

“Kenny’s Umbil-ievable Start”

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Introduction

Umbilical disorders in postnatal calves are of great clinical significance and can be classified as infectious, noninfectious, or a combination thereof. Infectious disorders involve extra- or intra-abdominal structures and are mainly caused by species such as Streptococci, *Arcanobacterium pyogens*, Staphylococci, *Proteus* spp, *Pasteurella* spp, *Bacteroids* spp, and *E. coli*. Some of the infectious agents listed are known to cause systemic infection and septic polyarthritis². Infectious disorders of the umbilicus include omphalitis, omphalophlebitis, omphaloarteritis, urachal infection, and umbilical abscessation. Omphalitis is inflammation of the external aspects of the umbilicus due to an infectious cause. Omphalitis can then lead to an umbilical abscess, which can be classified as intra-abdominal or extra-abdominal. Infectious disorders can then lead to secondary umbilical disorders such as a patent urachus. A patent urachus is a urachus that has persisted or has delayed closing after birth⁶. Noninfectious disorders can span from involvement of hernias to urachal cysts². An umbilical hernia is the abnormal exit of organ or tissue through the umbilical opening⁴. Common organs associated with umbilical hernias include the intestines and abomasum; the liver and bladder have also been appreciated in an umbilical hernia as well¹.

Signalment and History

Kenny, an approximately 17 day old White Park bull calf, presented to Mississippi State College of Veterinary Medicine on July 7th, 2020 for an enlarged umbilicus and a cloudy eye. The owners noticed an enlarged umbilicus that was not able to be reduced when palpated. The owners were giving 2 tablets of trimethoprim and sulfadiazine orally twice a day and applying a triple antibiotic without dexamethasone eye ointment three times a day at home before presentation.

On initial presentation, Kenny was bright, alert, responsive, and was willing to walk around. He weighed 100.2 lbs with a body condition score of 5/9. He had an elevated temperature of 104°F, his right carpus and stifle palpated warm to touch and swollen, and his right eye showed signs of hypopyon and corneal edema. His heart rate was 136 bpm, respiratory rate was 60 bpm, and his hydration status was determined to be within normal limits. On palpation of Kenny's umbilicus, structures could be felt and were not able to be reduced back into the abdominal cavity. There was an approximately 7cm x 7cm scab on the distal aspect of the enlarged umbilicus that contained purulent discharge when manipulated. Furthermore, urine was seen coming from the umbilicus at spontaneous times, but Kenny was visualized urinating from his urethra as well. Kenny had a normal defecation while the physical exam was performed. Lastly, Kenny had a good appetite when offered a bottle of milk replacer.

Diagnostics

The most important part of the examination of umbilical masses by a veterinarian is manual palpation. Manual palpation of the umbilicus during the initial physical exam while the patient is standing is utilized to determine if there is a hernia or any enlarged structures in the umbilical sac. Many practitioners will further palpate if they can get the calf in dorsal recumbency when the calf is being prepped for surgery or if the calf will allow for to be place in the recumbency on initial exam; the importance of palpating when prepping for surgery is the abdomen relaxing and allows for deeper palpation, which may aid in identifying an enlarged urachus or umbilical vein. The reason identifying an enlarged abscess intra-abdominally is important is to aid in making a surgical approach opposite the structure to avoid opening it into the abdominal cavity; however, care should still be taken when palpating extra-abdominal abscesses as well. Another aspect of palpation is inducing any signs of pain when manipulated;

presence of a scab or any discharge indicates previous drainage¹. In addition to palpation, ultrasound sonography can aid in identifying intra-abdominal abscesses and the possible herniation of certain organs like the liver, intestines, or urinary bladder². Ultrasound can also help diagnose omphalophlbitis, omphaloarteritis, infected urachus, or patent urachus. The ultrasound guide can tract the umbilical vein to see if infection travels all the way back to the liver; similarly, with the urachus, the ultrasound guide can tract the urachus to see if dilation continues to the bladder.

On presentation, Kenny's umbilicus was palpated and established to be enlarged and infected. A non-reducible hernia was also suspected based on palpation. The structures inside the umbilicus could not be clearly defined on palpation, but differentials included an infected umbilicus with abscessation, communication into the abdominal cavity, and herniation of abdominal organs. An ultrasound prob was placed on his umbilicus while he was standing, and intestines could clearly be seen in the umbilical stump. Normal small intestine movement was noted, indicating no strangulating bowel. Kenny was diagnosed with an infected, non-reducible umbilical hernia with small intestine entrapment, as well as a patent urachus. Furthermore, Kenny's PCV came back at 25% (25-45%), and his TP was 5.8 g/dl (7-8.9). Kenny had a significantly elevated fibrinogen 800 mg/dl (100-600), increased glucose 127 mg/dl (61-102), increased ALP 395 U/L (25-160), increased phosphorous 8.3 mg/dl (4-7.1), and decreased magnesium 1.4 mg/dl (2-2.8). The total protein level indicated that Kenny was not a failure of passive transfer calf. The elevated fibrinogen is a common marker of inflammation. The increased glucose and ALP can be contributed to normal findings for a stressed, growing calf. Lastly, an ear notch sample was taken to run a BVD snap test that was negative.

Pathophysiology

Umbilical structures in the calf include the umbilical vein, 2 umbilical arteries, and the urachus. In utero, the normal physiology of the umbilical vein, as it runs cranial to the fetus's umbilicus to the liver, is to deliver oxygenated blood from the placenta to the fetus. The umbilical arteries run caudal to the umbilicus in the fetus and deliver unoxygenated blood from the fetus to the placenta to be recirculated by the dam. The urachus runs caudal to the umbilicus and ends at the apex of the bladder; the urachus allows for excretion of urine from the fetus. When the fetus is born the umbilical cord is torn or removed distal to the attachment on the calf, and soon after the structures related to the umbilicus become remnant structures. The umbilical vein becomes the round ligament of the liver; the umbilical arteries become the lateral ligaments of the bladder. The urachus dries and shrinks within a few days after birth and regresses into the apex of the bladder ⁶.

Inflammation of the external aspects of the umbilicus due to an infectious cause is known as omphalitis and occurs frequently in calves within 2 to 5 days of birth and often endures for several weeks. Commonly, the umbilicus is enlarged, can be closed or draining purulent discharge, and painful on palpation. Calves that present with omphalitis will have varying clinical signs from not nursing properly, febrile, and being relatively depressed or weak. In approximately 25% of omphalitis there are associated umbilical hernias ⁶. Umbilical hernias can occur due to "infection early after birth which then interferes with the normal closure of the abdominal rent and resolution of fetal structures" ³. Common sequelae of umbilical hernias and abscessation of umbilical structures include intestinal incarceration, joint ill, septicemia, meningitis, liver abscess, and chronic ill thrift ². Omphalitis can lead to umbilical abscessation; the abscessation can be classified as extra-abdominal or intra-abdominal. Extra-abdominal umbilical abscessation is an abscess formation in the umbilicus outside of the body wall that

does not affect any other umbilical structures. Treatment of extra-abdominal umbilical abscessation involves lancing and draining the abscess and occasionally administering systemic antibiotics ¹. Intra-abdominal abscessation can include infection of the umbilical vein, omphalophlebitis; infection of the umbilical arteries, omphaloarteritis; urachal infection; or herniation. Spontaneous rupture of intra-abdominal umbilical abscesses can lead to peritonitis, then death ⁶. Treatment of intra-abdominal umbilical abscessation calls for surgical intervention to remove the abscessed structure and systemic antibiotics.

When parturition occurs, the umbilical arteries withdraw into the abdomen and close by way of smooth muscle contraction in response to the elevated partial pressure of oxygen in the blood. The urachus and umbilical vein rupture outside the abdomen when the umbilical cord is torn, but the umbilical vein closes swiftly by smooth muscle contraction. The urachus should close quickly with the rupture of the umbilical cord. Because of the urachus and vein rupturing outside of the body wall, these structures have a greater risk of contracting an infectious agent. When there is an incomplete or delay in closure of the urachus, the condition is known as a patent urachus. A patent urachus can be acquired or congenital; however, a “congenital patent urachus in ruminants is rare” ⁶. Acquired patent urachus is a condition that can be caused by infection of the urachus itself or of the other umbilical structures. The most common way a patent urachus is diagnosed is direct visualization of a urine stream or dripping from the urachus at the umbilical stump ⁵. Another diagnostic method that can be utilized is intravenous or retrograde contrast radiography. The most common therapy for a patent urachus is removal of the entire urachus by surgical means. Due to high risk of ascending infection in the urachus, cystitis is a common sequela to the condition ⁶.

Treatment

After an extensive physical exam was performed on intake, Kenney was given Banamine (1.1 mg/kg) IV for pain relief of his joints and Florfenicol (40 mg/kg) SQ to start fighting any infection related to his umbilicus and joints. On July 8th, 2020, Kenny underwent surgery to remove and repair his umbilical hernia. Kenny was first given Butorphanol at 0.025 mg/kg and xylazine at 0.05 mg/kg IV to sedate, and then he was given a lidocaine high volume caudal epidural. The patient was then heavily sedated using 5 mg/kg of ketamine (half IV and half IM). The patient was positioned in dorsal recumbency, and the abdomen was clipped and sterilely prepped with Chlorhexidine and alcohol, and a lidocaine ring block was performed using 15 mls around the umbilicus. The most distal aspect of the infected umbilicus was over-sewn to prevent mucopurulent discharge from draining into the surgical field. A semilunar skin incision was made around the umbilicus with a scalpel, and caudal reflection of the prepuce was achieved. A stab incision was made at 3 o'clock (head serving as 12 o'clock) position and a finger was inserted into the abdomen to feel for adhesions and enlarged structures. The elliptical incision was continued in the abdominal wall using Metzenbaum scissors. Hemostasis was achieved with straight mosquito hemostatic forceps. Small intestines were observed adhered to the umbilicus. The umbilical vein was mildly enlarged immediately inside of the abdomen, but narrowed prior to reaching the liver. The dilation of the umbilical vein continued approximately 6 cm into the abdomen. The umbilical vein was ligated and cut 3 cm proximal to the enlargement of the vein. The urachus was moderately enlarged at approximately 4 cm in diameter and communicated with the bladder. Both umbilical arteries were normal in size. In order to remove the urachus, Doyen forceps were used to lightly clamp distal to the apex of the bladder, and the apex of the bladder was resected. The open bladder was then closed with a two layer inverting Utrecht pattern with 2-0 monocryl. The umbilical arteries were ligated with 2-0 monocryl in an

encircling fashion and transected and removed along with the infected umbilicus. Each stump (vein, both arteries, bladder) was inspected for proper hemostasis, and released into the body cavity. The small intestines adhered to the umbilicus were carefully dissected away. After attempting to relieve the adhered intestines, it was determined that the small intestines were too roughened and the chance of readhering was high. Therefore, a resection and anastomosis was determined to be the best option. Two Doyen clamps were placed on either side of the adhered intestines and laparotomy pads were placed around the surgical field. The intestine distal to the most proximal Doyen clamp on each side was then resected with Metzenbaum scissors. The infected umbilicus and resected parts were then disposed, and the cut sections of jejunum were sutured back together with two continuous patterns on each side of the intestines to reduce the risk of purse string effect. The entire abdomen was flushed with a liter of sterile saline. The body wall was closed with 2 vicryl in with an interrupted cruciate pattern. Prior to completing the body wall closure, the abdomen was infused with 120ml of carboxymethylcellulose. The subcutaneous tissue was closed with 2 vicryl in a simple continuous pattern and walking sutures were used to re-appose the prepuce. The skin was closed with 0 braunamid in a ford-interlocking pattern. Alluspray was applied to the incision site, and the calf recovered uneventfully.

After surgery, Kenny was started on procaine penicillin G (44,000 IU/kg SQ) once a day for 7 days, florfenicol (40 mg/kg SQ) once every 4 days. He also received Meloxicam (1 mg/kg orally) once daily for 3 days, then once every other day. Kenny's incision healed nicely and no further complications of his umbilicus or associated structures were appreciated. Kenny's right carpus and stifle were flushed while in hospital as a means of treatment, for the owner did not want to pursue any other further diagnostics for the joints. He was sent home on oral Meloxicam to be given at home.

Conclusion

In conclusion, umbilical disorders are of great significance to food animal practitioners. Umbilical disorders can range from non-infectious to infectious. Infectious disorders include omphalitis, omphalophlebitis, omphaloarteritis, infected urachus, and umbilical abscessation. Infectious umbilical disorders can lead to umbilical herniation of abdominal organs and secondary disorders of umbilical structures such as a patent urachus. A patent urachus forms when there is delayed or incomplete closure of the urachus. Diagnostic tools for umbilical disorders include manual palpation, ultrasound, and intravenous or radiography contrast. The most common therapy for intra-abdominal umbilical abscessation and herniation is surgical intervention. Kenny arrived at Mississippi State University with an enlarged umbilicus. Through manual palpation and ultrasound guided assessment, it was determined that Kenny had an infected umbilicus, an umbilical hernia with small intestine involvement, and a patent urachus. Umbilical surgery was elected and successful with removal of the umbilical structures, adhered small intestines, and umbilical stump. Systemic antibiotics were administered post operatively, and Kenny had no further complications.

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