

# Sorting out umbilical abnormalities in the young calf

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## Abstract

Umbilical abnormalities in the calf can result from multiple underlying problems. Given the potential complications of some of those conditions, umbilical growths can be daunting for some practitioners to handle in the field. A systematic approach to diagnosis utilizing palpation and ultrasound, along with aspiration in some cases, can allow for accurate diagnosis and successful first line treatment. Surgical evaluation is sometimes required to confirm the diagnosis and often necessary for resolution. This article will offer practical tips for the workup of umbilical disorders.

**Key words:** umbilical mass, umbilical abscess, umbilical hernia, herniorrhaphy

## Résumé

Les anomalies ombilicales chez le veau peuvent découler de plusieurs problèmes sous-jacents. En raison de la combinaison de certaines de ces conditions, le traitement des problèmes ombilicaux sur le terrain peut poser un grand défi à certains praticiens. Une approche diagnostique systématique utilisant la palpation et l'échographie de même que l'aspiration dans certains cas peut permettre un diagnostic précis et un traitement de première ligne efficace. L'évaluation chirurgicale est parfois requise pour confirmer le diagnostic et est souvent nécessaire pour la résolution. Cet article offrira des conseils pratiques pour l'examen des troubles ombilicaux.

## Introduction

Umbilical disease can be a common postpartum occurrence in neonatal calves. Omphalophlebitis (infection of the umbilical vein) has been described as the 4th most common disease in calves, following diarrhea, respiratory disease, and ringworm in calves 0 to 90 days of age.<sup>3</sup> During a normal birth, the umbilical structures (urachus, umbilical arteries, umbilical vein) retract into the abdomen, helping to protect them from environmental contamination and thus prevent umbilical complications. Calves born via cesarean section have a greater risk of umbilical infection due to the differences in clamping the cord versus "stretching", preventing the normal retraction of umbilical structures.<sup>1</sup> Some umbilical abnormalities have also been documented in cloned calves.<sup>1</sup> There is also anecdotal evidence that *in vitro* fertilized bovine embryo calves have a higher incidence of umbilical complications after birth, but a likely correlation exists that a larger

proportion of those calves are also delivered by C-section.

Infection and herniation are the primary problems associated with the umbilicus in calves. Either one of these can lead to enlargement of the umbilicus. An umbilical mass is not always an umbilical hernia. Infection with environmental bacteria following birth is the most common source of infection; however a generalized septicemia can seed bacteria into the umbilical remnants. Environmental pathogens most commonly isolated from umbilical infections are *Trueperella pyogenes* and *Escherichia coli*.<sup>1,6</sup>

Proper dipping of the external umbilicus after birth is an important management tool in preventing umbilical infection and possible subsequent herniation. Strong iodine (7%) is recommended by the author as an effective dip against navel infections. A Cornell study showed that calves with non-dipped navels had an 18% death rate, compared to 7% for calves with dipped navels.<sup>4</sup>

Umbilical disorders can be divided into 5 categories: 1) uncomplicated umbilical hernia; 2) umbilical hernias with subcutaneous infection/abscesses; 3) umbilical hernias with umbilical remnant infections; 4) umbilical abscess (chronic omphalitis); and 5) urachal cysts/ruptures.<sup>6</sup> In cases of umbilical hernias, others have chosen to describe them as complicated or uncomplicated. Uncomplicated hernias are the result of heritable defects of the body wall or developed after mild infections of umbilicus that go unnoticed.<sup>5</sup> Uncomplicated congenital hernias have been proven heritable in Holsteins.<sup>1</sup> Umbilical hernias are the most common bovine congenital defect, with a reported incidence between 0.65% and 1.04%.<sup>6</sup> These uncomplicated hernias are typically easily reducible by manual palpation, unpainful, and have likely had little impact on the growth and performance of the calf unless gastrointestinal contents become strangulated within the hernia sac. Complicated hernias are described as non-reducible and/or infected. They may be painful and the calves may show systemic signs of depression or poor growth.<sup>3,5</sup>

Therapy decisions are largely based on making an accurate diagnosis. This can be challenging, especially in the case of deep umbilical remnant infections. Diagnosis is typically made by performing a thorough physical exam including deep palpation of the umbilical enlargement. Care should be taken not to apply too much force, especially for hernias that aren't readily and easily reducible, so as not to rupture deeper abscesses/infected structures. Placing the calf in lateral recumbency, with or without sedation, can assist in thorough palpation of the umbilical structures. The presence of infected umbilical remnants is often easier to determine in the recumbent calf.<sup>2</sup> Pollakiuria can indicate urachal infection/inflammation, and fever, diarrhea, septic

joints, and meningitis may indicate septicemia.<sup>3</sup>

Ultrasonography is a useful tool in determining the type and scope of the umbilical mass. A linear ultrasound probe, such as is commonly used for rectal reproductive ultrasound, is sufficient to visualize most umbilical disorders. Ultrasound is typically performed with the calf standing, although it can also be applied while the calf is in lateral recumbency for examination or even in dorsal recumbency under anesthesia prior to surgical exploration to confirm to absence or presence of enlarged/infected umbilical remnants. Ultrasound can differentiate between external or internal abscessation, can aid in evaluating the integrity of the abdominal wall, and can also help to determine which, if any, of the umbilical remnants are involved/infected.

For suspected external umbilical infection with intact body wall (verified by ultrasound and/or palpation), aspiration of a fluid viscus with a 16-gauge or 14-gauge needle can be helpful ruling in or ruling out abscess.

In some cases, surgical exploratory via ventral midline laparotomy is required to determine the extent of involvement/infection of internal structures. Laparoscopic evaluation of intra-abdominal umbilical structures has been shown to be a potentially useful adjunct to physical exam and ultrasound. In 1 study, laparoscopy was performed in calves under general anesthesia in dorsal recumbency. Scope portals were placed 10 cm cranial to the umbilicus and 5 cm off midline. In some cases laparoscopy detected adhesions that were not suspected on ultrasound, as well as focal enlargements of the umbilical arteries and urachus close to the bladder.<sup>7</sup>

Treatment of uncomplicated umbilical hernias can be surgical or non-surgical and often are accomplished in the field. For hernias less than 3 cm in diameter, a belly band or umbilical support (hernia belt) can be applied to the abdomen over the hernia site. Various devices have been used to hold the hernia sac inside the abdomen. A smooth metal lid from a frozen juice concentrate can or a plastic ear tag glued to the hair of the abdomen, both followed by taping or placing a band around the abdomen has good success. Elastikon (4" width) applied snugly over the hernia site and also extended several inches cranial and caudal to the edges of the hernia and left in place for 2 weeks is very effective in allowing small (<3 cm) uncomplicated hernias to fibrose. The Elastikon or tape should be applied with the calf standing following the return of hernia contents into the abdomen.<sup>3</sup> Hernia clamps have also been used for uncomplicated hernia repair, but the author has mixed experience with clamps. For uncomplicated hernias >3 cm, surgical repair is nearly always necessary.

Surgical repair of uncomplicated hernias can be accomplished in the field under injectable anesthesia or in clinic via gas inhalation. Field anesthesia can be accomplished with 0.1 mg/lb (0.22 mg/kg) BW of xylazine along with 3 mg/lb (6.6 mg/kg) BW of ketamine mixed together and injected IM. Alternate protocols include xylazine (0.09 mg/lb; 0.20 mg/kg IM) followed by ketamine (1.8 mg/lb; 4 mg/kg IV).

Xylazine and ketamine can be repeated every 20 to 30 minutes as needed. Alternatively, simple hernias can be repaired using xylazine sedation (0.045 mg/lb; 0.10 mg/kg IM) and lumbosacral epidural of 2% lidocaine (1 ml/10 lb [4.5 kg] BW).<sup>3</sup> Calves should be held off feed for 24 to 26 hours prior to surgical repair of any umbilical mass to facilitate abdominal exploratory and closure of the body wall.

Approach to the hernia involves an elliptical incision around the hernia removing the excess skin. A combination of sharp and blunt dissection is used to expose the shiny external rectus sheath. Cut through the external rectus sheath, then internal rectus sheath, then peritoneum. Enter the abdomen through the edge of the hernia sac at 3 or 9 o'clock (laterally) to avoid the umbilical vein (cranial) and umbilical arteries and urachus (caudally) if still present.<sup>3</sup> After making an initial 2 cm incision laterally, the underlying tissues should be explored digitally to determine if underlying tissues are adhered to the hernia capsule. Most commonly adhered are the abomasum and/or omentum. All umbilical hernia tissue should be removed and the body wall edges debrided and freshened. Closure by simple apposition of the unscarred hernia ring with minimal tension is thought to lead to ideal healing.<sup>6</sup> Several suture patterns may be used. Some surgeons suggest simple interrupted, simple continuous or interrupted cruciate patterns to close the body wall. This author typically uses a "vest over pants"/near-far-far-near pattern placed at regular intervals for body wall closure. This tension relieving pattern may be especially necessary for larger (>5 cm) hernias. Vicryl or PDS are acceptable absorbable sutures for closure of the internal and external rectus layers. The leading edge of the body wall is then over-sewn with absorbable chromic gut with swedged-on taper needle. Skin is closed by surgeon's preference with non-absorbable monofilament suture. Alternate body wall closure has been proposed as: peritoneum and internal rectus sheath, simple continuous (0 or 2/0 PDS or Maxon); external rectus sheath (the strength closure), simple interrupted (0 PDS or Maxon); skin closure.<sup>3</sup>

Perioperative antibiotics (procaine penicillin G 10,000 U/lb [4,500 U/kg] IM or ceftiofur 1 mg/lb [0.45 mg/kg] IM) 1 hour before surgery should be initiated.<sup>3</sup> Systemic antibiotics are recommended for 5 days following surgery. Tetanus vaccination is also prudent as is pain mitigation by flunixin at labeled dose or meloxicam (0.45 mg/lb; 1 mg/kg orally).

Calves with an umbilical hernia associated with subcutaneous infection usually have a history of an enlarged umbilicus since birth. The mass may not be present until the calf is several weeks old. Palpation of the mass reveals a reducible dorsal hernia and firm non-reducible ventral portion attached to the skin. Many of these hernias are secondary to original umbilical infection that weakened the body wall and created a hernia. Surgical removal of the abscess/cellulitis, together with hernia repair, is the treatment of choice.<sup>6</sup> Surgical repair of the hernia continues as described above for uncomplicated herniorrhaphy. In cases of draining abscesses superficially over the hernia site, this author has

found it prudent to treat the calf with procaine penicillin G (10,000 U/lb [4,500 U/kg] IM) twice daily for 5 to 7 days prior to attempting surgical repair.

Umbilical hernias with umbilical remnant infection (omphalophlebitis, omphaloarteritis, and infection/abscessation of the urachus) are more complicated. Surgical reduction should not be attempted in the field. Referral may be necessary. The typical history of these calves is intermittent purulent drainage from the umbilicus beginning at 1 to 2 weeks of age. The drainage is often followed by a rapidly enlarging mass over the next several weeks. These calves are often unthrifty and small for their age and may have concurrent pneumonia, septic arthritis, peritonitis or bacteremia.<sup>6</sup> Ultrasound of the ventral abdomen is a great way to determine which, if any, umbilical remnant structures are involved.

The urachus is the most frequently infected umbilical remnant. Dysuria, pollakiuria, pyuria, and cystitis are all potential sequella to urachal infections in calves.<sup>6</sup> In some cases, the urachal infections extend all the way to the apex of the bladder. The umbilical vein is the next most likely infected remnant. Often there is a clearly delineable mark on the umbilical vein between infected and uninfected portions. Infections of the umbilical vein that extend to the liver can lead to liver abscesses, septicemia, bacteremia, and poor performance.

Surgical repair with removal of all infected/inflamed umbilical remnants followed by hernia repair is necessary in these cases. Removal of all infected urachal tissues is necessary and when the urachal infections extend to the apex of the bladder, surgical resection of the apex of the bladder is necessary. The entire urachus, umbilical arteries, hernia tissue, and overlying skin are removed en bloc to prevent contamination of the abdomen.<sup>6</sup> In cases of omphalophlebitis, the umbilical vein is ligated and transected proximally to the infected area. When the umbilical vein infection extends all the way to the liver, the umbilical vein stump is marsupialized to the body wall and skin through a separate incision cranial to the herniorrhaphy. This allows drainage of the infected vein +/- lavage of the umbilical artery following surgery. Care should be taken with lavage of the umbilical vein so as not to rupture the vein internally or flush with such pressure as to cause an ascending infection into the liver, which could lead to septicemia. Closure of the hernia is continued as outlined above once all infected/inflamed remnant tissues have been removed.

Umbilical abscesses are common sequelae to contained omphalitis.<sup>6</sup> The umbilical mass can develop shortly after birth but may also be delayed until the animal is over 1 year of age in some cases. Palpation of an intact body wall is a common finding, although some cases may have an evident "stalk" extending toward or through the body wall. Ultrasonography is useful to document the presence of purulent material inside a well encapsulated umbilicus. Ultrasound may also be able to determine if the infection travels deeper through any intact remnants.

Needle aspiration to confirm the presence of purulent

material follows palpation and ultrasound of the umbilical enlargement. If the body wall is intact, a 2 to 4 cm incision travelling cranial to caudal along the umbilical abscess is made with a scalpel to establish good drainage. Lavage of the abscess should be attempted twice a day for 3 to 5 days using a dilute betadine solution.

The need for surgery depends on how well the infection responds to medical treatment and the cosmetic appearance required. The possibility of infection extending into the umbilical remnants must be considered and monitored.<sup>6</sup> Surgical excision is necessary if the infection extends deeper into abdominal remnants. Systemic antibiotics (procaine penicillin G or ceftiofur) as described above should be instituted for 5 days following excision and drainage.

Urachal cysts/ruptures can be imaged by ultrasound and are typically confirmed at surgery. Ultrasound with or without abdominocentesis can confirm the presence of free urine in the abdomen. Surgical reduction and removal of involved urachal tissue is necessary and subsequent closure of the body wall is continued as described above.

## Conclusion

Umbilical masses in the calf can seem daunting to some practitioners in the field. Systematically working through physical examination, good history taking, and ultrasonography can help categorize these abnormalities into 1 of 5 categories: 1) Uncomplicated umbilical hernia; 2) Umbilical hernias with subcutaneous infection/abscesses; 3) Umbilical hernias with umbilical remnant infections; 4) Umbilical abscess (chronic omphalitis); 5) Urachal cysts/ruptures. Further categorization of an umbilical hernia into complicated vs uncomplicated can delineate between on-farm management with belly wrap or surgery or referral for extensive surgical exploratory and correction. Deeper infected umbilical remnant tissues (urachus, umbilical vein, and umbilical arteries) generally cause systemic illness to the calf and poor performance, as well as require extensive surgical excision. Exceptional management through proper navel dipping and pen/stall cleanliness is critical to prevention of many umbilical issues.

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