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Surgical Diseases of the Neonate

David E Anderson, DVM, MS, DACVS
Head, Food Animal Medicine and Surgery
College of Veterinary Medicine
Ohio State University
Columbus, Ohio 43210

Umbilical Disease

A variety of publications have addressed the development of neonatal bovine physiology and umbilical changes in the early post-partum period.¹⁻⁹ Normal anatomic (embryonic) structures: urachus, paired umbilical arteries, umbilical vein (paired externally), external umbilicus. After rupture of the umbilical cord at birth, the urachus, arteries, and umbilical vein normally retract into the abdomen, thus protecting them from environmental contamination. C-sections have a much greater risk of umbilical infection because of clamping or ligation of the umbilical cord, thus preventing the normal retraction of the umbilical structures. Several publications have addressed the association of umbilical abnormalities with calf morbidity and mortality.¹⁰⁻¹⁴

Umbilical abnormalities have been extensively described in the literature and can be divided into three categories¹⁵⁻³⁹:

Umbilical Infections: There are 5 anatomical types of umbilical infections. Most infections are caused by *Arcanobacterium pyogenes*, *E coli* being the second most commonly isolated bacteria and is the most likely to cause systemic infection and septic polyarthritis. Risk of septicemia is closely associated with ingestion of colostrum. Quantity of immunoglobulin transferred has been correlated with morbidity, mortality, and performance in calves (Table 1). **Urachal sepsis:** The most common structure infected. **Omphalophlebitis** - Infection / inflammation of the umbilical vein. The second most commonly infected structure. **Omphaloarteritis** - Infection / inflammation of the umbilical arteries. The least commonly infected (but this does not mean rare!). **Umbilical Abscess** - Soft tissue abscess of the external umbilicus. Umbilical mass is non-reducible. **Chronic Omphalitis** - Chronic / active umbilical infection. "Navel Ill" refers to septicemia and possibly hematogenous septic polyarthritis ("Joint Ill"). Any of these umbilical infections may lead to this eventually.

Umbilical Hernias: Congenital umbilical hernias are of concern for *heritability* (this has been shown to be true for Holsteins). However, many umbilical hernias are secondary to umbilical sepsis (so cull carefully). Most owners are willing to "tolerate" umbilical hernias as a side effect of genetic pressures for high lactation production or growth rates (the same may be said to be true for cystic ovaries, poor conformation, dystocia, etc..). Because the issue is clouded, most veterinarians perform herniorrhaphy as a service without extensive discussions about

heritability. Hernias are made up of the hernia sac, peritoneum, and may contain peritoneal fluid and viscera. The most common viscera involved in umbilical hernias in cattle is the **abomasum** with or without omentum. Hernias may be small at birth and enlarge with age. These should be differentiated from umbilical sepsis. **Simple (or uncomplicated) hernias** are easily reducible. **Complicated hernias** (incarcerated viscera usually without strangulation, or concurrent infection of umbilical structures) can not be completely reduced. Rarely, the viscera may become locally devitalized and rupture to the outside resulting in an enterocutaneous fistula. Our subjective clinical experience working with cloned dairy calves over the past two years suggests that cloned calves *may* have a greater likelihood of umbilical hernia / infection and that there *may* be a difference in the holding strength of collagen in the ventral abominal wall of clones.

Umbilical Infection with hernia: Umbilical infection may result in weakening of the adjacent abdominal wall and cause an acquired umbilical hernia (or sepsis and hernia may simply occur concurrently). These are usually partially reducible. *Umbilical hernias* may be treated using various techniques. Small hernias may respond to digital irritation of the hernia ring 1 to 2 times daily until closed. "Hernia belts" to maintain reduction of the hernia for a period of time may be successful in small (< 4 cm diameter) hernias. Larger hernias may be treated using hernia clamps or surgical closure. Hernia clamps should be reserved for hernias < 5 cm diameter and you must be absolutely sure that no viscera are adhered to the interior of the sac and no internal umbilical structures are infected. Also, administer a tetanus toxoid vaccine. Surgical closure may be accomplished by inverting the hernia sac, scarifying the hernia ring, and suturing the edges of the ring / sac closed. You must be absolutely sure that no internal umbilical structures are infected and that you do not puncture any viscera with the needle.

Open herniorrhaphy is the treatment of choice for umbilical hernias. This technique ensures that the hernia is removed and permanently closed, no infected umbilical structures are closed within the abdomen, recurrence of the hernia is minimal, and no viscera are entrapped. You must be sure to remove the hernia ring. This part of the abdominal wall is abnormal and should not be used to anchor sutures.

Umbilical infections may be treated medically or surgically. If medical treatment has not resolved or significantly improved the umbilical infection within 5 days, then surgery is probably indicated. If the calf is overtly sick, the umbilicus should probably be removed as soon as the calf is stabilized. The antibiotic of choice for umbilical infections is penicillin (trimethoprim-sulfa, ceftiofur, ampicillin are reasonable choices). Surgical treatment of umbilical infection involves removal of the umbilicus and all infected structures:

Urachus ---> resection of the apex of the bladder.

Omphaloarteritis ---> omphalectomy and artery resection.

Omphalophlebitis: Stops before liver ---> omphalectomy with vein resection
Enters liver ---> umbilical vein marsupialization

Umbilical vein marsupialization has been described as a one-step or two-step procedure. In the *One-step procedure*, a ventral midline celiotomy is performed and the infected umbilical vein isolated. The umbilicus is excised and the umbilical vein sutured closed. A sterile glove may be placed over the stump to prevent abdominal contamination. Then, the umbilical vein is marsupialized through a separate 2 to 4 cm incision in a right paramedian location as close to

the liver as possible to minimize the length of vein to provide drainage. The vein is sutured to the abdominal wall and skin. The celiotomy incision is closed. As the vein infection resolves, granulation tissue contraction closes the defect in the rectus abdominus muscle such that no hernia forms at the incision site. In the *Two-step procedure* a ventral midline celiotomy is performed and the infected umbilical vein isolated (first step). The umbilicus is moved as far cranially in the incision as possible and the umbilical vein sutured to the cranial aspect of the wound. The vein is sutured to the linea alba and skin. The celiotomy incision is closed. As the vein infection resolves, a defect in the linea alba remains as a small hernia. This hernia is closed at a second surgery to repair the small defect (second step).

Abstract

Les problèmes chirurgicaux sont fréquents chez le veau nouveau-né. Les conditions chirurgicales les plus souvent rencontrées sont les atteintes ombilicales et gastro-intestinales. L'emphase de cette conférence sera sur le processus décisionnel pour traiter les conditions de l'ombilic ainsi que la réhabilitation et le pronostic pour ces veaux.

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Table I. Adapted from Wittum TE, Perino LJ. Passive immune status at postpartum hour 24 and long-term health and performance of calves. American Journal of Veterinary Research 1995;56:1149-1154.

Variable	Odds Ratio for development of "variable" in calves with inadequate IgG (< 800 mg/dl)	Odds Ratio for development of "variable" in calves with inadequate plasma protein (<4.8 g/dl)
Pre-weaning mortality	5.4	
Neonatal morbidity	6.4	
Pre-weaning morbidity	3.2	
Morbidity		3.0
Respiratory tract morbidity		3.1
Weaning weight	16 kg lower weaning weight	
Respiratory disease	0.04 kg loss in daily rate of gain	