SOFT TISSUE SURGERY OF THE CALF

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1. INTRODUCTION

Among the everyday work of many bovine practitioners, surgical interventions in calves play only a minor role or no role at all. However, there is a good number of disorders in calves that always require surgical intervention (ileus, urethral obstruction, abomasal torsion) or if they have evolved to a certain stage (navel ill, recurrent ruminal bloat). In the area of soft tissue surgery, there are many possibilities to enrich the spectrum of practice work in a stimulating way. The importance of this aspect should not be underestimated in this age of increasing bureaucracy and restrictions in the availability of drugs.

In addition to surgical techniques, the causes and signs of the most important disorders in calves that require surgical intervention will be described. This is considered necessary because early diagnosis is often critical for the success of surgical interventions. Also, modifications of surgical procedures will be described that have been found useful during the last few years. Readers that want to go into details are referred to the literature listed in the references section.

2. TEMPORARY RUMINAL FISTULA IN PATIENTS WITH RECURRENT BLOAT

Free gas bloat is a complication of various diseases. The unphysiologic accumulation of gas in the forestomachs is not a consequence of an increase in the rate of gas formation, but rather of a decrease in gas eructation, either mechanical in nature by compression of the oesophagus (e.g. by a cervical haematoma), or functional in nature by a disturbance of the vagal nerve (e.g. during or after pleuropneumonia).

2.1 Diagnosis

The distension of the abdomen is located in the upper left quadrant. Although ruminal contractions sounds are hardly audible upon auscultation, waves of ruminal contraction can be seen in the left flank. The possibility of complete evacuation of the gas with a stomach tube confirms the diagnosis. In cases of recurrent bloat, a hard lump can often be palpated in the rumen following evacuation (sometimes even from the right flank).
2.2 Technique

The patient must be properly restrained, and the hind legs should be hobbled (for protection of the surgeon).

The left flank is prepared for surgery in the standard manner.

If present, bloat is relieved. This will facilitate subsequent manipulations considerably (incomplete contractions will occur in a bloated rumen, and the rumen will “roll” all the time).

Local anaesthesia using 20-30 ml of a 2% local anaesthetic.

A round piece of skin with a diameter of about 3 cm is excised in a location 6-8 cm caudal of the last rib, and the same distance ventral of the end of the lumbar transverse processes.

The muscle layers are separated by blunt dissection using forceps.

The peritoneum and fascia are pulled out with forceps, and are incised.

The blue-gray ruminal wall is exteriorized with forceps until it protrudes from the wound about 2 cm.

As quickly as possible the transverse fascia and peritoneum are sutured onto the rumen with a simple continuous suture with Dexon® 4 or 5 metric; the suture starts at 3 o’clock and is continued clockwise).

Finally the tip of the cone formed by the exteriorized piece of rumen is excised. With a second suture of the same kind and with the same material, the ruminal wall is sutured to the skin.

Postoperative antibiotic treatment usually is not necessary.

2.3 Post-operative course

The author has performed about 100 such operations during the past few years. In not a single case, wound complications or peritonitis occurred. In the course of about two weeks, the sutured ring of the ruminal wall becomes necrotic and sloughs. The opening then becomes smaller rapidly and closes after about two to five months.

Establishment of a ruminal fistula is usually followed by normalisation of forestomach function (efficient ruminal contractions, rumination, formation of a fibre mat) within one or two days, irrespective of the underlying disorder. The hard lump mentioned above dissolves quickly.

3. ABOMASAL VOLVULUS

Abomasal torsion can occur in calves that are only a few days old; however, its incidence is highest in four to 12 week old calves. The onset is often right after a meal. Partial or complete infarction of the organ may occur rapidly.

3.1 Diagnosis

Colic of abrupt onset; distension of the abdomen on the right side; percussion and auscultation and succussion and auscultation (PA/SA) will produce metallic pings, and splashing sounds,
respectively, over a large area of the right side; rapid deterioration of the general condition and the circulation.

Abrupt deterioration of the general condition together with signs of shock, moaning, recumbency, abdominal distension, in a clinical setting suggestive of abomasal torsion will probably indicate the event of abomasal rupture (Rademacher & Lorch, 1999). Such patients should be euthanized because the prognosis is poor.

3.2 Therapy

Abomasal torsion requires immediate surgical intervention.

3.3 Technique

Patients are restrained in left lateral recumbency under general anaesthesia or sedation and local anaesthesia (see laparotomy in calves); the abdominal cavity is opened with a long incision in the right flank; almost always, the abomasum is rotated in a counter-clockwise direction (as viewed from the right side); following an abomasal torsion of 360°, the pylorus is located cranioventrally on the right side, adjacent to the liver; if the attempt to relieve the torsion within the abdominal cavity is unsuccessful, the abomasum is exteriorized and then the torsion is corrected by clockwise re-torsion, which is usually easy to perform.

The abomasal contents should always be evacuated through an incision of about 3-5 cm in the corpus region; if part of the wall is devitalized, the incision should be made in this area. The incision is closed with a double inverting continuous suture with absorbable material (4 metric). The abomasum is fixed to the abdominal wall for prevention of recurrence. To this end, about 5-6 cm of the wall in the pyloric region or a piece of the omentum of the same length close to the pylorus is included in the ventral part of the suture of the fascia and peritoneum (non-absorbable material, 6 metric).

4. PERFORATING ABOMASAL ULCERS

Calves aged 4-12 weeks are affected most frequently, within a few weeks after introduction in a fattening unit.

4.1 Diagnosis

Our own investigations (Lorch, 1999; Rademacher & Lorch, 2001; Lorch & Rademacher, 2001; Rademacher & Lorch, 2003) have shown that perforating abomasal ulcers must be considered in the following clinical setting: the course of the disease is not peracute; no or minimal colic; abnormal posture; disturbance of the general condition; submersion of the muzzle into water; abnormal shape of the abdomen; increased tension of the abdominal wall; absence of rumen and intestinal sounds; distinct pain reaction to deep abdominal palpation.

In most cases, the ulcers are located in the pyloric region, and perforate into the omental bursa, hence the protracted course. In 70% of our cases, the abomasum was also displaced to the left side (ping and splashing sounds upon PA/SA are clear on the left side, but muffled on the right side!).

4.2 Course

There is no intervention with a reasonable prognosis. Most patients can be euthanized after the clinical examination; exploratory laparotomy can be restricted to a few questionable cases.
5. **ILEUS**

Calves of all ages can be affected with any of the ileus condition described below. The relevant clinical signs are listed under the individual conditions.

5.1 **Mesenteric torsion and intestinal volvulus**

Moderate to severe colic of peracute onset; initially there are no other remarkable clinical signs, but the general condition deteriorates rapidly; the colic subsides, but the abdomen becomes distended; tachycardia, dehydration, and recumbency demonstrate the impairment of the circulation; ping and splashing sounds with increasing intensity; defaecation ceases.

5.2 **Intestinal obstruction**

The causes of this condition which we see most often in older calves are unclear; the obstruction is located most frequently in the ileum (Klee, 1989).

Most cases exhibit colic of low or (transiently) moderate intensity which can persist for several days; often, a marked saw-horse stance is assumed; abdominal distension occurs gradually, and begins in the right ventral quadrant; succussion will produce diffuse splashing sounds on the right ventral aspect of the abdomen; there are either no faeces in the rectum or only a small amount of faeces mixed with sticky mucus.

In young calves with diarrhoea, intestinal obstructions can occur following the application of preparations containing swelling substances (Dirksen & Rademacher, 1996).

5.3 **Intestinal intussusception**

Intussusceptions of the small intestine are seen most frequently in young calves in the course of neonatal diarrhoea, and should be suspected if the disturbance of the general condition and signs of dehydration increase despite apparent cessation of diarrhoea. The rectum of such calves is empty or contains mucus or sticky blood. In many cases, the intussusception can be detected as a firm mass by bimanual palpation of the abdomen.

Intussusception of the caecum and colon can occur in calves of all age groups. Affected calves can exhibit continuous or recurrent colicky behaviour of low intensity. Defaecation is possible in some cases (past the caecum that is intussuscepted into the proximal colon). The patients often assume a pronounced saw-horse stance. The intussusception is sometimes palpable as a firm mass.

5.4 **Intestinal meteorism**

In our clinic, this condition has been observed only in older calves that still receive milk or milk replacers. The onset of colic is sudden, and its intensity is low to moderate; abdominal distension is bilateral (!) from the beginning; intense intestinal sounds can be auscultated on both sides of the abdomen; the findings of PA/SA are quite variable!

5.5 **Caecal dilatation and caecal volvulus**

Three quarts of the patients are 4-12 weeks old. The course often extends over several days (dilatation probably precedes volvulus). The signs change with the phase of the condition: abdominal distension (in some cases, a bulge caused by the dilated caecum can be seen in the right flank); colic; ping and splashing sounds can be elicited by PA/SA over a large area of the right side.
5.5.1 Therapy

Under certain conditions (only minimal disturbance of the general condition, no dehydration, colic of low intensity, no marked abdominal distension), conservative therapy with neostigmine (2.5 mg/kg sc) and sodium sulphate (1 g/kg in 2-3 L water/100 kg body weight via stomach tube) is possible in patients with intestinal obstruction, intestinal meteorism, and caecal dilatation. After 4-6 hours at the latest, passage of increasingly loose faeces should set in.

Surgical intervention is the alternative, which is mandatory in cases of mesenteric torsion, intestinal volvulus, intestinal intussusception and caecal volvulus.

5.5.2 Laparotomy in calves

The preoperative application of flunixin and a drip infusion before, during, and after surgery are recommended.

The patient is restrained in left lateral recumbency.

General anaesthesia which can be achieved in practice with xylazine (0.3 mg/kg sc or iv) and ketamine (5 mg/kg iv). If necessary, the application of ketamine can be repeated in smaller doses (0.5-1 ml each, depending on effect). Local anaesthesia using 30-40 ml of a 2% local anaesthetic.

Standard preoperative preparation of the right flank, including cover with sterile drape.

Open abdominal cavity with a large enough incision.

Exteriorize the intestine and perform the necessary interventions:

In cases of mesenteric torsion, the root of the mesentery is located, in order to determine the direction and extent of the torsion. The torsion is reduced following exteriorization of the intestine. In fresh cases of intestinal volvulus, the correction of the twisted portion of the intestine is much simpler. Prognosis of patients with mesenteric torsion or intestinal volvulus deteriorates in a matter of hours (Rademacher et al. 1995; Rademacher & Lorenz, 1997).

In cases of intestinal obstruction, the congested contents must be massaged in distal direction. Prognosis is relatively favourable.

Intussusceptions of parts of the large intestine can often be reduced quite easily, whereas resection is necessary in most cases of intussusceptions of the small intestine. Prognosis is much more favourable in the former cases than in the latter. The technique of intestinal resection is described in standard textbooks of surgery.

In cases of caecal dilatation or volvulus gas is evacuated if present by puncture of the caecum with a needle; fluid contents are emptied through an incision at the apex of the caecum. The incision is closed with a double inverting suture with absorbable material.

In cases of meteorism, the accumulation of gas in the caecum is also evacuated by puncture, and from the abomasum by incision (see abomasal torsion).

Finally the intestine is repositioned into the supraomental recess from cranial to caudal.
The abdominal wound is closed in three layers (see umbilical surgery).

The post-operative therapy (flunixin, drip infusion, plus neostigmine [2.5 mg/kg sc] and sodium sulphate [1 g/kg by stomach tube]) can make a difference in the outcome.

6. ILEUS CAUSED BY MALFORMATIONS

6.1 Atresia ani

In our clinic, atresia ani is the second most frequent intestinal malformation, second only to partial atresia of the colon.

6.1.1 Diagnosis

Absence of an anus, straining, colic, increasing abdominal distension with concomitant deterioration of the general condition within a few days. Although the diagnosis is simple, the affected calves should always be examined thoroughly because many animals with atresia ani have additional malformations (Rademacher & Blank, 2005) that preclude their economical use, or even the success of surgical intervention. Therefore, patients with atresia ani should only be operated on under the following conditions: good intake of colostrums; no marked disturbance of the general condition; distinct bulge in the anal area when the calf strains; no other malformations detectable.

6.1.2 Technique

The patient is retrained under general or epidural anaesthesia in dorsal recumbency with the hind legs extended forward. The operation site is prepared in a standard manner. After resection of a circular piece of skin with a diameter of about 3 cm, the underlying tissue is dissected bluntly with forceps until the hemispherical end of the rectum is identified. It is then mobilized bluntly all around for a distance of about 1-2 cm, and pulled caudally with forceps in a gently way. Then the rectal serosa is sutured to the subcutaneous connective tissue (absorbable material, 4 metric). Following resection of the tip of the rectum, its wall is sutured to the skin in a simple continuous suture with the same material as before. Usually, no special after-care of the wound is necessary.

6.2 Partial aplasia of the colon

This is the most frequent intestinal malformation among the patients of our clinic. The aplasia can be located in any region of the ascending colon. Possible or suspected causes, clinical picture, and attempted treatments have been described in various publications in the last three decades (Schlegel et al. 1981; Müller et al. 1982; Ness et al. 1982; Constable et al. 1989, 1998; Dreyfuss & Tulleners, 1989; Smith et al. 1991; Rademacher et al. 2002).

6.2.1 Diagnosis

The disorder can be suspected in the following clinical setting (Rademacher et al. 2002): cessation of milk intake after a few meals or incomplete consumption of the milk offered from birth, no faeces or only blood or mucus in the rectum, colic with increasing and then decreasing intensity, increasing abdominal distension, bulges in the right flank, slow deterioration of the general condition.

The fact that an anus is obviously present often leads to a delay in the presentation of the animals to a veterinarian. This makes the prognosis much worse, while increasing the need for intensive care.
6.2.2 Therapy

Several authors (as mentioned above) have published results of various surgical procedures for this disease. According to them, satisfactory survival rates can be expected under the following conditions: The patients must not be older than 24 hours, and the general condition must not be appreciably disturbed. Experienced surgeon, and short duration of the operation. The site of the aplasia must be suitable for anastomosis. No other malformations that could compromise the chances for survival detectable. Adequate pre-operative and post-operative care.

In the course of nine years, only four (!) out of 118 patients in our clinic could be discharged after hospitalization of 16 days, on average. Therefore, we have since adopted a policy of euthanasia following confirmation of the diagnosis.

7. URETHROSTOMY IN MALE CATTLE WITH URETHRAL OCCLUSION

Frequently, urethral occlusion is falsely considered to be a synonym for urolithiasis. While urinary calculi are the main cause for complete or partial obstruction (blockage from within) of the urethra, this condition can also be caused by plugs of fibrin or pus (for instance on the basis of chronic cystitis, nephritis, or omphalourachitis). The obstruction is almost always located in the sigmoid flexure. In rare cases, urethral occlusion is caused by a penile haematoma or by a malformation of the urinary tract. About 4/5 of our patients are between three and six months old.

7.1 Diagnosis

Cattle with complete blockage of the urethra initially almost always exhibit certain changes in posture (saw-horse stance, raised tail, extension of legs while lying), and colic (kicking, lying down and getting up in rapid succession, tail switching, straining). Micturition occurs neither spontaneously nor following stimulation (gentle massage of the prepuce). The preputial hairs are dry. If the patients are large enough for rectal exploration, the diagnosis can be confirmed by detection of an enlarged urinary bladder that extends beyond the pelvis into the abdominal cavity.

Most cattle with urethral obstruction due to urinary calculi are in good body condition; whereas those in which the obstruction is a complication of chronic inflammatory processes appear chronically ill (moderate or poor body condition, rough hair coat). This has an important influence on prognosis (Gronau, 2003) (Table I).

As a consequence of urethral obstruction several complications in addition to uremia are possible, which have a significant influence on prognosis:

- subcutaneous urine oedema following leakage from the urethra or uroperitoneum following leakage from the urinary bladder (both in the case of urolithiasis),
- urine phlegmon or peritonitis (in the case of leakages as mentioned above, but in connection with chronic inflammatory processes).
Table I. Cure rates in 119 cattle with urethral obstruction in relation to the cause of obstruction and occurrence of different complications

<table>
<thead>
<tr>
<th>Patients with uncomplicated urethral obstruction</th>
<th>42/58 (72 %)</th>
</tr>
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<tbody>
<tr>
<td>without evidence of chronic inflammation</td>
<td>40/45 (89%)</td>
</tr>
<tr>
<td>with evidence of chronic inflammation</td>
<td>2/13 (15%)</td>
</tr>
</tbody>
</table>

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<tr>
<th>Patients with subcutaneous accumulation of urine</th>
<th>13/24 (54%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>without evidence of infection (urine oedema)</td>
<td>13/14 (93%)</td>
</tr>
<tr>
<td>with evidence of infection (urine phlegmona)</td>
<td>0/10 (0%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Patients with intraabdominal accumulation of urine</th>
<th>7/37 (19%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>without evidence of infection (uroperitoneum)</td>
<td>7/16 (44%)</td>
</tr>
<tr>
<td>with evidence of infection (peritonitis)</td>
<td>0/21 (0%)</td>
</tr>
</tbody>
</table>

7.2 Therapy

In the case of complete urethral obstruction, urethrostomy is the method of choice. The method described below was developed in our clinic (Rademacher, 2006, in print) and has proven to be very successful.

The patient is restrained in dorsal recumbency under epidural (or general) anaesthesia, with the hind legs extended forward (in the case of extensive urine oedema or uroperitoneum the operation must be performed on the standing animal under epidural anaesthesia).

An incision of about 8 to 10 cm is made in the midline starting about 7 to 8 cm distal to the anus.

The fascia is incised with a pair of scissors. The penis which lies several cm below the level of the skin is exposed by blunt dissection with large forceps. The penis is then lifted above the level of the skin with the same forceps, this takes considerable force). Then two pieces of strong suture material (e.g. Supramid® 8 metric) are passed underneath, and perpendicular to, the penis, and parallel to each other at a distance of about 1.5 to 2 cm. The ends of both pieces of suture material are passed through the skin and tied. This will elevate, and fix, the ventral aspect of a piece of penis to the level of the skin and relieve it from the tension, which is important for the following steps of the operation. The urethra is incised in the midline as far as possible. A piece of infusion tubing (about 35 to 40 cm long) is passed through the opening of the urethra into the urinary bladder; a wire inserted into the tubing facilitates this procedure significantly. The urethral wall is sutured to the skin with a simple continuous suture with absorbable material (4 or 5 metric). The tubing is fastened to the skin with a simple suture.

7.3 Aftercare

Antibiotics are given systemically for 3 to 5, and an analgesic is administered for 1 to 3 days, post-operatively. In patients that received epidural anaesthesia, the hind legs are hobbled for a few hours following surgery; the tubing is removed after 1 to 3 days (Table II).

The majority of the patients that were discharged completed the normal course of fattening.

8. Diseases of the Navel

Among calf diseases, those involving the umbilicus rank third behind diarrhoea and pneumonia. Calves of all ages can be affected. The principle division is between inflammations and hernias.
Table II. **Umbilical inflammations and umbilical hernias**

<table>
<thead>
<tr>
<th>Umbilical inflammations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Limited to the external navel</strong></td>
</tr>
<tr>
<td>Phlegmonous omphalitis (acute inflammation of the external navel)</td>
</tr>
<tr>
<td>Navel abscess</td>
</tr>
<tr>
<td><strong>Ascending into the abdominal cavity</strong></td>
</tr>
<tr>
<td>Omphalophlebitis (inflammation of the umbilical vein, which runs from the navel to the liver)</td>
</tr>
<tr>
<td>Omphalorachitis (inflammation of the urachus, which runs from the navel to the urinary bladder)</td>
</tr>
<tr>
<td>Omphalarteritis (inflammation of one or both umbilical arteries which run from the navel to the interior iliac artery)</td>
</tr>
<tr>
<td>Periarterial hematoma (as sequelae of haemorrhage from umbilical arteries), either infected or uninfected (Rademacher, 2006)</td>
</tr>
<tr>
<td><strong>Umbilical hernias</strong></td>
</tr>
<tr>
<td>Uncomplicated hernias (hernial contents [abomasum, small intestines, or omentum] can be reduced completely)</td>
</tr>
<tr>
<td>Incarcerated hernias (hernial contents cannot be reduced completely)</td>
</tr>
</tbody>
</table>

### 8.1 Diagnosis

A thorough clinical examination of the calf with umbilical inflammation should produce, or rule out, evidence for involvement of other organs. During the special examination of the navel size, consistency, tenderness, and reducibility of any mass are assessed by inspection and palpation.

In addition, deep palpation of the abdomen (with the animal standing as well as in lateral recumbency) will provide information on involvement of intraabdominal umbilical structures (umbilical vein, urachus, umbilical arteries) (Rademacher, 1988; Rademacher et al. 2006).

Technique of deep palpation in the patient in lateral recumbency: While one hand moves the intestines aside, the other hand palpates the parts of the abdomen cranial and caudal of the navel with the “pliers grip”. The possibilities in the diagnosis of umbilical diseases offered by ultrasonography have been described by a number of authors (Craig et al. 1986; Steiner et al. 1988 and 1990; Lischer, 1991; Lischer & Steiner, 1993 and 1994; Lischer et al. 1994; Heidemann, 1995; Heidemann & Grunert, 1995; Schleifer, 2002).

### 8.2 Therapy

Surgical intervention is indicated in the following situations:

Ascending navel infections, extensive phlegmonous omphalitis and those cases that do not resolve satisfactorily under conservative therapy (systemic antibiotics for 3-5 days, and antiphlogistics for 1 to 3 days), compact navel abscess, incarcerated umbilical hernia and prophylactic hernia resection (by special request of the owner) in calves not used as replacements.

The technique is basically always the same. It was first described by Bouckaert & de Moor (1965) and has since been also described by Dirksen & Hofmann, 1976; Trent & Smith, 1984; Baxter, 1989; Steiner & Lischer, 1993; Lischer & Steiner, 1994; Edwards & Fubini, 1995; Rademacher, 2006; Rademacher, 2006 in print, among others.

The patient is sedated (see laparotomy in calves) and restrained in dorsal recumbency.

Standard preparation of an extensive (!) operative field. (Fistulas must be closed by insertion of a ball of dry cotton and followed by a purse string suture before the final disinfection of the operative field. This prevents contamination of the operative site by pus during the operation).

Local anaesthesia by infiltration of 20 to 40 ml of a 2% solution of local anaesthetic.
Rhomboid incision around the navel. Blunt dissection of subcutaneous tissue until the fascia is revealed. In male calves, the prepuce may be mobilized and laid sideways.

The abdominal cavity is incised lateral to the navel.

Digital exploration of the vicinity of the navel for adhesions. Then the entire navel is excised with a pair of scissors under digital control.

The remainder of the procedure depends on the situation presented by the individual case!

8.2.1 Hernias

In the case of umbilical hernias, the hernial sack is resected.

8.2.2 Omphalophlebitis

Resection of the umbilical vein following double ligation with absorbable material in an unaffected area, as close to the liver as possible.

8.2.3 Marsupialization of the umbilical vein in case it is connected to a liver abscess

The umbilicus is excised as described above. Any adhesions around the umbilical vein are broken down bluntly or with incisions; the stump of the vein is brought several cm above the level of the abdominal wall. The abdominal cavity is closed from caudal up to the stump of the umbilical vein. The vein is then sutured into the cranial edge of the wound with a deep circular simple continuous suture through peritoneum/fascia and the wall of the umbilical vein (slowly absorbably material, e.g. Dexon® 4 or 5 metric) and a second suture with the same material through the skin and the wall of the umbilical vein.

Following complete closure of the wound, the calf is placed in lateral recumbency, and the stump of the umbilical vein is resected about 1.5 to 2 cm away from the last suture. A tube is inserted into the lumen of the vein in the direction of the liver, in order to drain the abscess. The abscess is then irrigated cautiously with warm diluted povidone iodine solution. Additional irrigations may do more harm than good.

The liver abscess and the lumen of the umbilical vein usually close by granulation within a period of 2 to 4 weeks. During this time, the protruding stump of the umbilical vein becomes necrotic and sloughs. The vein remains in place. The further course is usually uneventful.

8.2.4 Omphalorachitis or urachal empyema (“uracheal abscess”)

The most cranial part of the urinary bladder should always be resected along with the affected urachus. The bladder is closed with a double inverting suture (absorbable material, 4 metric). Frequently there are adhesions between the omentum and the urachus. In this case, the omentum is partly resected, and closed by simple continuous suture with absorbable material (6 metric).

8.2.5 Omphaloarteritis and/or periarterial haematoma

Following double ligation with absorbable material in an unaffected area, the umbilical arteries are resected. In both conditions, resection of the distal portion of the urinary bladder is usually necessary.
8.2.6 Incarcerated umbilical hernia

In calves with incarceration of intestinal loops or parts of the abomasum in an umbilical hernia, spontaneous reduction occurs in some cases during dissection of the hernial sac. In many other patients, the incarcerated viscus can be reduced by a lateral incision of the hernial ring following resection of the umbilicus. If the incarcerated intestinal loops are severely compromised, or fibrous adhesions between parts of the abomasal wall and the hernial sac have developed, resection is inevitable.

The general condition of calves with incarceration of the pyloric region of the abomasum is sometimes poor (impairment of the circulation, distension of the abdomen, abomaso-ruminal reflux with metabolic alkalosis and dehydration). Because these patients are a poor surgical risk, the operation should be delayed for 12 to 24 hours following reduction of the hernia (which is usually possible with the patient in lateral or dorsal recumbency), and a constant drip infusion with physiological saline should be administered.

Closure of the abdominal wall in three layers: the peritoneum and the fascia are closed with a continuous mattress suture and followed by a lock-stitch suture with non-absorbable material (e.g. Supramid® 6 metric or 8 metric for calves > 80 kg). The subcutaneous tissue is sutured with a continuous lock-stitch suture with absorbable material (6 metric). The skin is sutured with an interrupted mattress suture with silk (6 metric or 8 metric for calves > 80 kg).

8.3 Supportive therapy

Parenteral antibiotics for 3 to 4 days (no local antibiotics in the abdominal cavity or the wound!), and analgesics for 1 to 3 days. The skin sutures are removed after 10 days.

9. SUMMARY

In the area of soft tissue surgery, there are many possibilities to enrich the spectrum of practice work in a stimulating way. In addition to surgical techniques, the causes and signs of the most important disorders in calves that require surgical intervention will be described. This is considered necessary because early diagnosis is often critical for the success of surgical interventions. Also, modifications of surgical procedures will be described that have been found useful during the last few years.

10. KEY WORDS

Calf, soft tissue surgery, temporary ruminal fistula, abomasal volvulus, ileus, urethrostomy, navel diseases.

11. RESUME

La vie quotidienne du vétérinaire se voit largement enrichie par un grand éventail de possibilités dans le domaine de la chirurgie abdominale chez le veau. Par ailleurs les causes et les symptômes des maladies les plus importantes qui peuvent ou doivent être traités chirurgicalement sont présentées. Ceci est d’autant plus important qu’un diagnostic très rapide est décisif pour la réussite de l’intervention. De plus des techniques chirurgicales nouvelles s’étant avérées efficaces dans les dernières années sont également abordées dans la présentation.
12. MOTS CLES
Veau, chirurgie abdominale, fistulation temporaire du rumen, torsion de la caillette, iléus, uréthrotomie, maladie de l’ombilic.

13. ZUSAMMENFASSUNG

14. SCHLÜSSELWÖRTER
Kalb, Weichteilchirurgie, temporäre Pansenfistel, Torsio abomasi, Ileus, Urethrostomie, Nabelerkranzungen.

15. RESÚMEN
La cirugía de los tejidos blandos del ternero ofrece muchas posibilidades, las cuales enriquecen en forma interesante el trabajo diario del veterinario dedicado a los bovinos. En esta contribución se describen las enfermedades esenciales, sus causas y síntomas, que requieren un tratamiento quirúrgico o se pueden tratar quirúrgicamente. Esto es necesario dado que un diagnóstico rápido decide sobre el éxito del tratamiento quirúrgico. Además se demuestran modificaciones de técnicas quirúrgicas, las cuales en los últimos años se han utilizado exitosamente.

16. PALABRAS CLAVES
Ternero, cirugía de los tejidos blandos, fistula ruminal temporaria, torsión del abomaso, obstrucción intestinal, uretrostomía, enfermedades del ombligo.

17. REFERENCES

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