

## **UMBILICAL SURGERY IN CALVES**

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### **INTRODUCTION**

Umbilical surgeries are frequent in cattle. The most frequent condition is the umbilical hernia. With an increase in the number of calves born through in vitro fertilization, pathologies involving the embryonic internal structures are more frequent. This presentation will review the principles of hernia repair and will discuss challenging umbilical surgeries. First, the use of the ultrasound in the pre-operative period will be discussed. Second, anesthesia of those calves will be discussed in regards to their size and the length and difficulty of the procedure. Finally, the surgery and its post-operative management will be discussed.

### **ULTRASOUND EVALUATION**

Every calf should undergo a complete physical exam prior to surgery for an umbilical pathology. A complete physical exam includes a deep palpation of the umbilical structures. Palpation could be difficult to perform on larger cattle. Ultrasound evaluation is an extension of the palpation. It will help determine the structures involved in the pathology (e.g., urachus or arteries). It will help determine the severity of the pathology (does the umbilical vein go into the liver). It will help determine the structure involved in the strangulated hernia (abomasum or jejunum) helping the veterinarian elaborate his surgical plan.

A 3.5 MHz curvilinear probe is ideal for umbilical evaluation. A linear probe, like a transrectal probe, can be useful, but lacks depth to evaluate some structures (ex: liver). The scan starts at the navel and goes toward the liver (right paracostal area) to evaluate the umbilical vein, and toward the bladder (caudal abdomen) to evaluate the urachus and the umbilical arteries. It is important to visualize the bladder, because oftentimes arteries and the urachus decrease in size going into the umbilicus but increase in size at the cranial aspect of the bladder.

### **PRE-OPERATIVE TREATMENTS**

Keeping the calf off-feed prior to surgery is very important especially when dealing with a large hernia. Typically, hay is restricted for 36 hours, grain for 24 hours and water for 12 hours. On very large hernias, the hay can even be restricted for 48hours. With this off feed protocol, even

very large hernias can be surgically repaired. Preoperative antibiotic (PPG) and NSAID (Flunixin) are mandatory.

## **ANESTHESIA**

Some factors like the size of the animal and the structures involved in the pathology will change the protocol used to anesthetise the calf. Pathology, other than simple hernia, on larger cattle, should be tackled under general anesthesia. If available, gas anesthesia is ideal. If not, a double drip solution (GGE 5% and ketamine (2mg/ml) given to effect allows the surgeon to perform the procedure without significant movement of the animal. We do not recommend giving large volume epidural anesthesia to cattle over 300kg to avoid complications during recovery (hip luxation). If used, it is recommended to recover the animal with hobbles on a non-slippery floor (sand or thick bedding).

On smaller cattle with complicated umbilical surgery, we recommend using general anesthesia. Omphalophlebitis and deep omphaloarteritis should be tackled with gas anesthesia. During the manipulation of the arteries and vein, a lot of traction will be applied on the liver and on the aorta creating pain. Having the animal under gas anesthesia makes it easier to control the plane of anesthesia during those painful manipulations. Injectable general anesthesia is adequate for umbilical pathology where the traction is placed on the bladder (urachal surgery). A double drip solution (GGE 5% and ketamine (2mg/ml)) given to effect allows the surgeon to perform the procedure without significant movement of the animal.

On smaller cattle, except for simple hernia, a large volume epidural anesthesia is helpful to anesthetise the caudal abdomen and to immobilize the rear end of the calf. This is our protocol for a calf undergoing surgery for an infected urachus:

- A. Premidication: Diazepam (0.2mg/kg IV).
- B. Epidural anesthesia: Lidocaine 2% (0.15ml/kg sacro-coccygeal) +/- Xylazine (0.05mg/kg). The xylazine increases the sedation of the calves and increases the duration of action of the epidural (3–5 hours vs. 1–2 if lidocaine is used alone). The calf is kept in sternal recumbency for 15 minutes after the epidural.
- C. During surgical preparation, a nasotracheal tube, especially if a double drip is used, should be placed. The easiest way to perform a nasotracheal intubation is with the calf in dorsal recumbency. The neck is straightened and the tube is slid slowly into the trachea paying attention to the breathing pattern of the calf (advancing the tube during inspiration).
- D. Local anesthesia: ring block around the umbilicus (especially at the cranial aspect, which is not anesthetized by the epidural).
- E. Double drip: 5% GGE mix with ketamine (2mg/ml) given to effect

## **PRINCIPLES OF HERNIA REPAIR**

First, if there is a draining tract, don't forget to suture it. Second, if you are doing an umbilical surgery on a male, clean the prepuce and do a purse string.

Two types of herniorrhaphy are described: open and closed techniques. In cattle, because of the rate of adhesions and infection of internal structures, the open technique is the technique of choice.

A fusiform incision is created around the navel through the skin and subcutaneous tissue. Hemostasis is performed. The external and internal sheet of the rectus abdominal muscle are next incised with a blade at the left cranial aspect of the incision to avoid damaging any potentially infected internal umbilical structures. The peritoneum is exposed and punctured bluntly with a finger. The abdomen is digitally explored and the incision through the abdominal wall is continued around the hernia ring with a Mayo scissor creating another fusiform incision. Adhesions with the omentum (if present) are broken down. Any hole created in the omentum is sutured with an appositional continuous pattern. The liver and bladder are palpated to avoid leaving infected tissue in the abdomen.

The incision is then sutured in 3 layers: linea alba, subcutaneous tissue and skin. An appositional layer (simple interrupted, cruciate, inverted cruciate) is used to close the linea alba. When tension is present, a near-far-far-near pattern can be used to create an apposition of the tissue. Patterns such as the vest over pants are not recommended any more. They are associated with delayed healing, surgical site infection and recurrence of the hernia. Absorbable suture materials such as polydioxanone (PDS II) are recommended on the body wall. Recommended suture material size for calves under 100 pounds is USP 0. For calves between 100 and 200 pounds is USP 1 and for calves over 200 pounds is USP2.

A simple continuous pattern is used on the subcutaneous tissue. Absorbable suture material such as polyglactin 910 (Vicryl) is recommended for this layer. It is important to avoid including the dermis into the subcutaneous layer to avoid contaminating the incision with bacterial flora present in the skin. The size of the suture material used varies between USP 2.0 and 0.

A cruciate pattern is used on the skin. Non-absorbable suture material such as polypropylene (Prolene) or nylon (Supramid) is recommended. The size of the suture material used on the skin follows the same guideline as the size of the suture material used on the body wall.

## **POST-OPERATIVE TREATMENTS**

Antibiotics are given for 3 to 5 days and NSAIDs are repeated the day following surgery. Hay is reintroduced over a 3 day period, especially on calves that had tension on the body wall during closure. The calf is stall rested until the stitches are removed no more than 14 days after the surgery. Leaving the stitches for a longer period increases the risk of surgical site infection.

## **INFECTED URACHUS**

Infected urachus is a frequent condition in calves. Rarely, the infected structure communicates with the bladder. However, clinical signs of chronic urinary tract infection (cystitis, urinary calculi, polyakiuria) are usually present. The diagnosis is made by palpation alone or by ultrasonography. The abdomen is surgically prepared and a fusiform incision of the skin and subcutaneous tissue is created around the infected umbilicus. Expect more bleeding on your approach of the body wall. As for the hernia, the abdomen is entered at the left cranial aspect of the incision. The body wall incision is enlarged, the urachus located and then isolated from the body wall. The skin, the subcutaneous tissue and the body wall incision is extended caudally. Adhesions between the urachus and body wall are sharply cut with a Metzenbaum scissor until the urachus and bladder can be exteriorize. Then, the adhesions between the urachus and omentum are bluntly or sharply cut. If present, the umbilical arteries are ligated and transected before removing the apex of the bladder with the infected urachus. Ideally 2 Doyen atraumatic forceps are used to do a partial cystectomy,. The forceps are placed 2 cm apart from each other. The bladder is amputated distally to the most distal forcep (proximal to the urachus). The incision on the bladder is closed with 2 inverting layers. The first one includes the submucosa and the second one includes the muscular layer and the serosa. Absorbable suture materials of USP 3.0 are used. It is important that the suture material is not exposed to urine to avoid early absorption or urinary calculi formation.

The holes in the omentum are repaired and the body wall is closed as described previously.

## **OMPHALOPHLEBITIS**

Two clinical presentations of omphalophlebitis are encountered. The first one is a partially infected vein that does not penetrate into the liver. This umbilical pathology has only minimal repercussions on the health and the growth of the calves. The umbilical stump is usually enlarged and the owner often reports multiple episodes of purulent drainage from the stump. Antibiotic administration usually resolves the drainage temporarily. The diagnosis is confirmed by palpation and ultrasound. The surgery involves removing en block the infected vein. In some cases, liver adhesion around the vein might need to be dissected to gain access to an area where the vein tapers. The vein is double ligated. The ultrasound can be used intra-operatively to ensure that the vein is cut in a safe location. It is recommended to swab the stump and to submit it for bacterial culture and sensitivity.

The second presentation is a combination of extra and intra-hepatic infection of the vein. This umbilical pathology has significant repercussions on the health and the growth of the calves. Usually, they are poor doers and have multiple problems (septic arthritis). The diagnosis is made by palpation and ultrasound. In the liver, the vein could be the only structure infected. However, in some cases, multiple liver abscesses can be found, worsening the prognosis.

On presentation, those calves are usually in rough shape. It is important to stabilize them and start treating any concomitant diseases prior to surgery. The surgery can be delayed only if the infected vein is actively draining. In some cases, medical therapy combined with an efficient umbilical drainage can decrease the size of the infected structure to the point that it is possible to remove the vein en bloc. However, because of the angle of the vein in regards to the umbilical stump, it rarely drains efficiently. In those cases, the surgery cannot be postponed indefinitely. As soon as the animal can handle the surgery, it should be performed. Postponing the surgery for too long can cause the infection of other structures (especially joints).

Since the infected structure cannot be removed totally, it should be marsupialized. The marsupialisation can be performed at the cranial aspect of the incision or through an independent circular incision at the cranial and lateral aspect of the incision. The goal of the marsupialisation is to create a shorter, larger and straighter draining tract. The marsupialisation is created by suturing the vein in 2 or 3 plains to the body wall. Passing a large umbilical stump through the circular incision is impossible. The stump will have to be transacted during the surgery increasing the risk of contaminating the surgical field. It is usually performed in an area where the vein tapers just next to the body wall (they usually all do). A ligature is placed around the vein. A sterile glove (only a finger) is placed over the vein and is again ligated. The protected vein is then pulled through the body wall.

The day following the surgery, the stump is amputated. Often, the drainage coming out of the vein is disappointing. However, you need to resist the temptation of flushing actively the vein for the first couple of days. Frequently the wall, separating the abscess from the portal vein, is paper thin. Flushing actively might cause some bacteria to disseminate systemically.

The marsupialisation site will heal by second intention after resolution of the infection. In a large number of cases, a hernia will result and will need to be revised surgically. It is important to warn your client of the costs associated with a second procedure.

## **OMPHALOARTERITIS**

Omphaloarteritis is uncommon. There are only a few reports of this condition in the literature. Like omphalophlebitis, the artery could be partially or almost completely involved. More systemic repercussions are seen with the latter. When the artery is partially involved it is recommended to remove it en bloc. However, when it is almost completely involved, it could be extremely difficult to remove it completely. Again, if the artery is draining through the navel, it is recommended to treat the animal medically prior to surgery. In our hospital, I have seen a handful of cases where the artery regresses to the point where en bloc removal was possible. If the artery cannot be removed en bloc and it is not draining actively through the umbilicus, the artery can be marsupialised. However, this procedure is more challenging to do than with the vein. The marsupialisation is created just cranial to the pubis and lateral to midline. Revision of the marsupialization incision is more difficult in this location if a hernia appears.

During surgery, the ultrasound can be used to find the safest location to ligate the artery. Usually, a lumen will be present in the abdominal stump. A lumen does not mean that the infected tissue is not totally excised. A swab of the stump should be submitted for bacteriological culture and sensitivity. If the lumen is large, an inverted suture should be performed on the stump.

After the surgery, I recommend dissecting the artery. I usually cut the artery at its widest point and I take a sample of the purulent material for bacteriological culture and sensitivity. Then, I feed a small gauge urinary catheter toward the amputation site to evaluate patency. If it does not exit at the amputation, I dissect the artery until I find the blind end following the catheter. If the catheter exits the amputation site, I will keep the animal on antibiotics for a longer period of time. I will readjust the therapy according to the results of culture and sensitivity.

### **INCARCERATED HERNIA**

Incarcerated hernia is a common condition in calves. However, because the most frequent structure involved is the omentum, it does not usually cause severe clinical signs. After the omentum, the most frequent structure involved in an incarcerated hernia is the abomasum and the jejunum. Abomasal incarceration is usually found on poor doer calves with an enlarged umbilicus. Rarely, they have a complete obstruction of the abomasum. However, on bloodwork, they might have signs of proximal obstruction. The condition is confirmed with ultrasound. A neophyte ultrasonographer may misdiagnose an incarcerated abomasum for an umbilical abscess. It is important to always stick a needle in an enlarged umbilicus before cutting into it with the scalpel blade.

Prior to surgery, severely affected calves should be treated medically. The umbilicus is approached like an umbilical abscess. When the body wall is incised, the abdomen is protected and the abomasum is evaluated. The hernia ring is incised carefully and fibrinous adhesions between the abomasum and the hernia sac are broken carefully. Sharp dissection through fibrous adhesions is unrewarding. If the abomasum cannot be freed by blunt dissection, it will have to be incised. Therefore, an assistant is needed to hold the abomasum with its fingers to obstruct the flow of ingesta while it is incised. The hole created is closed with a double inverting suture pattern. In some cases, when I am worried about stricture, I close the incision with a simple interrupted pattern on the mucosa and submucosa and an inverting layer on the seromuscular layer.