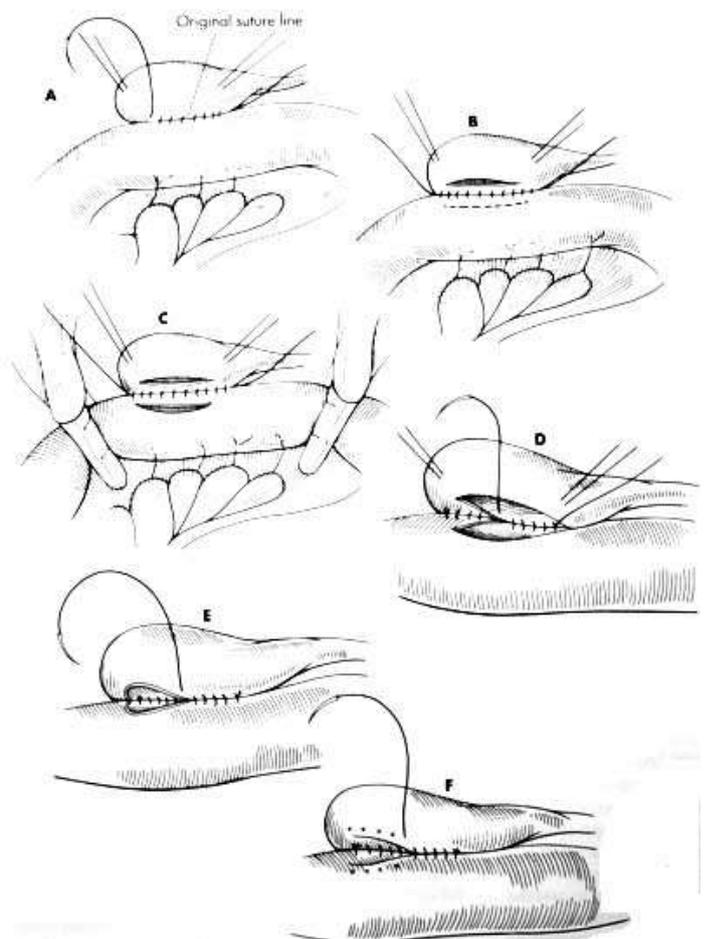
Obstructions or rupture of the common bile duct can be managed with bile flow diversion techniques.

Cholecystoduodenostomy is the technique of choice in these cases.

Cholecystojejunostomy can lead to postoperative maldigestion of lipids, and choledochoduodenostomy is technically difficult to perform due the small size of the duct.

2.3.2 Technique for cholecystoduodenostomy:

- 1- Release the gallbladder from the liver as described for cholecystectomy to avoid tension in the stoma.
- 2- Appose the gallbladder to the antimesenteric surface of the descending duodenum and hold it in position suturing the serosa of the gallbladder with the serosa of the duodenum in a 3-4 cm line using 2-0 to 4-2 absorbable suture material.
- 3- Aspirate the contents of the gallbladder with a syringe and make an incision of 2-3 cm parallel to the suture line.



- 4- avoiding intestinal leakage make a correspondent incision in the antimesenteric side of the duodenum.
- 5- Suture, using a continuous pattern with the same suturing material, the mucosa of the gallbladder with the mucosa duodenal starting with the side that is close to the original suture.
- 6- Finish the closure suturing the duodenal serosa with the serosa of the gallbladder on the other side of the stoma.

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Partial gastrectomy

Tomas Guerrero, med.vet.

Introduction:

Gastric necrosis is an infrequent complication of GDV syndrome, but when it happens a partial gastrectomy has to be performed.

The junction between the fundus and body, along the greater curvature of the stomach is the area most commonly affected.

Observing serosal color, gastric wall texture and thickness, and vascular patency assesses gastric wall viability. If the serosal surface is torn, gray-green, or black 10 minutes after anatomic reposition of the stomach, resection of the affected area should be performed.

Neoplasia or ulceration are also indications to perform a partial gastrectomy.

Anatomy:

The stomach is divided into the cardiac part, fundus, body, and pyloric part. It is located in the cranial abdominal region, caudal to the liver and in contact with the intestinal mass through the visceral surface. The left side (cardias, fundus and body) is big and round, and the right side (pyloric antrum, pyloric canal and pylorus) is small and cylindrical.

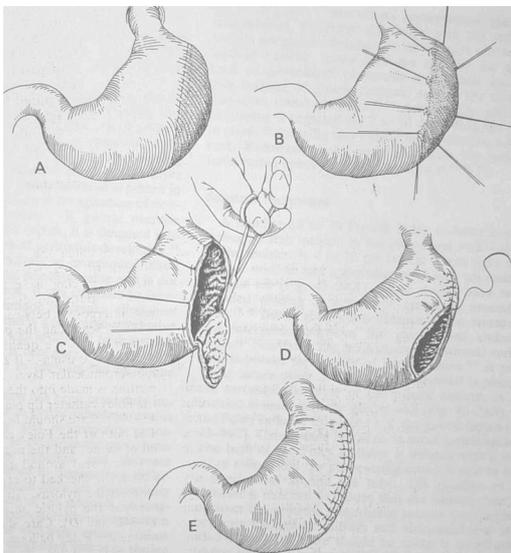
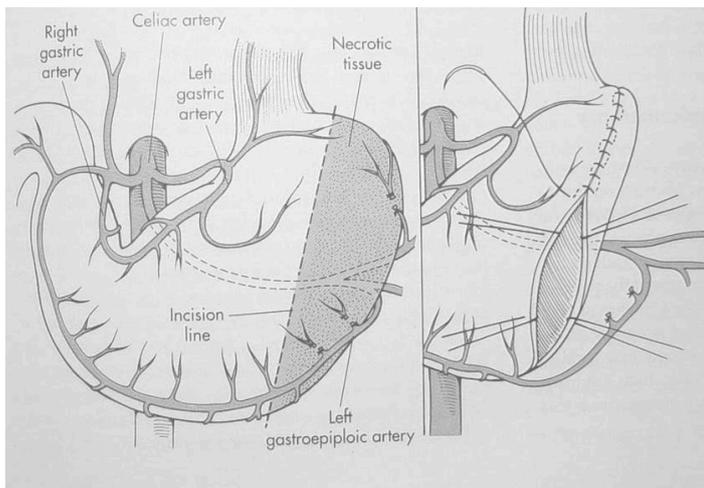
The right and left gastroepiploic arteries together with the short gastric arteries irrigate the area of the great curvature of the stomach.

Surgical technique:

- Place stay sutures to fix the stomach and aid in manipulation.
- Ligate branches of the left gastroepiploic vessels and/ or short gastric vessels along the section of the stomach to be removed.
- Excise the necrotic tissue using a metzembaum scissors or a scalpel blade leaving a margin of normal actively bleeding tissue to suture.
- Close the stomach with a two layers suture pattern using an absorbable suture. Use a simple continuous pattern for the first layer and an inverting pattern (Cushing or Lembert) for the second one.
- Alternatively, a thoraco-abdominal (TA) stapler can be used to close the incision.

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Seminar on perineal hernia

Barbara Haas, Dr. med. vet., Fachtierärztin für Kleintiere

Case 1

9 year old Dobermann intact male is presented with a history of problems with defecation. The problems exist since 4 weeks. Several times the dog showed diarrhea as well.

The clinical abnormalities found by rectal palpation included an enlarged prostatic gland and a deviation of the ampulla recti to the right side.

Case 2

7 year old pekingese male with a perineal swelling is presented with vomiting and is anuric since yesterday

Perineal hernia

Barbara Haas, Dr. med. vet. Fachtierärztin für Kleintiere

Perineal hernia occurs when pelvic diaphragm muscles fail to support the rectal wall. The exact cause of the muscular weakness is unknown, but several factors have been proposed. The muscle weakness may be associated with male hormones, straining, and congenital or acquired muscle weakness or atrophy. Atrophy possibly of neurogenic origin has been identified in some animals with hernias.

Herniation may be unilateral or bilateral and most often occur between levator ani muscle, external anal sphincter and obturatorius internus muscle. Caudal displacement of intraabdominal organs or deviation of the rectum into the perineum can occur. Contents found in the hernial sac may include jejunum, colon, and prostate. Retroflexion of the bladder occurs in 20% of patients. This may result in urinary obstruction and is then considered as emergency. However, more commonly retroperitoneal fat and fluid fill the sac.

Tenesmus, constipation, and perineal swelling are the three most consistent clinical findings. Tenesmus is the result of the collection of excessive feces in a rectal dilatation or sacculation in the perineal hernia. Rectal palpation is the most important part of physical examination.

There are several surgical methods; we present you colopexy, vaspexy, and cystopexy in comparison to the obturatorius flap. Sometimes it is necessary to use them in combination. You have to be familiar with the anatomy in the anal region.

Surgical anatomy

The structures involved in surgical repair of perineal hernia include the pelvic diaphragm, the perineal fascia, and the nerves and vessels in the proximity of these structures. The levator ani and coccygeus muscles form the lateral boundary of the rectum or the medial boundary of the pelvic diaphragm. The sacrotuberous ligament and the superficial gluteal muscle form the lateral aspect of the pelvic diaphragm. The ventral aspect is bounded by the internal obturator muscle. The striated muscle surrounding the anal canal is called the external anal sphincter.

The internal pudendal artery and vein and the pudendal nerve are bound together by loose connective tissue, and this neurovascular bundle passes ventrolaterally to the coccygeus muscle and continues caudomedially across the dorsal surface of the internal obturator muscle. At the caudal border of the ventral aspect of the external anal sphincter muscle, the pudendal nerve gives off the caudal rectal nerve. This branch of the pudendal nerve provides motor innervation to the external anal sphincter muscle.

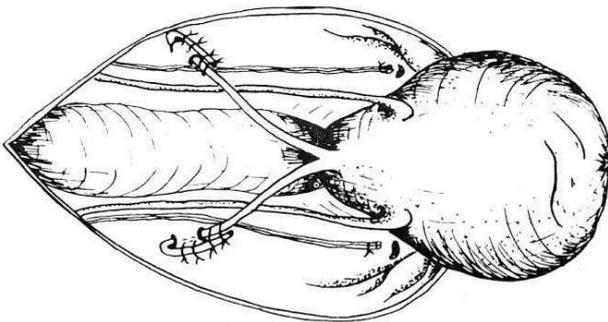
Surgical technique for the colopexy, vaspexy, and cystopexy

1. Castrate open
2. Celiotomy
3. Colopexy:

pull the colon descendens cranially, a helper is checking rectally that the ampulla recti is tubular and not kinked; sacrifice peritoneum caudal to left kidney in a length of 8 cm, use two rows of diagonal sutures between colon and peritoneum, enter the lumen with the suture (PDS), pre-place the dorsal line;

4. Vaspexy:

loosen the ductus deferens from the vessels; cut a tunnel into the peritoneum and m. transversalis , use the apex of the bladder as landmark for your tunnel; pull the ductud deferens with a mosquito clamp in a caudocranial direction through the tunnel; each ductus is sutured to itself and the abdominal wall with diagonal sutures;



5. Cystopexy:

sacrifice the abdominal wall on the right side next to the bladder neck, do the same to the bladder serosa, use diagonal sutures to fix the bladder to the abdominal wall.

Internal obturator muscle transposition for repair of perineal hernia

Katja Voss, Dr. med. vet., B. Haas

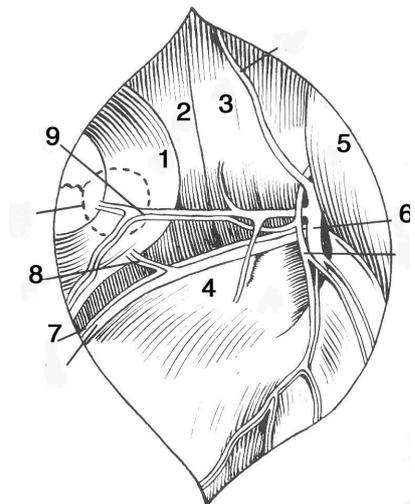
Introduction

The internal obturator muscle transposition technique for treatment of perineal hernia has been first described in 1983. The elevation of the internal obturator muscle allows closure of the defect under less tension, compared to standard herniorrhaphy. The operation can be performed bilaterally, although a staged procedure causes less postoperative discomfort and complications. Reported complication rates range from 14% - 67%. Complications include rectal prolapse, wound infection and seroma, urinary and fecal incontinence and flatulence. Recurrence rates between 4,6% and 23% are reported.

Surgical anatomy

The pelvic diaphragm is the vertical closure of the pelvic cavity. It consists mainly of the levator ani and the coccygeal muscle and the deep and superficial perineal fascia. They connect the pelvic floor to the caudal vertebrae. Important vessels and nerves are the caudal gluteal artery, the pudendal artery and nerve and the caudal rectal artery and nerve.

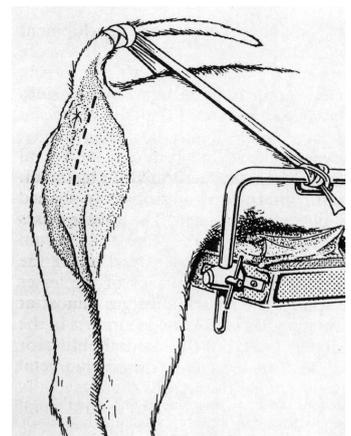
- 1) External anal sphincter muscle
- 2) Levator ani muscle
- 3) Coccygeus muscle
- 4) Internal obturator muscle
- 5) Superficial gluteal muscle (sacrospinous ligament is behind it)
- 6) Caudal gluteal artery
- 7) Pudendal artery and nerve
- 8) Caudal rectal artery and nerve
- 9) Perineal artery and nerve



Surgical technique:

The anal sacs are evacuated, a lubricated gauze tampon is inserted into the rectum and a purse string suture is placed around the anus.

The animal is positioned in sternal recumbency with the pelvis elevated and the hindlimbs hanging over the padded edge of the table. The tail is loosely fixed over the back.

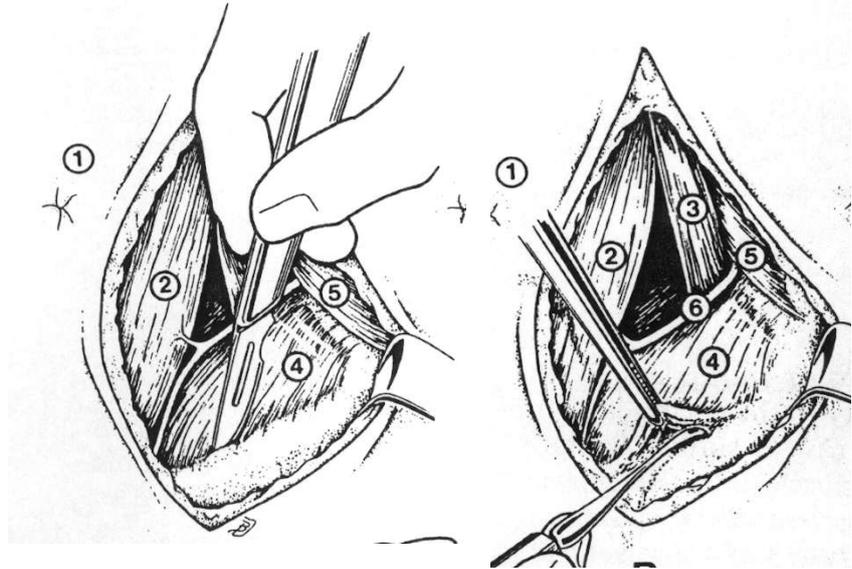


A slightly curved vertical skin incision is made lateral to the anus from the base of the tail to the ischiatic arch. The superficial perineal fascia is incised the same way.

Hernial contents are gently freed and repositioned into the pelvic cavity. Hernial reduction is maintained by packing the defect with a moistened sponge.

Identify the muscles involved in the hernia, the pudendal artery and nerve, the caudal rectal artery and nerve and the sacrotuberous ligament.

The attachment of the internal obturator muscle (4) is incised at the periosteum along the caudal border of the ischium with a scalpel from medially towards laterally. The incision is



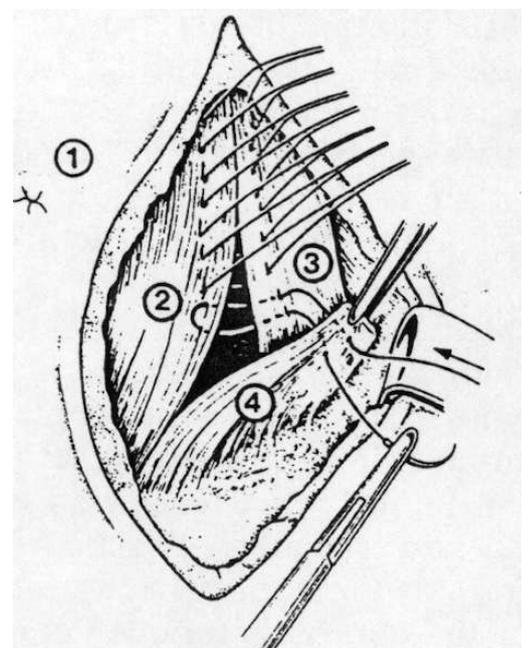
continued laterally and cranially with scissors.

The internal obturator muscle (4) is elevated from the ischium with a periosteal elevator up to the caudal border of the obturator foramen. For additional mobility, the internal obturator tendon is dissected just medial to the sacrotuberous ligament, which lies behind the superficial gluteal muscle (5). Be careful not to damage the ischiadic nerve and the pudendal nerve and vessels (6).

The internal obturator muscle is then flapped towards dorsomedially.

Preplace simple interrupted or cruciate pattern sutures, using 0 or 2-0 monofilament suture material with a large curved needle (for example Polydioxanone, PDS®). All sutures are spaced less than 1 cm apart.

The apposition begins dorsally by suturing the external anal sphincter muscle (2) to the coccygeus muscle (3). Then sutures are placed between the internal obturator (4) and the external anal sphincter muscle medially



(avoid the anal sacs), and between the internal obturator and the coccygeus muscle laterally.

The sutures are tied, beginning dorsally. Remove the sponge used to maintain reduction before tying the last sutures.

Suturing the perineal fascia to the external anal sphincter muscle eliminates dead space. Subcutis and skin are closed in a single interrupted suture pattern.

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Seminar on upper airway obstruction

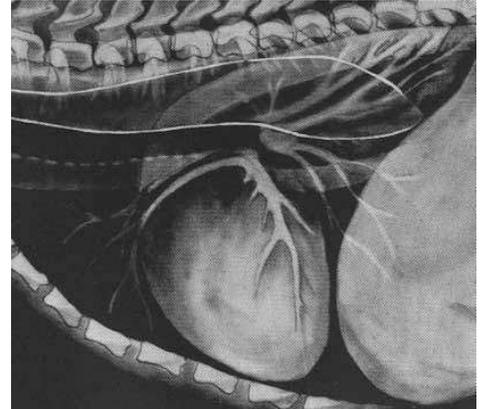
Daniel Koch, Dr. med. vet. ECVS

Case 1:

Leonberg, 7 years, male

Exercise intolerance

Inspiratory dyspnea, stridor



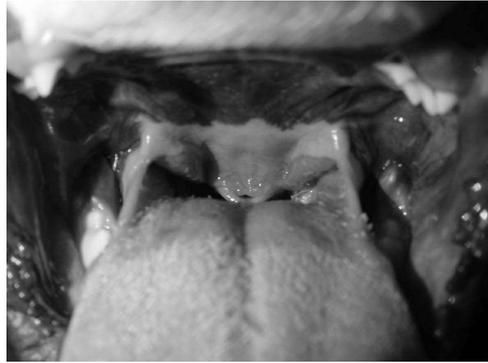
Case 2:

Norwich Terrier

9 months

inspiratory stridor

nocturnal asyphxia



Case 3:

German shepherd dog

4 years

bilateral epistaxis

painful on palpation

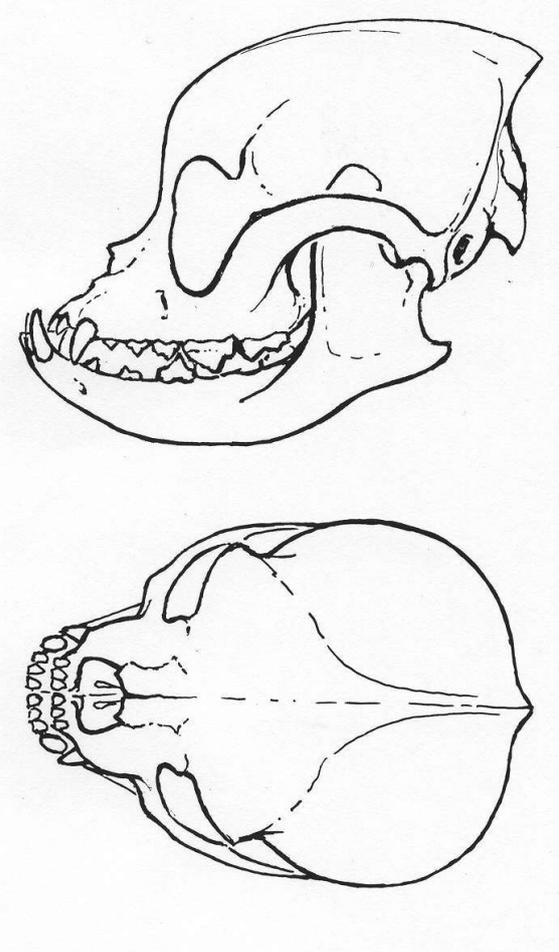


Brachycephalic syndrome

Daniel Koch, Dr. med. vet. ECVS

Introduction

The term brachycephalia expresses a local chondrodysplasia. Therefore, an early ankylosis occurs of the cartilage of the base of the skull leading to a shortening of the longitudinal axis of the skull. The division of dogs into dolichocephalic, mesocephalic and brachycephalic is based on skull measurements from German and American authors. Alternative measurements are based on the angle between the base of the skull (basilar axis) and the facial skull (facial axis). Brachycephalic dogs have craniofacial angles between 9° and 14° , mesocephalic dogs between 19° and 21° , and dolichocephalic greyhounds between 25° and 26° . Depending on the division modality the following breeds are typical representatives of the brachycephalic dog: Chihuahua, Bulldogs, King Charles Spaniel, Maltese, Pekingese, Miniature Pinscher, Shi Tzu, Yorkshire Terrier and Boxer. Due to the shape of their skull these breeds not only suffer from respiratory problems, but also have a predisposition for hydrocephalus, facial nerve paralysis, skin fold dermatitis, eye bulb prolapse or false positioning of the teeth.



It is obvious to take the shortened nose of brachycephalic breeds as a starting point for explanation. Through breeding the anatomy of the respiratory tract has been changed and this in turn leading to an increased resistance during inhalation. As possible stenoses, that must be considered and therefore the primary characteristics, are the narrowed nostrils, or the anatomy of the endoturbinata. In order to obtain sufficient oxygen brachycephalic dogs have to produce a higher negative pressure, by increasing laboured breathing, distally to the resistance. With this negative pressure the soft tissues are drawn into the lumen and become hyperplastic in time. If there is a high enough negative pressure in the lumen it might even exceed the resistance of the tissues, leading to a collapse of these structures. The secondary manifestations of the brachycephalic syndrome, such as everted laryngeal sacculles or tonsils, narrowed rima glottis or the collapse of the cartilaginous respiratory tract, constrict the lumen even more. This increases the clinical signs and leads to a further deterioration that may ultimately lead to death from suffocation. It is not yet elucidated, if the elongated soft palate is a primary or secondary event. It can however be so elongated, or pushed caudally together with the maxillary bone, that breathing is heavily impeded. During inhalation the soft palate audibly flutters during

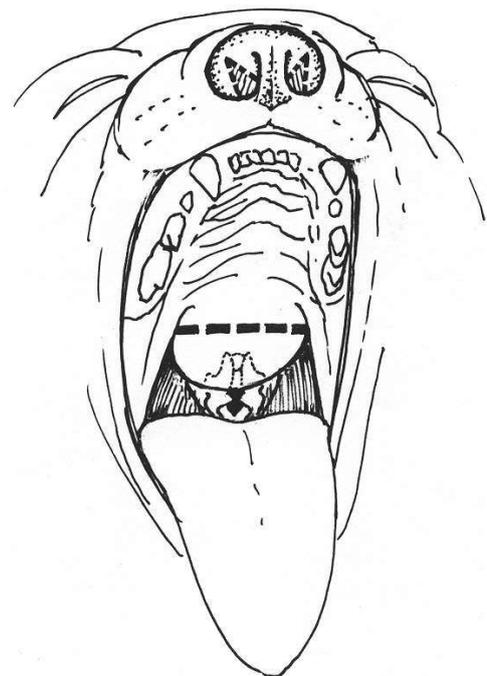
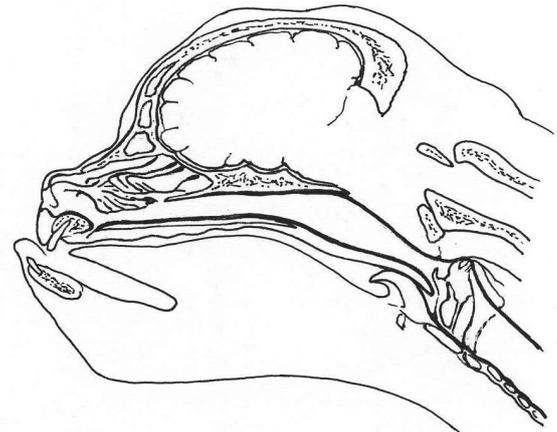
breathing. It may even be caught dorsal of the epiglottis, nearby the rima glottidis (Fig. 2), which provokes a sudden attack of suffocation.

Affected dogs try to interrupt or prevent this vitious circle with suitable countermeasures. If possible they avoid stress or heat. During excitement a sympathetically controlled mechanism causes a vasoconstriction, leading to a reduced resistance for a short time. During inhalation the wings of the nostrils are actively dilated. If signs of dyspnoe occur the dogs stretch their necks upward to dilate the nasopharynx and larynx and, if necessary to place the elongated soft palate below the epiglottis. If the elongated soft palate is held above the epiglottis, the dogs lie down on their sides, which releases the soft palate by allowing to glide laterally to the epiglottis. Panting helps the dogs to get rid of their surplus of heat. The respiratory tract is not the only organic structure which is exposed to an increased negative pressure during inhalation. Due to their close vicinity to the airways the esophagus, auditory canals, central nervous system and lower respiratory tract should also be examined. It is not rare that an enlarged tongue, difficulty in swallowing, hiatal hernia, gastric bloating, otitis media, neurological signs or bronchiectasies are reported in brachycephalic breeds.

Patients suffering from the brachycephalic syndrome often show severe dyspnoe. Some are also hyperactive and hyperthermic. Therefore, the initial examination is preferably performed without any restraint or anesthesia. In an emergency situation the animals have to be sedated, provided with oxygen and cooled down with alcohol. If ever possible, diagnosis and therapy should be executed in the same narcosis. The anesthesia of brachycephalic dogs is a particular challenge, as almost all sedatives or anesthetic drugs relax the muscles of the upper respiratory tract. After inspection of the nostrils, the oropharynx and the larynx is carefully evaluated with a laryngoscope or endoscope. Radiographs of the the thorax and the trachea are taken.

According to the literature, the treatment of the brachycephalic syndrome should be carried out from the frontal to the caudal parts, therefore the widening of the stenotic nostrils is the first step. This should prevent secondary changes such as the protrusion of soft tissues of the nasopharynx or the collapse of the larynx and the trachea. The procedure consists of removing a triangle of the wings of the nostrils and the wound edges are adapted with a non-absorbable thread. By this procedure, the clinical signs should considerably improve.

An elongated soft palate should be shortened to the correct length, in order to prevent interference with the epiglottis. For the correct length, the tip of the epiglottis or the middle of the ton-



sils can be given as the caudal landmark. The shortening of the soft palate can also be performed by a laser technique. After widening of the nostrils and shortening of the soft palate the prognosis is generally quite good, and it is far better the younger the patients. The everted laryngeal sacculles and the laryngeal collapse are considered to be a sequelae of a further rostrally situated stenosis. The everted laryngeal sacculles are cut off with long scissors. In cases of laryngeal collapse, a tracheostomy is the treatment of choice, because partial laryngectomies caused too many deaths postoperatively.

The removal of the tonsils is controversial. Usually, they are removed as they protrude, due to the irritation or the negative pressure, into the air passages into the oropharynx. However, due to their anatomical location they should not interfere with respiration and so can be left in place.

Exercises

Stenotic nares

1. Place the animal in sternal recumbency
2. Plan a wedge removal
3. Excise the wedge with a scalpel
4. Suture the wound edges with one to three stitches
5. Control breathing of the animal over 24 hrs

Overlong soft palate

1. Place the animal in sternal recumbency
2. Fix the endotracheal tube to the lower jaw
3. Estimate the length of the soft palate. Physiological position means, that the end of the soft palate is on the height of the tip of the epiglottis or approximately on the half of the tonsil length
4. Use long Metzenbaum scissors, forceps and a rapid absorbable suture material (eg Vicryl® rapid)
5. Cut the soft palate in increments and immediately suture it in a continuous pattern to control hemorrhage.
6. Alternatively, a carbon dioxide laser may be used to cut the soft palate (excellent hemorrhage control, expensive, security precautions)

Laryngeal paralysis

Daniel Koch, Dr. med. vet. ECVS

Introduction

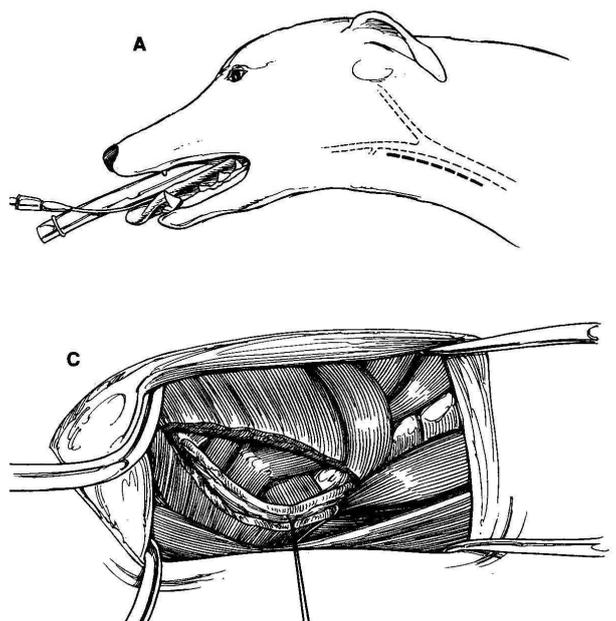
Laryngeal paralysis can result from isolated neuromuscular dysfunction or can be a manifestation of a generalized polyneuropathy or polymyopathy. Congenital laryngeal paralysis occurs in the Bouvier des Flandres and in Siberian Husky breeds, usually before 6 months of age. Acquired causes include traumatic injury, neuropraxia from tumors, polyneuropathy (metabolic, toxic and others) and polymyopathy (myasthenia gravis). Spontaneous laryngeal paralysis occurs most frequently in middle-aged to older large-breed dogs.

Clinical findings of laryngeal paralysis result from impairment of the three functions of the larynx and include upper airway obstruction (stridor, dyspnea, exercise intolerance, collapse, cyanosis, hyperthermia), aspiration, and altered vocalization. Diagnosis is established by laryngoscopic examination during light anesthesia. In animals with laryngeal paralysis, the rima glottidis does not enlarge during inspiration and may instead show paradoxical inward movement. Animals with laryngeal paralysis should be evaluated for concurrent neuromuscular disease, especially dysphagia or megaesophagus which greatly enhance the risk for aspiration pneumonia after surgery.

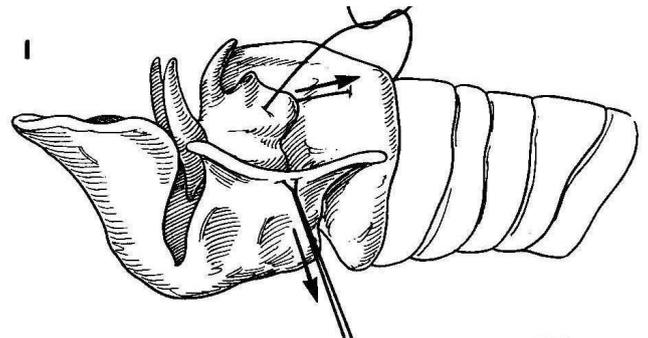
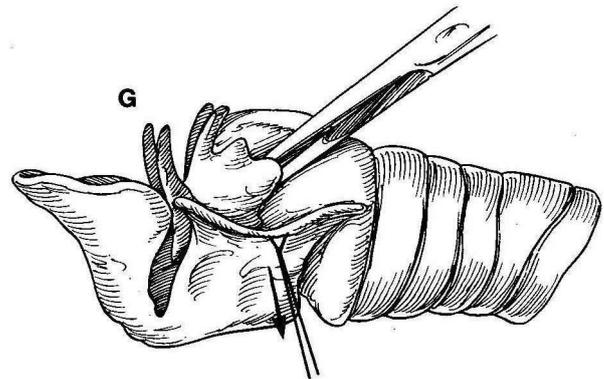
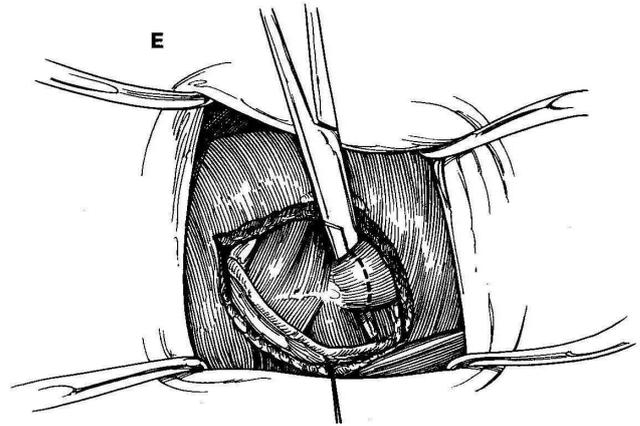
Emergency medical treatment for laryngeal paralysis consists of rest, supplemental oxygen cooling, and intravenous corticosteroids. On occasion, a temporary tracheostomy is necessary to relieve acute respiratory distress. Surgical treatment advocated for laryngeal paralysis include ventriculocordectomy, partial laryngectomy, castellated laryngofissure, and arytaenoid lateralization. The first three procedures produce inconsistent results or require much experience. The arytaenoid lateralization is preferred by most surgeons. Unilateral lateralization is sufficient to relieve airway obstruction in most cases and decreases the risk for postoperative aspiration.

Technique

1. Place the animal in lateral recumbency
2. The incision is made in the skin and subcutaneous tissue caudally from the angle of the mandible and below the jugular veins
3. The larynx is exposed by separation of the sternohyoideus and sternocephalicus muscles



4. The thyropharyngeus muscle is incised along the border of the thyroid cartilage. The cartilage is retracted laterally to expose the arytaenoid cartilage
5. The muscular process of the arytaenoid cartilage and the cricoarytaenoideus dorsalis muscle are identified. The cricoarytaenoideus dorsalis muscle is divided
6. The cricoarytaenoid articulation is disarticulated with scissors. In rare cases, the arytaenoid-arytaenoid articulation is separated
7. An 0 polypropylene suture is passed through the caudodorsal border of the cricoid cartilage and then through the muscular process of the arytaenoid cartilage. The suture is tied to abduct the arytaenoid cartilage.
8. The thyropharyngeus muscle is closed with 4-0 suture. Subcutis and skin are closed.



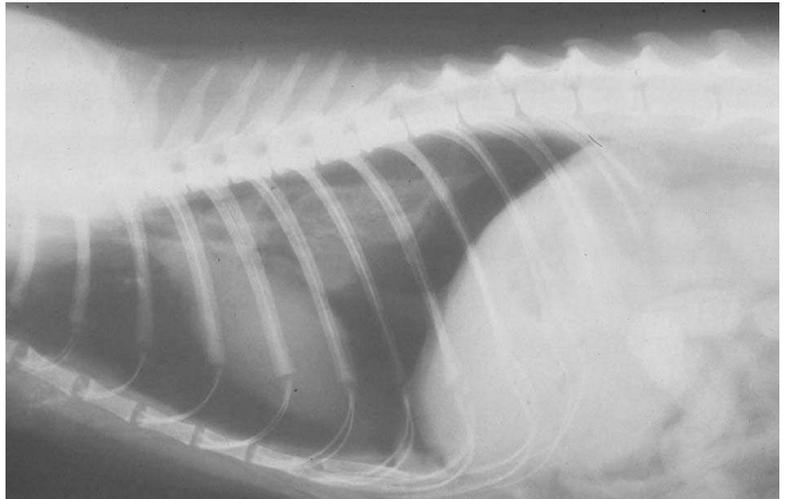
Seminar on chest trauma

Marcel Keller, Dr. med. vet.

Case 1:

Cat, fell from 6th floor:

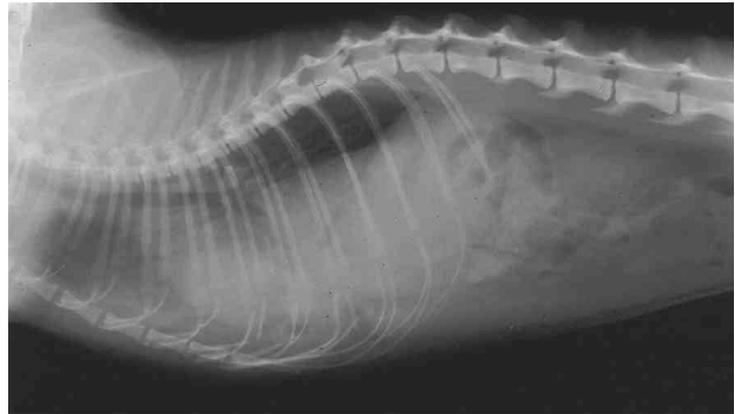
- severe dyspnea
- rapid shallow breathing



Case 2:

Cat hit by car:

- severe dyspnea
- paradoxical chest wall movements



Case 3:

Dog ran into a stick

- not able to move
- white mucous membranes, tachycardia, weak pulses
- rapid shallow breathing



Thoracocentesis

Marcel Keller, Dr. med. vet.

Indication

- Therapeutic (air or fluid removal from pleural space) and diagnostic (cytology, bacteriology)
- Pneumo-, Pyo-, Hemo-, Chylothorax

Instrumentation

Butterfly needle, three-way stopcock, 20 ml syringe

Procedure

Clip and prepare aseptically an area around the 7th and 8th intercostal space. Air is best aspirated from the midthorax with the animal in lateral recumbency or from the dorsal third with the animal in sternal position. Fluid is collected in the ventral half of the thorax while the animal is standing or sternally.

Connect the butterfly needle to the three-way stopcock and the syringe. Insert the butterfly needle through the skin and advance it into the thorax cranial to the rib in an 45° angle with the bevel towards the thoracic wall (Fig.1). Intercostal artery, vein and nerve are located caudal to the rib. Entering the thoracic cavity is felt by a slight „plop” and when air or fluid is easily aspirated. Repeat the procedure on the other side of the thorax.

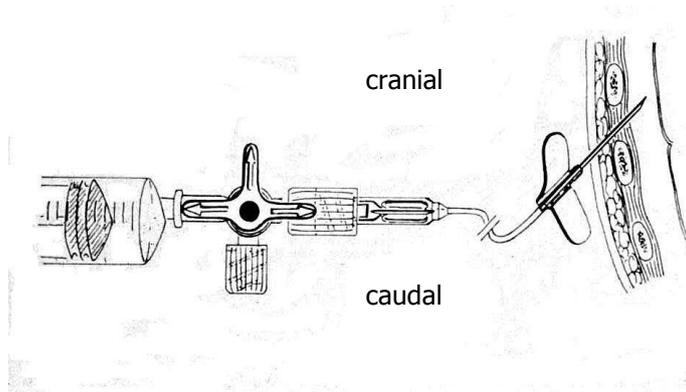


Fig.1 Thoracocentesis with a 20 ml syringe (left), a three-way stopcock (middle) and a butterfly needle (right).

Chest tube placement

Marcel Keller, Dr. med. vet.

Indication

- Persistent pneumothorax
- Postoperative thoracotomy
- Complete evacuation and/or lavage of the thorax

Equipment

Technique Fig. 2a

alternatively

Technique Fig. 2b

- thorax drain with stylet
- number 10 scalpel blade
- antiseptic ointment
- Supramid 2-0

- red rubber feeding tube
- number 10 scalpel blade
- curved hemostat
- antiseptic ointment
- Supramid 2-0

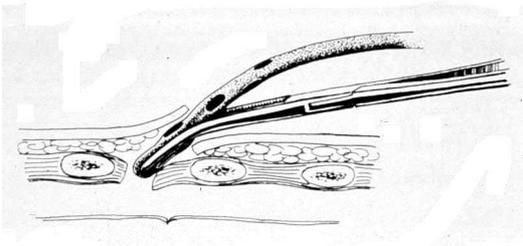


Fig 2b: Insertion of a chest tube

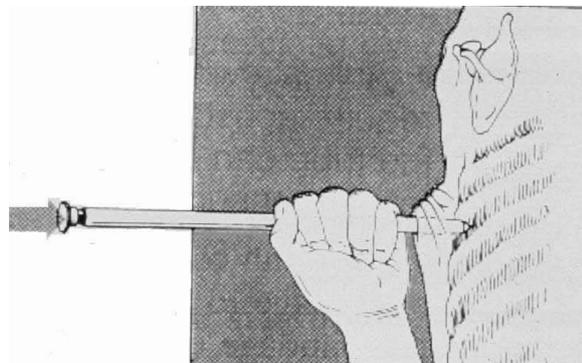


Fig. 2a: Insertion of a chest tube with a stylet with a hemostat

Procedure

An appropriate sized chest tube is selected, approximating the diameter of a mainstem bronchus.

The animal is placed in lateral recumbency. A chest tube can be inserted under general anesthesia or even under local anesthesia. A skin incision is made at the level of the 11th to the 12th intercostal space. A subcutaneous tunnel directed cranioventrally is created bluntly by the tip of the tube with the stylet (Fig. 2a) or with a hemostat (Fig. 2b) and the tube inserted at the 7th intercostal space at the level of the junction between the dorsal and the middle third (Fig.3). Using either the chest tube with a stylet (Fig. 2a) or the technique with the help of a hemostat (Fig. 2b) the introduction into the thorax needs a controlled thrust. Once the tube is through the thoracic wall advance it into the pleural space, parallel to the thoracic wall, directed towards the opposite elbow joint. Secure it with a chinese fingertrap suture (Fig.3). The tube is

connected to an extension tube, all connections are secured with superglue. The entrance side is covered with antiseptic ointment, the tube is wrapped with a light bandage. The position is confirmed with a thoracic radiograph. Drainage may be either intermittend or continuos.

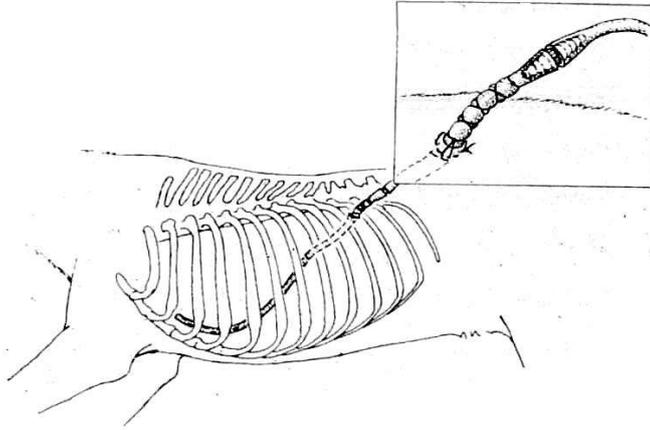


Fig 3: Proper placement of the chest tube within the pleural space

Transtracheal intubation

Marcel Keller, Dr. med. vet.

Indication

A transtracheal intubation is performed to bypass lifethreatening obstructions of the upper airway or to facilitate surgical procedures in the head and neck region.

Instrumentation

- endotracheal tube of appropriate size
- if available special transtracheal intubation set

Procedure:

The cat should be anesthetized intravenously and if possible intubated with an endotracheal tube and anesthesia maintained by gas. The ventral neck area is clipped and aseptically prepared for surgery. The skin is incised from the cricoid cartilage to a point 2-3 cm caudal to it. Hemostasis is performed. The left and right sternohyoideus muscles are separated bluntly. The midline between these two muscles is found easier if they are stretched gently over the trachea. With the scalpel blade an incision large enough to insert the appropriate sized endotracheal tube is performed between the fourth and fifth intertracheal ring. Watch out not to damage the cuff of the inverted endotracheal tube. Two stay sutures are around the rings adjacent to the tracheotomy to help insertion of the endotracheal tube. They are left in place even after intubation for postoperative management, secured with a knot and left with long ends. The tube is fixed with a chinese finger trap suture or with tape stirrups which are sutured to the skin and the insertion site is covered with antiseptic ointment. The cranial and caudal end of the incision can be adapted with a single layer skin suture.

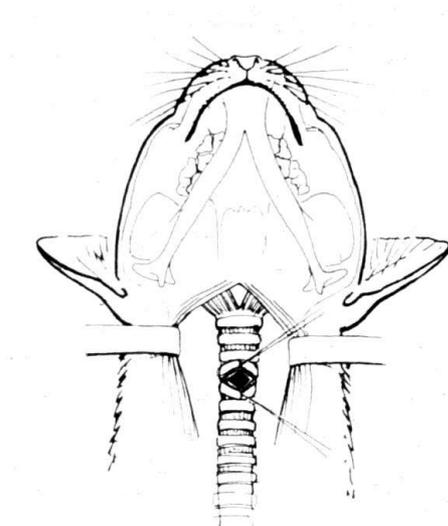


Fig. 1: Surgical anatomy of the ventral neck of a cat

Thoracotomy and lung lobectomy

Marcel Keller, Dr. med. vet.

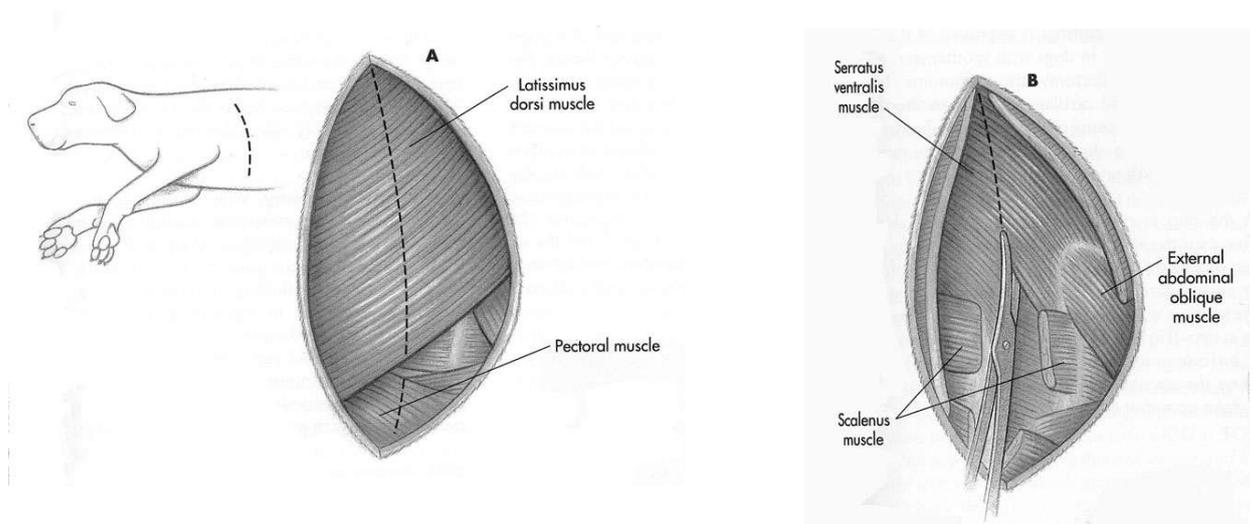
Thoracotomy may be performed by incising between the ribs (intercostal thoracotomy) or by splitting the sternum (sternotomy). The approach used depends on the exposure needed and underlying disease process. A lung lobectomy is best performed through an intercostal thoracotomy. If further exposure is needed a rib can be resected either cranially or caudally the original incision (rib resection thoracotomy). This improves visibility by about 33%. Also the incision can be extended over the sternum (transsternal thoracotomy) which has the same effect. The ribs displace easier cranially, therefore the incision should be rather caudally than cranially the recommended intercostal space.

Thoracic Structure	Intercostal Space	
	Left	Right
Heart and pericardium	4, 5	4, 5
Ductus arteriosus	4 (4,5 cat)	
Pulmonic stenosis	4	
Pericardiectomy	5	5
Cardiopulmonary bypass	4, 5	4, 5
Lungs	4-6	4-6
Cranial lobe	4, 5	4, 5
Intermediate lobe		5
Caudal lobe	5, 6	5, 6
Esophagus		
Cranial	3, 4	3-5
Caudal	7-9	7-9
Caudal vena cava		7-9
Thoracic duct		
Dog		8-10
Cat	8-10	

Intercostal thoracotomy at the 4th intercostal space

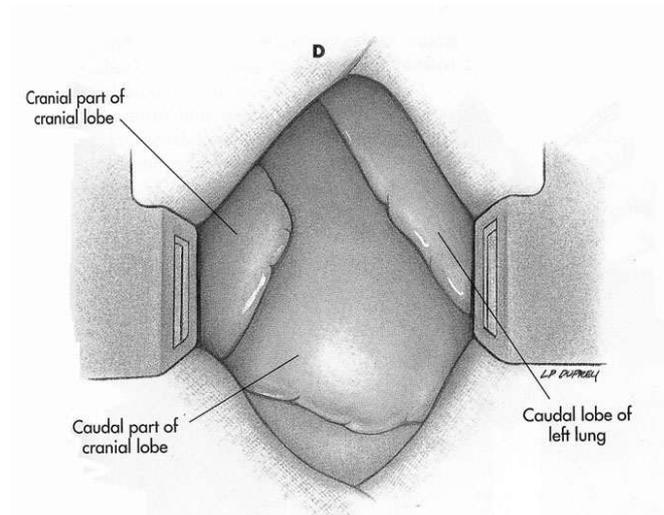
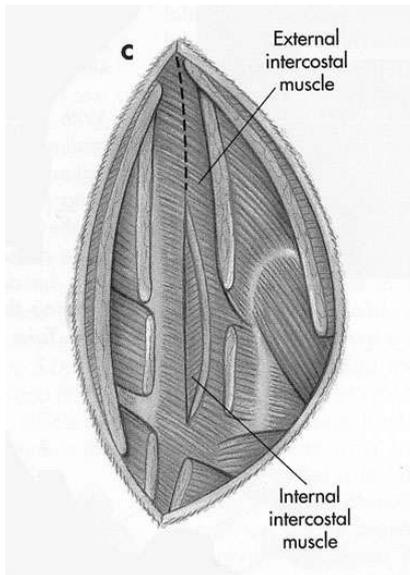
A) Locate the approximate intercostal space and sharply incise the skin, subcutaneous tissues, and cutaneous trunci muscle. The incision should extend from just below the vertebral bodies to near the sternum. Deepen the incision through the latissimus dorsi muscle with scissors. Verify the correct intercostal space by palpating the first rib.

B) Transect the scalenus (attaches at the 5th rib) and pectoral muscles with scissors perpendicular through their fibers, then separate the muscle fibers of the serratus ventralis muscle at the selected intercostal space.



C) Near the costochondral junction, place one scissor blade under the external intercostal muscle fibers and push the scissors dorsally in the center of the intercostal space to incise the muscle. Incise the internal intercostal muscle similarly. After identifying the lungs and pleura use closed scissors or a blunt object to penetrate the pleura. Extend the incision dorsally and ventrally to achieve the desired exposure. Avoid incising the internal thoracic vessels near the sternum.

D) Use a Finochietto retractor to spread the ribs.



Complete lung lobectomy

Indications:

- Neoplasia
- Lung lobe torsion
- Abscesses
- Spontaneous pneumothorax (Bullae/Blebs)
- Severe traumatic injury

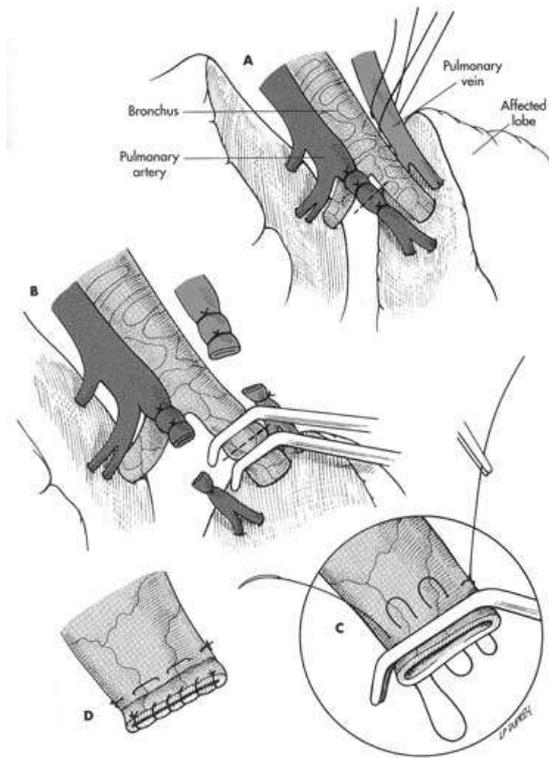
Procedure:

A) Identify the affected lobe and isolate it with moistened sponges. Blunt dissection of the vessels should be parallel not perpendicular to the long axis of the vessels. The pulmonary artery is exposed and divided first by retracting the lung lobe ventrally and caudally. The vein is then exposed and divided by retraction of the lobe dorsally and cranially. All vessels are triple ligated with silk.

B) After the vessels are divided, the lobar bronchus is clamped with a noncrushing tangential clamp and divided approximately 3mm distal to the clamp.

C) The bronchial stump is closed with 4-0 suture in continuous mattress pattern. The suture ends are „tagged“ with forceps, the clamp is removed, and the bronchial stump is oversewn with a continuous pattern. Fill the chest cavity with warmed, sterile saline solu-

tion. Inflate the lungs and check for air leaks. Place a chest tube remove all the sponges and close the thorax.



Closure:

- 1) Rib closure is accomplished by preplaced heavy-gauge interrupted circumcostal sutures passed bluntly through adjacent intercostal spaces.
- 2) The serratus ventralis and scalenus muscles are closed in a single layer. The latissimus dorsi, cutaneous trunci muscle and subcutaneous tissues, and skin are closed in separate layers.

Surgical instruments

Katja Voss, Dr. med. vet., B. Degasper, C. Venzin, P.M. Montavon

Not only knowledge and surgical skills, but also the appropriate instruments are the key for a successful surgery. Available surgical instruments have been designed for specific tasks. Their correct use is important in order to minimize surgical trauma and instrument damage.

The basic soft tissue and orthopedic instruments, their correct use and quality control, are described below. General rules are that curved instruments facilitate visualization in the operation field and that instruments with long shanks and handles should be used for working in the deep, for example in the abdomen or thorax. In some instruments inserts on the blades or jaws can be exchanged, when damaged. These are marked with golden handles.

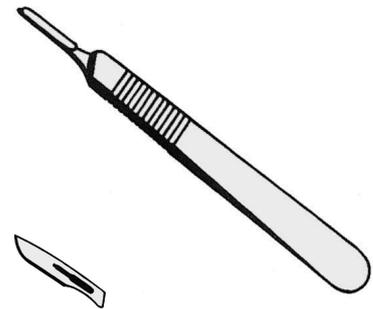
1. Soft tissue instruments

Scalpels

Scalpels are used for sharp dissection of tissues. The scalpel handle can also be used for blunt dissection. The blade is fixed to the handle using a needle holder, in order to prevent self-injuries. The finger grip is used for short and precise cuts, the palm grip for long incisions.

The most common scalpel handle in small animal surgery is the Bard-Parker handle. It is generally used with Nr. 10, 11 or 15 scalpel blades.

The connection between handle and blade has to be firm.



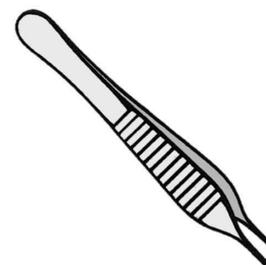
Thumb forceps

Functions of thumb forceps are gripping and holding of tissues and surgical materials. They are called thumb forceps, because they are held between the thumb and the first finger, as a pencil.

The Adson thumb forceps are less traumatic than the Adson Brown thumb forceps and are used for hemostasis and for suturing.

The Adson Brown forceps have a firmer grip and are therefore useful in holding tough tissues, as fascia.

The De Bakay tissue forceps are especially atraumatic, and are ideal for holding delicate tissues, as vessels or intestines.



Scissors

Scissors can be used for sharp or blunt dissection of tissues. In sharp dissection they cause more crushing than



scalpels, but dissection is safer. Scissors are held with the three-finger grip. The index finger is used as guidance. Cutting should always be performed only with the tips of the blades.

Metzenbaum scissors are fine scissors, generally used for preparation and blunt dissection of soft tissues, such as vessels and nerves. They are available with curved and straight blades and with short and long shanks.

The stronger Mayo scissors are used for cutting tough tissues, as fascia. A curved Mayo scissor is reserved as a suture scissor.

A Mayo scissor should be capable of cutting 4 layers of gauze sponges.

Tissue forceps

Tissue forceps come in variable shapes. They are generally used for holding tough tissues. They have a ratchet to insure permanent holding.

The Allis tissue forceps and Kocher tissue forceps have a strong grip and allow secure holding of tissues. They are useful for example in tumor resections, holding of fascia or manipulating vertebra in spinal fracture/luxations.

The Babcock tissue forceps are less traumatic and are designed for holding the stomach.

Doyen tissue forceps might be used for occluding bowel during bowel resection and anastomosis, although using the fingers is less traumatic.

The Backhaus towel forceps are needed for fixation of the drapings.



Hemostatic forceps

Next to their use in hemostasis, the hemostatic forceps are needed for holding suture ends and other surgical materials, as for example drains. They have a ratchet and come with straight and curved jaws.

The fine Halsted mosquito forceps and the larger Kelly and Crile forceps have transverse grooves on their jaws. They are used to occlude point bleeders. Only the vessel to be ligated and as less surrounding tissue as possible should be grasped.

Rochester Carmalt forceps are larger and have fine longitudinal grooves. They are used to ligate tissue bundles, because they allow easy retraction of the instruments, for example in ovariectomies.

An exact closure of the grip is important, in order to prevent slipping of the forceps. The ratchet must have a secure closure, when snapping the closed instrument on the hands.



Retractors

Retraction of tissues is important to optimize visualization in the surgical field and prevent damage to surrounding tissues. Retractors with teeth allow a better grip, but may be dangerous in areas with underlying nerves and vessels.

The Senn Miller retractor has an end with teeth and a blunt end, and is useful in retracting skin.



The Farabeuf retractor has two blunt ends with a double angle.

The malleable retractor can be formed as needed and is used to push abdominal or thoracic organs out of the surgical field.

The Balfour retractor is self-retaining and very useful in spreading the abdominal fascia during coeliotomies.

The self-retaining Finochietto retractor is designed for spreading the ribs open during thoracotomies.



Needle holder

The needle holder is the instrument for gripping, holding and guiding the needle during suturing. Needle holders can either be held with the three-finger grip or with the palm grip.

The most common needle holder in small animal surgery is the Hegar-Mayo needle holder.

Its grip should be firm and allow no movements of the needle, when ratchet is closed.

Suction tips

Suction is needed to for better visualization and for removal of fluids after flushing the abdominal or thoracic cavity.

The Frazier-Ferguson suction tip is used in areas not involving the abdominal cavities. It has a decompression hole, which allows varying suction force, when occluded with the index finger.

The Pool suction tip is used mainly in the abdominal cavity. The multiple holes prevent occluding the tip by the omentum during suctioning.

The Yankauer suction tip is large and works well for removing large volumes of fluid, for example in the thoracic cavity.

2. Orthopedic instruments

Instruments for orthopedic approaches

Orthopedic retractors

Orthopedic retractors must have a firmer grip than soft tissue retractors, because tissue to be retracted is generally tough. They therefore have different types of teeth, which prevent slipping. Retractors should be held perpendicular to the tissues to be retracted.

The Volkmann retractor has one or more sharp or blunt teeth. It is used for example in retracting the patellar tendon during knee surgery.

The Meyerding retractor has a row of small teeth and a large handle, which allows a hand grip from ventrally in order to retract muscle masses with more force.

The Fingermeier retractor is similar, but smaller, and is especially useful in retracting joint capsule.



The Langenbeck retractor has blunt ends, but a long blade and is good for retracting muscle masses.

Periosteal elevators

Periosteal elevators are helpful in reflecting soft tissues from bone or to elevate tendons or ligaments for better view. Periosteal elevators can have sharp or blunt working ends in different shapes. Pro- and supination movements from the wrist and elbow joint are made, while elevating soft tissue from the bone. The index finger on the working end leads the instrument.



The Adson periosteal elevator has an oval, straight or bent, working end.

The Freer periosteal elevator has two blunt working ends and is used mainly for manipulating tendons and ligaments. Because of the lean working ends it is also useful in cats and small dogs.

Bone levers

Bone levers are used for lifting bone up while retracting and protecting the surrounding soft tissues at the same time. The Hohmann bone lever is available in small and large size and with different shapes of the blade and point.



Instruments for cutting or removing of bone

Chisel and osteotome

Chisels and osteotomes are used to cut bone. Cutting is performed with the use of a mallet.

The working end of the osteotome is beveled bilaterally, the end of the chisel unilaterally.

Location of the bevel must be considered when working with a chisel, because the cut will form a slight curve away from the bevel.

The Slocum Hohlmessel is used to win corticocancellous bone graft from the ilial wing.

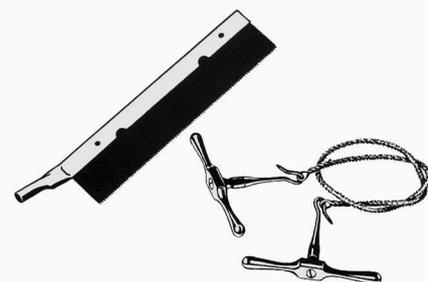
The blades of the osteotomes or chisels must be sharp enough to scrape a fingernail when pushed over it.



Saws

Saws are also used to cut bone. For preventing thermal necrosis, constant cooling with sterile isotonic solution is necessary.

The X-ACTO saw allows a fine and exact cut. It is used for performing the sulcoplasty in patellar luxation surgery.



The Gigli saw consists of cutting wire. The wire is fixed on T-shaped handles. It is often used for femoral head and neck excisions.

The saw blades and wire have to be sharp and clean.

Curettes

Curettes are needed for scraping tissues. They have round or oval sharp edged cups.

The Spratt curette has a round cup and is used for curettage of abscesses or bone and cartilage defects.

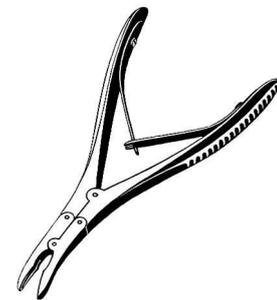
The Volkmann spoon is ideal for taking cancellous bone graft because of its oval working ends.

The Hatt spoon has a large cup and is used for cutting the femoral head ligament during femoral head and neck excisions.



Rongeurs

Rongeurs are instruments to cut and remove pieces of bone, cartilage or capsule with their sharp edged working cups. They come with different cup and blade sizes and shapes and can be single or double actioned. With double action rongeurs, more force can be applied on the working ends.



Luer, Ruskin, Stille and Cicorelli are used for cutting osteophytes and sharp bone surfaces.

For removing parts of the joint capsule or remnants of a ruptured cranial cruciate ligament the synovectomy rongeur is appropriate.

Rongeurs must be sharp enough to be able to cut a piece of paper.

Instruments for reduction

Bone holding forceps

Bone holding clamps are used for reduction and holding of bone fragments. The handles can either be locked with a ratchet or with a speed lock. The working ends may be pointed or transverse grooved. The bone holding forceps should be positioned at the vicinity of the fracture but not too close, in order to prevent iatrogen fractures at the bone ends. If used for compression of two bone fragments, positioning has to be perpendicular to the fracture line.

The Verbrugge bone holding forceps are used for tubular bones. Its jaws are perpendicular and bent sideways, allowing great width opening.

The Kern bone holding forceps have four pointed jaws. They can be used for distraction of fragments of long bones, but the risk of crushing is present.

For quality control, the exact closure of the jaws and an intact locking mechanism is important.



Seminar on otitis

Renate Dennler, Dr. med. vet. FVH

Case no. 1

A nine-month-old Siamese cat is presenting with unilateral, chronic aural discharge.

- i) What is your first differential diagnosis?
- ii) Describe some diagnostic procedures.
- iii) Describe two procedures to solve the problem and their prognosis.

Case no. 2

Your next patient is a eight-year old female Cocker Spaniel. It has been medically treated for chronic otitis externa for years. Now the dog is so painful that treatment by the owners is not possible anymore.



- i) Name some surgical procedures for the treatment of chronic otitis externa.
- ii) What criteria do you use to choose the appropriate procedure?
- iii) What are the most common complications after surgery?

Case no. 3

A twelve-year old castrated male cat is referred by the private veterinarian because of chronic unilateral aural discharge and a ipsilateral Horner's syndrome.

In otoscopy the vet could visualize a round mass obstructing the horizontal external ear canal.



- i) Name diagnostic procedures to assess the problem.
- ii) Name therapeutic procedures and their prognosis.

Otitis and surgical procedures

Renate Dennler, Dr. med. vet. FVH

Otitis externa is the most common ear disease in veterinary practice. The causes are numerous and it is most often a multifactorial disease. The anatomy of the ear and the presence of hair in the ear canal may predispose to infection. Atopy, food allergy, and contact sensitivities may also cause otitis. Also metabolic disease as hypothyroidism and seborrhea may cause severe otitis. So many cases of otitis are an extension of systemic disease.

Small numbers of gram-positive bacteria are cultured from normal ears. Gram-negative bacteria are usually found only in diseased ears. Bacterial pathogens in dogs include *Staphylococcus*, *Streptococcus*, *Pseudomonas*, *Proteus*, *Escherichia coli*. As with bacteria, small numbers of yeast can be isolated from normal ears. In diseased dog ears, *Malassezia canis* is the most common isolated yeast, followed by *Candida*. Do not forget mites, other parasites and foreign bodies as cause of otitis externa.

Once the disease begins, its progression is similar despite the original ethiology. The inflammation causes hypertrophy of sebaceous and ceruminous glands and a diffuse infiltration with inflammatory cells. Erosions and ulcerations occur. Moisture, debris, foreign bodies, hair, glandular secretions and serum exudates are trapped in the canal and form a perfect culture media for bacterial proliferation. Long-standing otitis externa results in hyperplasia and fibroplasia of the dermis and epidermis and can lead to total occlusion of the external ear canal. The tympanic membrane scleroses, ulcerates and eventually ruptures, leading to otitis media.

To properly determine the severity and the extent of ear disease, physical, neurologic and otoscopic examination (may need anesthesia) must be performed. The degree of the disease is important to choose the appropriate surgical procedure.

If neurologic deficits, especially facial nerve deficits are present before surgery, they are likely to persist after surgery.

Radiographs of the skull are taken to determine whether concurrent middle ear disease or neoplasia exists. Radiographs of the bulla should include left and right oblique views and an open-mouth rostrocaudal view. Changes seen include calcification of the external ear canal, thickening of the bulla walls and increased opacity of the bulla chambers. In 25% of animals with middle ear disease, radiographs appear normal. Computed tomography is more sensitive and is the diagnostic gold-standard for middle ear disease.

In young cats polyps are common. They might be congenital or inflammatory. Some extend through the Eustachian tube to enter the nasopharynx and cause dyspnea or dysphagia. Some grow up through the tympanic membrane into the external ear canal and cause aural discharge.

Surgical anatomy

The ear is composed of three parts:

- the inner ear, which consists of a membranous and a bony labyrinth and functions for hearing and balance.
- the middle ear, which is formed by the tympanic cavity and connects to the pharynx via the auditory tube (Eustachian tube).

- The external ear which is formed by the horizontal canal (annular cartilage) and the vertical canal (auricular cartilage).

The feline tympanic cavity is divided into dorsomedial and cranio-lateral (ventrolateral) compartments by a bony septum from the cranial aspect of the bulla to the lateral wall. The tympanic membrane forms most of the lateral wall of the smaller cranio-lateral compartment. The sympathetic nerves form a plexus on the promontory at the caudomedial aspect of the septum. They are often traumatized by during surgical curettage of the middle ear (Horner's syndrome).

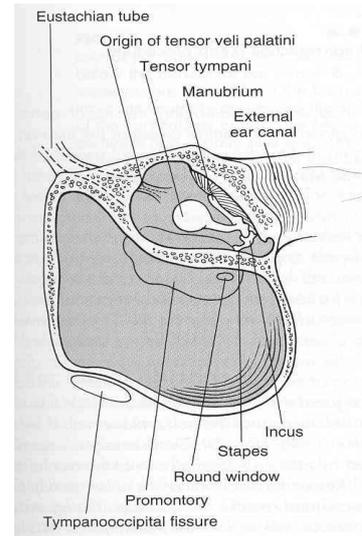


Fig 1: Anatomy of the feline tympanic cavity

Lateral ear canal resection (Zepp procedure)

Exposes the vertical and horizontal canals via excision of the lateral portion of the vertical cartilage. It is used to relieve stenosis of the vertical canal, and expose the horizontal canal improving drainage, air circulation and application of topical medications. This procedure is indicated only if the horizontal canal is patent and is often not a cure of the disease. Medical management of the ear probably will be necessary for the remainder of the animal's life..

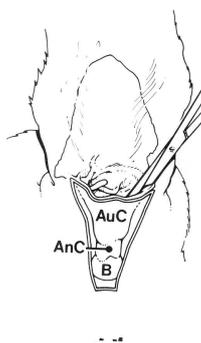


Fig 2: Zepp procedure: The skin overlying the canal is removed along the rostral and borders of the vertical canal.

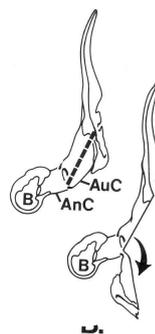


Fig 3: Zepp procedure. Incise the cartilage to the level of the annular cartilage. Note that the cartilage is left intact at the base and is flapped down.



Abb. 4: Zepp procedure. Final result with exposition of the horizontal canal and cartilage flap as a draining bord.

Vertical ear canal resection

Is performed if severe chronic otitis is limited to the vertical canal or a small tumor or polyp is present. The horizontal canal mucosa is apposed to the skin.



Fig 5: Vertical ear canal ablation. A triangular skin incision is made around the opening of the ear an over the vertical canal.

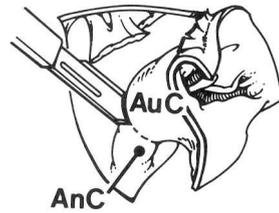


Fig. 6: Vertical ear canal ablation. Preparation and resection of the vertical ear canal. Resect cartilage at the junction of auricular (AuC) and annular (AnC) cartilage.

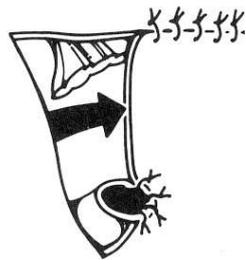


Fig 7: The opening of the horizontal canal is sutured into the ventral end of the skin incision.



Fig 8: The remainder of the skin is closed in a T-shaped manner

Total ear canal ablation

Is performed to remove the entire cartilaginous ear canal. Most animals with severe, chronic otitis externa have concurrent otitis media. Removing the avenue for drainage by performing a total ear canal ablation without treating the otitis media is disastrous. Therefore always perform a lateral bulla osteotomy in conjunction with total ear canal ablation for otitis externa and media.

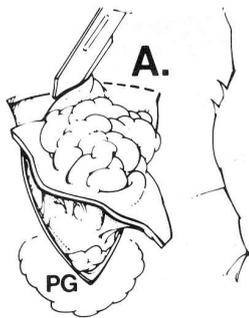


Fig 9: A triangular skin incision is made to isolate the ear canal, including all proliferative tissue at the opening of the canal.

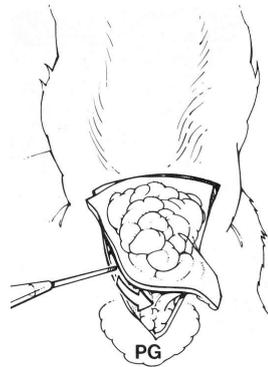


Fig 10: The auricular muscles are transected at their attachment to the perichondrium. The canal is dissected free in a circular fashion, staying close to the cartilage.

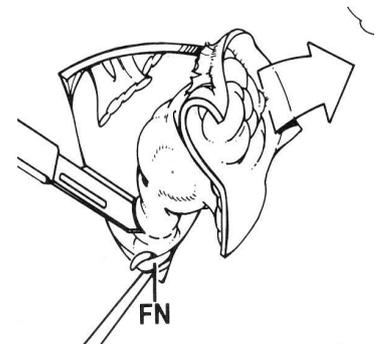


Fig 11: The horizontal is dissected to the level of the osseous bulla and transected, being careful to avoid damage to the facial nerve.

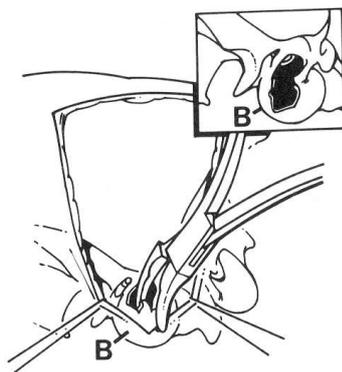


Fig 12: A lateral bulla osteotomy and curettage is performed.

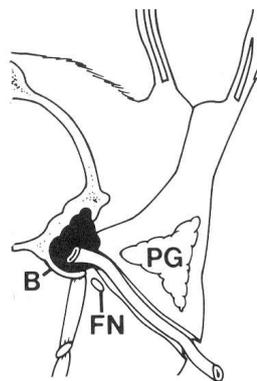


Fig 13: A penrose drain is placed into the tympanic cavity and exited ventral to the skin incision

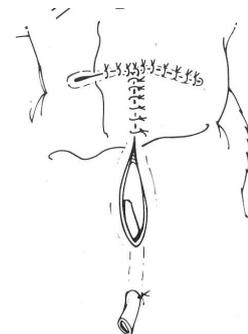


Fig 14: The skin is sutured in a T-shaped closure and the drain anchored to the skin

Ventral bulla osteotomy

For bulla osteotomy the cat is placed in dorsal recumbency with the neck elevated. The bulla is palpated caudal and slightly medial to the vertical ramus of the mandible. A paramedian skin incision is made over the bulla. By separating the digastric muscle from the hyoglossal and styloglossal muscles, the ventral bulla is visualized. The hypoglossal nerve is to be avoided. A Steinmann pin inserted into the bulla and the opening enlarged using rongeurs. The cat bulla is divided by a septum that must be opened for complete drainage and curettage. Polyps are excised at their base. Lavage is performed and a drain placed prior to closure. Prognosis is excellent long term but recurrence is likely if the entire polyp is not removed.

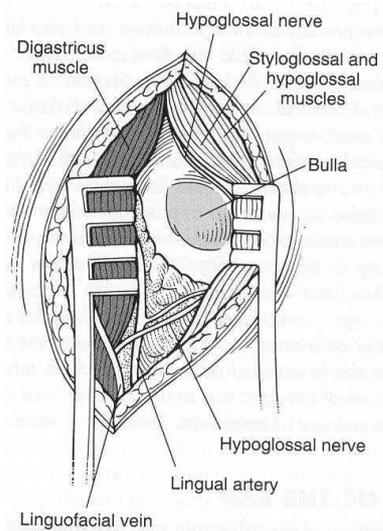


Fig 15: Ventral bulla osteotomy

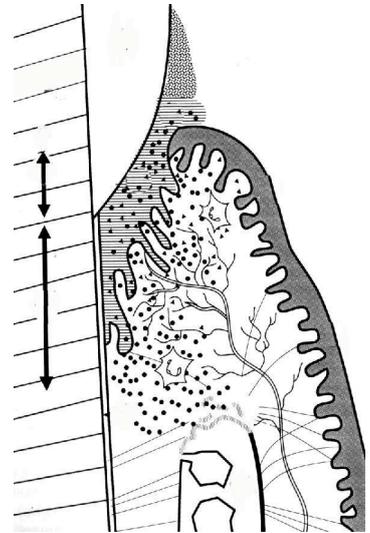
Stomatology

Daniel Koch, Dr. med. vet. ECVS

Introduction

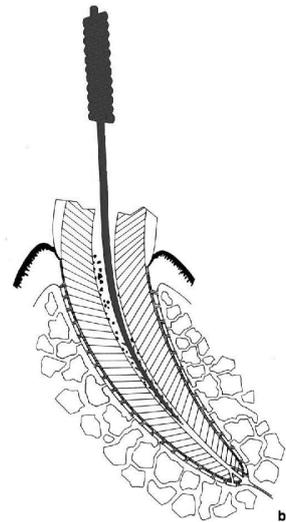
Periodontal diseases:

Most periodontal diseases start with plaque. Plaque develops to tartar by addition of saliva within 3 to 5 days. Furthermore, bacteria in the plaque can lead to gingivitis. Gingivitis only affects the mucosa attached to the tooth and is reversible. Under unfavourable circumstances, gingivitis turns into periodontitis. Clinical signs of periodontitis (fig.) include gingival bleeding, deepened tooth pockets, foetor ex ore, bony destruction and tooth loss. Treatment consists in tartar removal or teeth extractions and disinfection of the oral cavity. Proper home care, including frequent teeth brushing and adequate feeding, helps minimizing irreversible damage due to periodontal disease.



Tooth fractures:

Tooth fractures occur due to traffic accidents and biting on stones. Most treatment takes place on a canine tooth or an incisor. Tooth fractures without opening of the pulp are no emergencies. For those with pulp exposure, the most important point in the treatment plan is the age of the animal. Dogs (or cats) younger than 2 years have not yet completed their tooth growth and have a less strong dentin structure. Therefore, every attempt has to be undertaken to preserve the pulp living. In these cases, the dog must immediately receive antibiotics. Within 72 hours, a vital amputation of the pulp and an overcapping is performed. In dogs older than 2 years, a mortal amputation (fig.) and an overcapping is the method of choice.



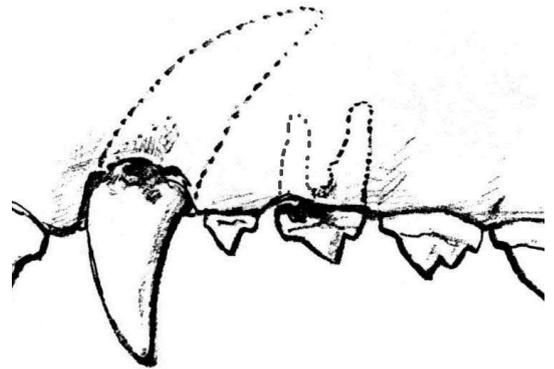
Malocclusions:

Malocclusions can be split up in skeletal and dental malocclusions. The first group is highly hereditary. The result is either a brachygnathia inferior or superior. Since these animals mostly do not suffer from any bite problem, they should not be treated. Dental malocclusions are mainly due to incorrect change from deciduous to permanent dentition. In case of the mandibular canine tooth, this may lead to linguoversion of the tooth, impression in the hard palate and

shortening of the lower jaw. Therapy should start as soon as the permanent tooth erupts. With daily repeated digital pressure or with the help of a rubber ball, many teeth may be directed to a correct position. Severe caninus malpositioning can be treated with orthodontic corrections, such as an inclined bite plane technique or a distracting screw. They are best applied between 7 and 10 months of age. Alternative possibilities are crown reduction or extraction.

Special conditions in cats:

Neck lesions (feline odontoclastic resorptive lesions, FORL) affect predominantly premolar and molar teeth in asiatic breeds. The pathophysiology is still to be elucidated, although the disease probably is autoimmune, accompanied by viruses, periodontal disease, and the special surrounding consisting of cement, enamel, gingiva, saliva, food and bacteria. Neck lesions are characterised by deep lesions. They are highly painful. Affected cats may get anorectic. Therapy consist in either conservative management with steroids or gestagene or total excision of all premolar and molar teeth.



The feline stomatitis-gingivitis complex is a disease with similar pathogenesis. Its clinical manifestation is either a gingivitis, a stomatitis or a faucitis. The therapy consists of medical palliative treatment with analgetics, steroids or cytostatica, temporary destruction of the affected tissue by laser ablation or total excision of all teeth.

Maxillary and mandibular fractures treated with dental equipment:

In cases of comminuted mandibular or maxillary fractures in cats, which are not treated by internal methods, an intercaninus occlusion technique can be used. After proper preparing all four canine teeth, bonding and a composite material are applied to fix the jaws in a slightly open and anatomical position. Feeding is possible by licking liquid food or by a feeding tube. As an alternative, a cerclage wire can be placed in the furcation of two opposite premolars or molars on both sides. These fixations are left in place for about four weeks.

Rostral mandibular or maxillary fractures, for which simple pinning or wiring is not indicated, can be treated by looping the cerclage wire around several teeth to bridge the fracture on the oral side. The loop twist in the oral cavity are then embedded in composite or polymethylmetacrylate.



Buccal flap technique:

Buccal flap techniques are indicated with acquired or traumatic palatal defects, severe periodontitis which led to oronasal fistulation or loss of palatal tissue after difficult resection surgery. The existing passage between oral and nasal cavity leads to nasal discharge and chronic rhinitis. Acute fistula should be treated as soon as possible (eg after caninus extraction with opening of the nasal cavity; simple caninus extraction does not require a flap). In chronic fistula, the edges are resected and a flap from the buccal mucosa is drawn over the defect. In larger defects, a double advancement flap technique (buccal flap and palatal flap) is advisable. Tissue enhancement is obtained by interposing a layer of small intestinal submucosa (Vet BioSIS®).

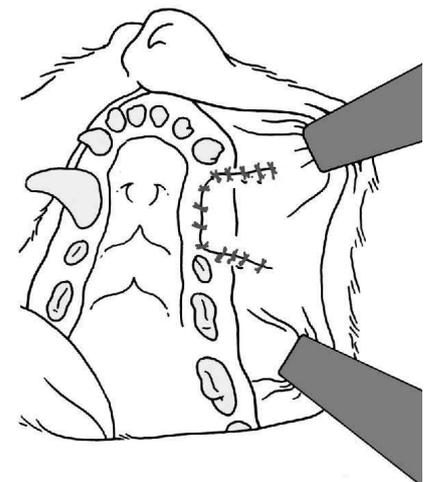
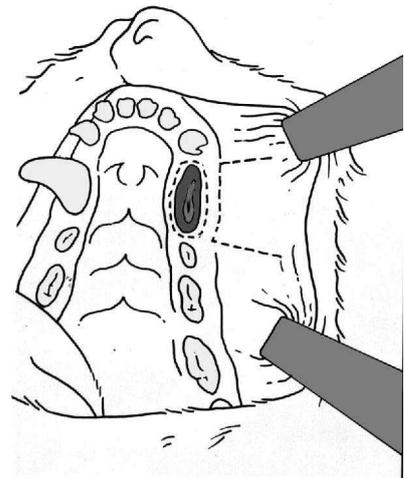
Exercise: Extraction Buccal flap with caninus extraction

Special instruments:

- Periodontal elevator (following Bein or Fahrenkrug)
- extraction forceps
- periosteal elevator
- rongeur

Technique:

1. Lift up the gingiva around the canine tooth with a periodontal elevator, incise the gingiva on the buccal side of the canine tooth along the whole root
2. Split the alveolar bone with a periosteal elevator along the gingival incision
3. Loosen the tooth with the periodontal elevator. Use it on each side of the tooth and apply gentle force of 20 seconds duration
4. Extract the tooth with the extraction forceps only when it is moveable
5. Debride the fistula with a rongeur
6. Create a flap from the buccal mucosa. Its base is on the mucodermal line. Avoid severance of the vibrissae (in cats)
7. Move the flap over the defect, interpose a sheet of Vet BioSIS®, if necessary.
8. Attach the flap to the palatum with single interrupted sutures.



Feline perineal urethrostomy

Katja Voss, Dr. med. vet.

Introduction

The most common indication for perineal urethrostomy in cats is feline lower urinary tract disease (FLUTD). The term FLUTD is used to describe an idiopathic, generally non-infectious, inflammatory process of the lower urinary tract. Urethral obstruction, due to plugs, crystals or calculi, leads to a life threatening condition. Cats at risk for obstructive FLUTD are overweight, male castrated indoor cats. Other indications for perineal urethrostomy are urethral strictures, trauma or neoplasia. The aim of the perineal urethrostomy is to create a larger urethral opening, allowing passage of plugs or calculi.

Obstructed cats have to be stabilized before surgery, especially if obstruction has been present for more than 36 hours. Stabilization includes passage of a urethral catheter and correction of uremia and hyperkalemia with intravenous fluids. In cats with hyperkalemia 0,9 % saline is used. Cystocentesis bears the risk of bladder disruption and is therefore reserved for cats, where passage of a urethral catheter is absolutely impossible.

Surgical anatomy

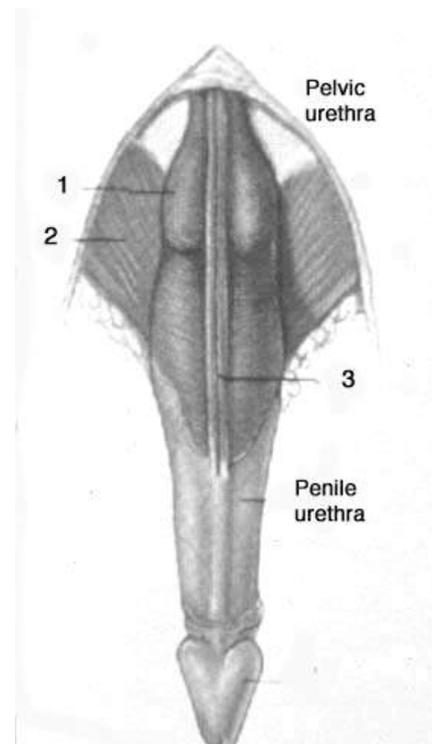
Urethral diameter is much wider in the pelvic than in the penile urethra. The pelvic urethra ends at the level of the bulbourethral glands (1). The crura penis (2) have to be severed at their attachment on the ilium for sufficient mobilization of the penis. The retractor penis muscle (3) lies dorsal to the penile urethra and has to be removed before opening the urethra.

Surgical technique

The anus is closed with a purse-string suture.

If possible, a urethral catheter is inserted for better visualization of the urethra.

The cat is positioned in sternal recumbency with the pelvis elevated and the hindlimbs hanging over the padded edge of the slightly tilted operation table. The tail is fixed over the back. Intact males have to be castrated first.



Small animal soft tissue surgery, special orthopedic procedures

An elliptical skin incision is performed around the penis, starting half way between the anus and the prepuce.

The glans penis is grasped with Allis tissue forceps to help manipulate the penis. The penis is freed bluntly, until the crura penis (PeC) are visible on the lateral aspect.

The insertions of the crura penis (PeC, ischiourethral and ischiocavernosus muscles (IUM, ICM)) at the ischium are cut with scissors, as close to the bone as possible.

The penile ligament (PeL) ventrally is cut with Metzenbaum scissors. Free the ventral area of the pelvic canal with fingers. After that, the penis should be movable towards caudally and the bulbourethral glands should be clearly visible.

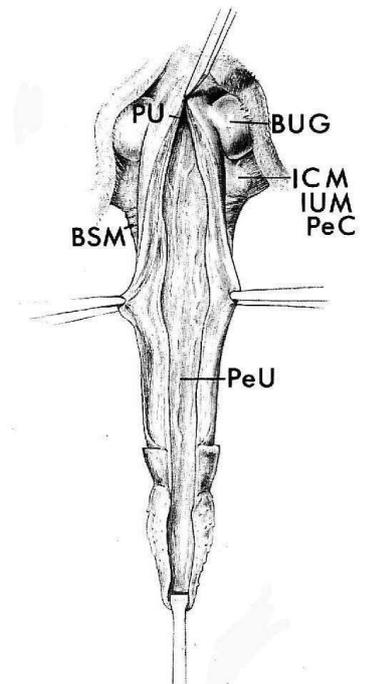
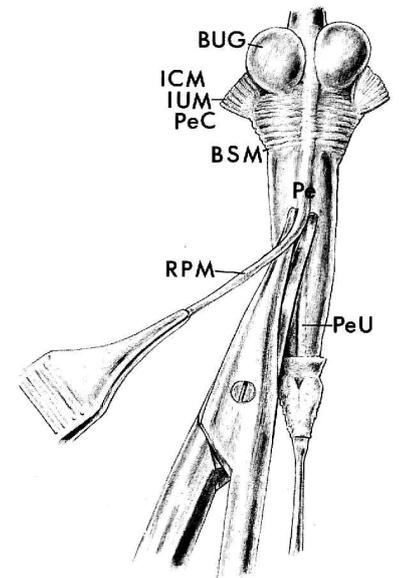
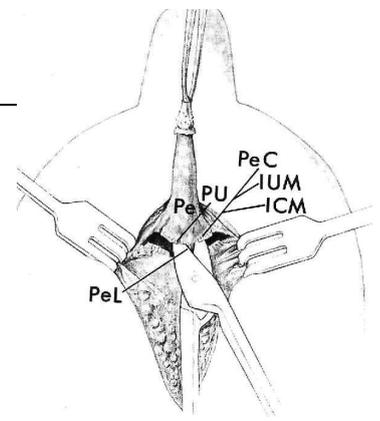
The retractor penis muscle (RPM) on the dorsal aspect of the urethra is removed with Metzenbaum scissors from distal to proximal without severing the urethra.

The urethral lumen is then opened from distal with straight iris scissors. The incision is continued proximally to the pelvic urethra, just beyond the level of the bulbourethral glands. The opening should be large enough to allow easy insertion of a Halsted mosquito hemostat into the proximal urethral lumen.

The urethrostomy is created by suturing the urethral mucosa to the skin with 5-0 non-resorbable, monofilament suture material with a taper-cut needle (Polypropylen, Prolene®).

First, 5 single interrupted sutures are preplaced at the proximal end at a 10, 11, 12, 1 and 2 o'clock position and are then tied.

The urethrostomy is then continued on both sides from a 9 and 3 o'clock position towards distally with a simple continuous suture pattern, in order to create a channel of an approximate length of 1 to 1,5 cm.



To prevent bleeding, a submucosal transfixation ligature is placed around the distal end of the penis, before it is amputated.

The remaining skin incision is closed routinely by suturing the subcutis and skin with an interrupted suture pattern.

Postoperative management

The area around the urethrostomy site is protected with a fatty ointment (Vaseline) to prevent urine scalding. The urethrostomy should be protected from licking either with a neck collar or a gauze sponge, sutured loosely over the area. Potassium values should be monitored and corrected as needed, because postobstructive diuresis may lead to hypokalemia. In cases with positive urine cultures, antibiotics are given for 2 or 3 weeks. Sutures are removed after 10 days. Dietary management might be necessary in cases with struvite or oxalate calculi.

The complication rate after perineal urethrostomy is low, if proper surgical technique has been advocated. The most common complication is urethral stricture formation due to making the stoma too small (i.e. the stoma in the proximal penile urethra instead of the distal pelvic urethra). Urinary or fecal incontinence may occur, if pelvic nerves are damaged. Cats with a perineal urethrostomy are at increased risk for urinary tract infection. Therefore urine should be cultured 4 weeks postoperatively.

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Seminar on Endocrinology

Barbara Haas, Dr. med. Vet., Fachtierärztin für Kleintiere

Make a doagnostic plan on the following two cases and – if possible- give treatment options

A 11 year old cat female neutered is presented with a history of weight loss. The cat is eating very well but shows sometimes periods with diarrhea and vomiting. Lately the owners are worried because the cat drinks a lot and has polyuria.

A 13 year old male dachshund is presented because he collapsed twice.

The abnormalities during physical examination showed excessive panting, a weak femoral pulse, and cardiac arrhythmias. The heart frequency was 180 beats per minute. The blood pressure measured not invasively was about 240.

Thyroidectomy

Barbara Haas, Dr. med. vet., Fachtierärztin für Kleintiere

Hyperthyroidism in the cat

Hyperthyroidism is one of the common diagnosed endocrine diseases in cats and is generally associated with adenomatous hyperplasia of one or both thyroid glands. Approximately 80% of affected cats have bilateral involvement and in 5% the thyroid mass is ectopic (i.e. thoracic inlet or cranial mediastinum).

Excessive circulating thyroxine increases the metabolic rate and sensitivity to catecholamines. Clinical findings reveal weight loss, polyphagia, hyperactivity, tachycardia, gallop rhythms, vomiting, diarrhea and hyperexcitability. In 10% you may find a cat that is profound depressed and weak. This form is called apathetic hyperthyroidism.

Your laboratory findings can include following abnormalities: increased PCV, neutrophilic leucocytosis, eosinopenia, lymphopenia, elevated aminotransferase and alkaline phosphatase. Most affected cats have high serum T4 but normal thyroxine concentration can not exclude hyperthyroidism.

Your treatment options consist of iodine 131, medical treatment with antithyroid drugs and surgery.

Before we perform surgery the cat should be made euthyroid. This reduces anesthetic risk associated with metabolic and cardiovascular abnormalities due to hyperthyroidism. The medical treatment before surgery consists of Methimazole 5mg/cat bid/tid. In euthyroid state you should repeat at least the kidney values before surgery, because the high metabolism might have obscured renal failure.

Surgical anatomy

The thyroid glands are positioned laterally and slightly ventral to the fifth to eighth cartilage rings of the trachea. The left lobe is usually located caudally to the right lobe. Normally they are 2cm long and 0,3 cm wide. Two parathyroid glands are associated with each of the two thyroid glands. The external parathyroid gland is located at the cranial pole (cranial thyroid artery!) and the internal gland is positioned within the thyroid at the caudomedial aspect.

The blood supply is derived from the cranial thyroid artery (branch of the common carotic artery) and the caudal thyroid artery (branch of the brachiocephalic artery), that is not always present in cats. The venous drainage is from the cranial and caudal thyroid veins.

There are several structures of importance located in close proximity to the thyroid glands: Common carotid artery, jugular vein, recurrent laryngeal nerve, parathyroid glands, oesophagus and trachea:

Thyroidectomy may be performed via an intracapsular w/o modification or extracapsular technique.

Skin Course II: Skin flaps and skin grafts

Christian Schwandt, Dr. med. vet.

Introduction

Extensive skin defects on the body may be created by various entities, under which degloving injuries or thermal damage are the most common. Coverage of these large wounds is often difficult or impossible to treat with local skin flaps described in the last course. When large areas are denuded from skin, possibilities to cover these defects are skin flaps or skin grafts.

Skin flaps

A portion of skin and subcutaneous tissue with a vascular attachment moved from one area of the body to another.

Subdermal flaps

Portions of skin nourished diffuse by the subdermal plexus, which is associated with the panniculus musculature layer, or directly with the undersurface of the dermis.

Local flaps

Rotation flap

Transposition flap

Advancement flap

-single-pedicle

-bipedicle

Distant flaps

Hinge flap

Pouch flap

Axial pattern flaps

Portions of skin nourished by a direct cutaneous artery, which allow the surgeon to transfer large skin segments in a single stage.

1. Omocervical axial pattern flap
2. Thoracodorsal axial pattern flap (*EXERCISE*)
3. Superficial brachial axial pattern flap
4. Caudal superficial epigastric axial pattern flap (*EXERCISE*)
5. Cranial superficial epigastric axial pattern flap
6. Deep circumflex iliac dorsal axial pattern flap
7. Deep circumflex iliac ventral axial pattern flap
8. Genicular axial pattern flap
9. Reverse saphenous conduit flap
10. Caudal auricular axial pattern flap

Skin grafts

A portion of epidermis and dermis completely removed from the body and transferred to a recipient site. It is dependent on revascularisation from the recipient bed. Therefore all subcutis has to be removed in order to achieve adherence, plasmatic imbibition and later inosculation, which have to take place to keep the graft viable at the beginning. Finally vessel ingrowth from the recipient bed has to take place.

Split-thickness grafts

A graft composed of epidermis and a variable quantity of dermis.

- thick
- intermediate
- thin

Full-thickness grafts

A graft composed of epidermis and full dermis.

- Mesh grafts (*EXERCISE*)
- Unmeshed grafts
- Seed grafts (*EXERCISE*)
- Strip grafts

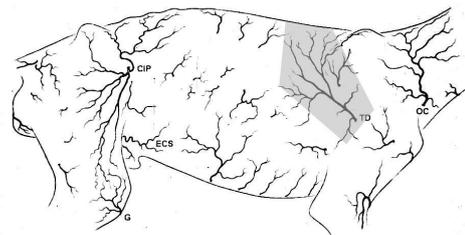
EXERCISEInstruments:

Scalpel
 Adson tissue forceps
 Metzenbaum scissors
 Mayo scissors
 Needle holder
 Suture material
 Biopsy punch

Technique:1) Thoracodorsal axial pattern flap (Fig. 1):

The thoracodorsal pedicle flap is commonly used to close defects involving the shoulder, forelimb, elbow, axilla and thorax.

- The animal is placed on the table in an physiologic position (!!Important!!)
- Creation of a defect over the cranial humerus into the area of the cranial elbow.
- Orientation of the flap by determining the anatomical landmarks.
 - a line is drawn over the spine of the scapula representing the cranial border of the flap
 - the thoracodorsal vessels originate at the caudal edge of shoulder depression at a level parallel to the dorsal edge of the acromion
 - a second line is drawn parallel to the first one equidistant from the shoulder depression to the other side and both lines are extended to the dorsal midline
- The flap is elevated by scissors below the level of the cutaneous trunci muscle beginning at the end of the flap and the thoracodorsal vessel is identified on the inner surface of the flap.
- Transposing of the pedicle flap over the defect. It is then sutured to the defect border with interrupted suture pattern. Dead space may be drained by a penrose drain. Later a bandage has to be applied.
- The originating defect is closed from both corners of the defect with interrupted suture pattern creating a y- shaped suture line.

**Fig. 1:**

2) Caudal superficial epigastric axial pattern flap (Fig. 2):

The caudal superficial epigastric pedicle flap is commonly used to cover defects involving the caudal abdomen, flank, inguinal area, prepuce, perineum, thigh and the rear limb. In cats the flap may reach down to the tarsal area. The flap includes the last three or four mammary glands, which remain functional and ovariohysterectomy is recommended in female animals.

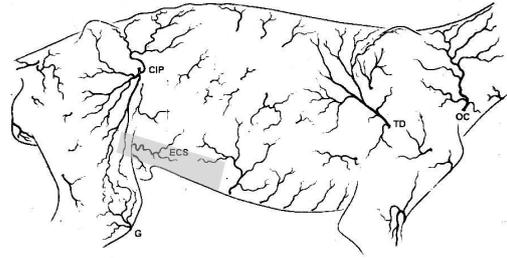


Fig. 2:

- The animal is placed on the table in an physiologic position (!!Important!!)
- A skin defect is created over the cranial and lateral stifle down to the mid of the tibia.
- Orientation of the flap by determining the anatomical landmarks.
 - A line is drawn along the midline of the abdomen to the prepubic area
 - A second line is drawn parallel to the first one equidistant to the line of mammary complexes to the other side
 - Depending on the required graft length a line perpendicular to the first two lines is drawn between the first and the second, or between the second and the third mammary complex
- The flap is bluntly dissected with scissors below the level of the supramammarius muscle and above the aponeurosis of the external abdominal oblique muscle beginning at the end of the flap progressing in caudal direction while the caudal superficial epigastric vessel is identified on the inner surface of the flap.
- Transition of the pedicle flap over the defect. It may be that a bridge incision has to be performed in order to place the flap. It is then sutured to the defect border with interrupted suture pattern. Dead space may be drained by a penrose drain. Later a bandage has to be applied.
- The originating defect is closed from both corners of the defect with interrupted suture pattern creating a y- shaped suture line. And in case of excessive tension some stay sutures may be applied like it is done in case of mastectomy.

3) Mesh grafts:

Mesh grafts can be for example made from full thickness grafts to extend the graft in size and to facilitate drainage from the recipient bed. They can be taken from areas with extensive loose skin and be transplanted to various places where skin is sparse and missing. Before taking a graft the recipient bed has to be prepared which needs several days to weeks. There should be no infection, nor hemorrhage but a good granulation tissue with proper vascularization.

- A larger skin defect somewhere on the extremities is created.
- A rectangular portion of skin, slightly smaller than the earlier created defect, is elevated from the lateral abdomen, where much loose skin is available. Separation is performed with scissors in the subcuticular plane.
- The graft is placed on a finger with the skin faced down and all subcuticular fat tissue is dissected with scissors from the cutis until hair follicles are clearly visible and palpable like small poppy seeds. Keep moistening the graft while preparing it.
- The graft is then incised with multiple staggered small longitudinal incisions parallel to each other with the scalpel blade.
- Positioning of the graft, which now can be stretched to the wanted size, over the created defect and suturing the graft to the defect with single stay sutures assuring that the skin borders of the graft overlap the defect by some millimeters.
- The skin defect created by harvesting the graft is closed with single sutures beginning from all four corners of the defect creating a x- shaped suture line.

4) Seed grafts:

Seed grafts are used for smaller skin defects in areas where availability of skin is sparse like on the extremities. They may be harvested from all body areas where loose skin is available.

- A three to four cm sized skin defect is created somewhere on the distal extremities.
- With the help of a biopsy punch multiple small skin grafts are harvested on the lateral abdomen, where much loose skin is available.
- The grafts are placed on a finger with the skin faced down and prepared likewise in the exercise before.
- On the recipient site small pockets are created and the grafts are inserted and or sutured to the recipient bed by single sutures.
- The skin defects created by harvesting the grafts are closed with single sutures.

Biomechanics of the stifle joint

Slobodan Tepic, Dr.Sci., Daniel Damur, DVM, Pierre M. Montavon, Prof., DVM

High incidence of the cranial cruciate ligament (ACL) deficiency in dogs, clinical success and widespread, if belated, acceptance of the tibial plateau leveling osteotomy (TPLO) proposed by Slocum^{1,2,3} have stirred and reinvigorated small animal veterinary orthopedics in an unparalleled way. Treating a stifle joint rendered unstable due to a failed ligament by a surgical intervention aimed at modifying basic joint geometry was a unique and uniquely successful proposal. Intuitively, a steeper inclination of the tibial plateau is a causative factor, and Slocum's surgical intervention aims to not only render the joint stable, but to in fact eliminate the prime suspect for the ligament failure. This was a departure from the conventional approaches to solving the problem by ligament reconstruction, augmentation, or replacement by a surrogate. Implied rationale for these very different management options is the presumed etiology of the cruciate ligament failure: trauma vs. gradual deterioration due to a functionally ill-conditioned stifle joint.

Ultimately, it was the superior clinical performance of the dogs treated by Slocum's TPLO, which has made it the preferred choice for the treatment of ACL deficiency. In comparison to extra-capsular ligament augmentation, which remains in the repertoire of most surgeons, TPLO shows a slower progression of arthrosis⁴, and hence a better long-term prognosis.

TPLO concept was born out of Slocum's appreciation for the tibial thrust test introduced by Henderson and Milton⁵ and was a more radical corrective intervention than his cranial closing wedge osteotomy⁶. It also appears that the tibial thrust test was the primary basis for determination of the angle of correction deemed appropriate for a TPLO. Yet, as will be discussed in this presentation, the outcome of the test is dependent on the way in which the test load is applied to the paw. Loading the paw with a pure moment, which is usually instructed and most surgeons seem to practice, results in the loading of the stifle joint with a total joint force nearly parallel to the Achilles' tendon, which in turn is approximately parallel to the "functional axis" of the tibia, as defined by Slocum. In order to neutralize the cranial thrust so produced, the plateau should be perpendicular to the Achilles' tendon. However, in its functional use of the limb, the dog is not loading its paw with a moment, but with a force. If the paw is loaded by a force, the stifle total force is nearly parallel to the patellar ligament. In which case, by the same argument, the correction should aim for making the plateau perpendicular to the patellar ligament. In both cases a certain degree of over-correction is warranted to provide a margin of safety in a joint with a ruptured or threatened ligament.

There are thus two possibilities to put up for analysis and discussion: (1) tibial plateau perpendicular to Achilles' tendon; (2) tibial plateau perpendicular to patellar ligament. There is an angle of approximately 15 degrees between the Achilles' tendon and the patellar ligament (with the stifle in extension). In both cases, one can attempt to influence either the plateau or the tendon/ligament. Slocum's TPLO turns the plateau, orienting it with respect to Achilles' tendon. A cranial closing wedge osteotomy, abandoned by Slocum, has been reinvented and is also practiced, and advocated as an alternative way to tilt the plateau, wherein in fact it mostly turns the Achilles' tendon. TPLO can of course be performed with a smaller angle of correction aiming at perpendicularity to the patellar ligament. The fourth possibility, that of correcting the

angle of the patellar ligament, is well known in orthopedics, but to our knowledge has not been used for ACL deficiency. And yet, it may be the simplest procedure to perform, with major benefits expected in terms of reduced morbidity and improved short and long-term performance.

Slocum's publications have in fact laid out basic mechanics of the stifle, but rather arbitrarily, he decided that the tibia is a simple axially loaded truss. Determination of true joint forces, in spite of many decades of research in biomechanics, remains an illusive task, mostly for the problems of muscle redundancy and co-contraction. The later has subtle and difficult to objectively assess functional / physiological causes. The arguments presented here are based on greatly simplified mechanics of the stifle, and should be used only for sorting out different possibilities when contemplating surgical interventions. Yet the need to perform them is such that we cannot wait to figure it all out. And for the benefit of many dogs and his fellow surgeons treating them, it is good that Slocum did not wait either. His insistence on the strictest adherence to the rules for execution of TPLO has perhaps prevented variations which otherwise might have suggested that the corrective angle is excessive. For that we have only anecdotal evidence. Yet one of the main drawbacks of TPLO may be caused by the excessive angle of correction: the most obvious, and generally overlooked fact is that the joint congruity is drastically changed by placing it on an average into 25 degrees of extra flexion. It may well be that the medial meniscal release is mandated by its impingement caused not by the tibial thrust (which should be well compensated), but by artificially increased flexion of the joint itself. If the total stifle joint force is in fact oriented by about 15 degrees more cranial than presumed by Slocum, the evidence for the causative role of the increased tibial plateau angle becomes even more convincing. Morris and Lipowitz⁷ have measured this angle to be about 18 degrees in controls and about 24 degrees in dogs with failed ACL. If the reference is shifted by some 15 degrees, this would suggest 3 degrees in controls and 9 degrees in failed ACL cases. Instead of a 30% increased load responsible for the failure, we would be looking at a 300% percent increased load. And if the functional reference of true relevance is the angle of the patellar ligament, instead of a tibial axis, we may find a further cause for ACL failure in the formation of the tibial tuberosity. A steeper slope of the plateau and/or a less cranially prominent tibial tuberosity will increase tension in the cranial cruciate ligament, and may consequently predispose for its injury. Surgical management of the cranial cruciate deficiency could then rationally involve a reduction of the slope of the plateau and/or a cranial advancement of the tibial tuberosity.

If only a crude approximation to the true biomechanical status of an active musculato-skeletal linkage, simple static analysis of the stifle joint may prove its utility in at least three ways: (i) by guiding the search for underlying causes of the unusually high incidence of the cranial cruciate ligament deficiency; (ii) by providing more precise, and rationally based, means of determining the parameters for the currently practiced surgical interventions; (iii) by inspiring new management procedures.

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School of Veterinary Medicine, University of Zurich
Winterthurerstrasse 260
CH-8057 Zurich, Switzerland
e-mail: kyon@datacomm.ch

Advancement of the tibial tuberosity for treatment of cranial cruciate deficient canine stifle

Pierre M. Montavon, Prof. Daniel M. Damur, Dr med. vet. FVH, Slobodan Tepic Dr. Sc.

Introduction

The introduction of biomechanical considerations has influenced the treatment of cranial cruciate deficient stifles in dogs. Recent techniques modify the basic joint geometry in an attempt to neutralize the tibiofemoral shear force, which appears to be responsible for the overload of the cranial cruciate ligament. The better long-term prognosis offered by the slower postoperative progression of arthrosis in comparison to previous techniques is considered as a clinical success by a majority of surgeons. Conformational malalignment entities have also been evidenced and surgical limb realignment is indicated in these clinical cases. The procedure presented here consists in advancing the tibial tuberosity, in order to position the patellar ligament perpendicularly to the tibial plateau, thereby reducing to zero the tibiofemoral shear force and easing the function of the deficient cranial cruciate. The lesser invasive technique reduces operative time and perioperative morbidity. Respecting the normal range of flexion of the stifle should make a meniscal release, hence a loss of intraarticular caudal support, not necessary. Decreased retropatellar pressure could alleviate the sulcus chondromalacia present in about 30% of the cases.

These advantages should improve the short and long-time results of the surgical treatment of cranial cruciate deficient stifle.

Preoperative planning

Mediolateral radiographs of the stifle in extension, avoiding the cranial drawer phenomenon in the presence of total rupture of the cranial cruciate ligament are necessary to figure out the angle necessary to bring the patellar ligament perpendicularly to the tibial plateau. The patellar ligament is represented by its cranial border, the orientation of the tibial plateau by a line passing through both tibial origins of the cranial and caudal cruciate ligaments.

Surgical technique

Arthroscopy or medial arthrotomy are performed in case of total cranial cruciate ligament rupture to explore the stifle joint and treat eventual meniscal lesions. Transverse osteotomy of the tibial tuberosity is carried through its distal extremity to the cranial borders of the menisci. A bone spacing structure of desired size is inserted into the distracted osteotomy in order to advance the tibial tuberosity, giving its new position to the patellar ligament. The tibial tuberosity is fixed to the tibia with a tension band. The wound is closed in appositional manner after mobilizing the edges in order to cover the implants.

Results

Failure to maintain the advancement of the patellar ligament has been encountered, resulting from excessive tension and compression forces for the internal fixation repair. In all other cases, clinical results are satisfactory as documented by force plate gait analysis. No additional postoperative meniscal damages have been observed at this date. The results are encouraging and the technique will be further developed.

Clinical application of *Zurich cementless canine total hip prosthesis*

Pierre M. Montavon, Slobodan Tepic

A new cementless total hip prosthesis, *Zurich Cementless*, was developed at the University of Zurich. The most important characteristics of the Zurich Cementless is avoidance of the coupling effect of the medial and lateral femoral cortices, and stress shielding due to compliance mismatch. The stem is fastened to the medial cortex with screws. This instantly provides a stable fixation, which approximates the normal physiological stress distribution on the proximal femur. It allows bone remodeling around the screws. The initial fixation of the cup is attained by a press fit insertion. The porous design of the cup allows fluid convection and its fixation by osseointegration. A Multicentric Study involving centers in America, Asia and Europe is underway to obtain reliable, comparative clinical results and information to improve the surgical procedure, instruments, and implants.

Materials and Methods

Experimental and clinical testing resulted in the latest design of implants of different sizes and adequate surgical instruments for surgical implantation. Transparencies as template on radiographs allow preoperative planning for the proper size of implants. The hip joint is approached from a craniolateral incision. Biplanar osteotomy reaching the level of the lesser trochanter distally allows resection of the femoral head and neck. Preparation of the proximal femur including the area of the intertrochanteric fossa is made with different reamers and broaches acting as template for the stem. Preparation of the acetabulum is the most challenging part of the procedure. Removal of the subchondral sclerotic bone and uniform preparation of the cavity is made with reamers of progressive sizes, beginning at the original ventral border of the acetabulum. The existing caudal and cranial acetabular rims are preserved. The hemispheric cup is then positioned. It is impacted insuring that the caudal and cranial equator areas are covered with bone. Protruding pelvic osteophytes are removed and the level of femoral neck resection is controlled to facilitate later reduction of the prosthesis. The femoral component is fixed into the guide and inserted into the proximal femur with desired anteversion. Access holes in the lateral and then screw holes in the medial cortex are drilled. Screws are placed into the femoral stem holes beginning proximally and proceeding distally. A femoral head and neck of desired length is impacted on the stem. The prosthesis is reduced. Stability of the hip prosthesis is tested and improved with intraoperative changes, if necessary. The surgical wound is reconstructed. Templates assist in evaluating the position of the acetabular cup possible on postoperative radiographs.

Results

The range of motion of the prosthesis is greater than that of the natural hip. The surgical technique is reproducible. The time required is less than 2 hours. Ideally 3 persons are needed. Patients recover a normal gait within 4–8 weeks. This technique is well suited for dogs 8-10 months of age. The number of complication as part of the Multicentric Study has been decreasing. The learning curve needing less than 20 cases was reported to be steep. A series of over 400 cases operated with the latest generation of implant designs showed early complications in 17 cases (rate of <5%): 8 luxations occurred and 6 acetabular cups were dislodged from their fixation on the pelvis mostly caused by inadequate implantation. Femoral fractures occurred in

3 patients. The revision proved to be successful in all but one case. Bacterial cultures done at the end of surgical revision were positive on 3 patients requiring long-term antibacterial medications. Evaluation of the results of the Multicentric Study will be reported at a later date. The contribution of active participants with useful suggestions to the Multicentric Study, results in invaluable improvement of techniques for canine total hip replacement.