Umbilical Masses in Calves

Clinicopathologic Conference – CPC

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February 17th, 2017

Introduction

Umbilical masses can be very common in calves. Determining the cause of the umbilical mass early in the disease course is essential for a successful outcome. The umbilical cord is a connection between mother and fetus during pregnancy. It consists of the umbilical vein, two umbilical arteries, and the urachus (Salci and Salci). The umbilical vein moves cranially and connects to the liver. It carries oxygenated blood as well as nutrients to the fetus and becomes the falciform ligament of the liver after birth. The umbilical arteries carry poorly oxygenated blood away from the fetus during pregnancy. As the umbilical cord stretches at birth, the umbilical arteries should normally retract back into the abdomen and become the round ligaments of the bladder. The urachus is the fetal form of waste disposal as it takes waste from the bladder to the allantoic sac (Baird). It routinely takes about one week for the umbilical cord to dry up following birth (Ganga et al.). Umbilical masses are an important topic for bovine practitioners because it can be a big source of economic loss for bovine farmers. The umbilical mass could be a hernia or infection of any umbilical structure that can lead to septicemia and life threatening events (Salci and Salci).

History and Presentation

Calves with umbilical masses can present in very different ways depending on cause, varying from a simple reducible hernia to a severe infection causing systemic illness (Edwards). Inflammation can occur as early as two to five days following birth. Calves can appear completely normal other than having a reducible hernia. Conversely, they can present with pain on palpation and purulent material draining from the umbilicus or systemic signs of illness such as pyrexia, poor growth, decreased milk intake, and mental dullness. Septicemic calves can have

other localized infections in the joints, meninges, bones, endocardium, eyes, and end arteries of the feet, tail, and ears (Ganga et al.). Dairy calves, specifically Holsteins, seem to be more affected with umbilical issues than beef breeds. This is due to management practices with dairy calves and how they differ from those of beef calves. Dairy calves typically receive one dose of colostrum while beef calves are given the opportunity to nurse the dam. This can lead to failure of passive transfer if the colostrum given is inadequate, given too late, or too little is given to the calf. Dairy calves are also housed in hutches leading to higher environmental contamination. Beef calves are kept on pasture with less chance of being repeatedly exposed to fecal material (Williams et al.). Additionally, male calves seem to have more umbilical abnormalities than female calves likely due to the difference in anatomy (Hopker).

Pathophysiology

Umbilical lesions are usually sporadic and have an incidence rate of approximately ten percent in calves. The most common lesion, making up twenty five percent of umbilical lesions, is an umbilical hernia. Hernias can be primary, for example being caused by genetics or secondary from abdominal wall weakness due to an infection. Coagulated blood collects in the umbilical vein and/or umbilical arteries following birth and this becomes a perfect growth medium for environmental pathogens. The umbilical vein has a wider lumen than the umbilical arteries, but has a weaker muscular layer. This causes it to be more sensitive to infections than the umbilical arteries. Many predisposing factors can lead to an umbilical infection including contaminated birthing or living areas, poor umbilical cord hygiene post parturition, malnutrition in cattle, failure of passive transfer, umbilical cord nursing by other animals, hematomas of the umbilical area associated with dystocia, insufficient retraction of the umbilical vessels into the abdomen, umbilical cord trimmed inappropriately short, abnormally thick umbilical cord, and

overall poor condition of the calf. Common pathogens that can be cultured from an umbilical cord infection are *Trueperella pyogenes, Fusobacterium necroforum, Pasteurella spp., Streptococcus spp., Staphylococcus spp., Proteus bacteriodes,* and *Escherichia coli.* Others pathogens can cause secondary infections in addition to the pathogens listed (Salci and Salci).

Differential Diagnoses

Several differentials come to mind when thinking about umbilical masses. Differential diagnoses for an umbilical mass are umbilical hernias, omphalitis, omphalophlebitis, omphaloarteritis, and an infected urachus. Hernias can be broken down into many categories depending on if they are primary verses secondary, reducible verses non-reducible, and the size of the defect in the body wall. Omphalitis is defined as an infection or abscess of the subcutaneous tissues outside of major umbilical structures and that is isolated extra-abdominally. It presents most commonly as a non-reducible swelling that can be closed or draining purulent material. Infection of the umbilical vein, omphalophlebitis, can also present as closed or a draining sinus and has the potential to extend up to the liver. This can be an issue because marsupialization of the vein may need to be performed to allow draining to be established. If the infection ends prior to reaching the liver, then only the portion of infected umbilical vein is removed (Edwards). The umbilical arteries are the least frequently infected structure of the umbilical cord, but when it does occur is known as omphaloarteritis. This usually happens due to incomplete retraction of the arteries at birth that then become inoculated with bacteria. It can be difficult with palpation alone to differentiate between omphaloarteritis and an infected urachus. The urachus is the most commonly infected structure of the umbilical cord. An infected urachus can lead to bladder complications such as pollakiuria, cystitis, and in rare cases pyelonephritis

due to the inability of the bladder to be emptied completely allowing infection to inhabit the bladder (Baird).

Diagnostic Approach/Considerations

A physical exam with careful palpation of the umbilical swelling is the most commonly used tool for umbilical masses. Umbilical masses can be classified as non-reducible, reducible, or partially reducible. If a hernia ring can be palpated, gentle manual reduction of the mass can be attempted. Inability to palpate a hernia ring or reduce the swelling is not enough to exclude the presence of an abdominal hernia. Adhesions, incarcerated gut, or incarcerated omentum can render a hernia irreducible making it complicated to differentiate between abscesses and hernias. A non-reducible mass can indicate an abscess that can be a large cavity with thick purulent exudate or foci of infection that has become surrounded by fibrous tissue. Ultrasound examination of the umbilical remnant is a useful diagnostic to further evaluate an umbilical mass. Differentiation of a thick-walled pus filled abscess, omentum, or thin-walled ingesta filled gut is possible with most every ultrasound and can allow for differentiation of hernias, abscesses, infected urachus, omphaloarteritis, and omphalophlebitis. These diagnostic tools are important for knowing which structures are involved for surgical planning (Hopker).

Treatment and Management Options

Lancing of an extra-abdominal abscess is a treatment option that can be pursued to allow drainage of the purulent material. This is usually done in combination with systemic antibiotics, a non-steroidal anti-inflammatory, and daily flushing of the abscess. In cases with inra-abdominal structure involvement, lancing is contraindicated not and surgery is neccessary. Surgery is the gold standard for resolution of umbilical masses. The umbilicus and its associated

structures and all infected tissue should be removed. When infection of the urachus extends all the way to the bladder, the apex of the bladder may need to be removed. Large intra-abdominal abscesses can be an indication to do pre-operative antibiotics. For simple hernia repairs antibiotics are often given only at the time of surgery. However, if there is an extensive infection, a longer course of antibiotics may be necessary. Non-steroidal anti-inflammatory drugs are useful for reducing pain, but should be used cautiously since they can cause abomasal ulcers if given too long and these calves are often stressed predisposing them to developing ulcers. After surgery, the calf should be slowly re-introduced to feed and should be confined, to some extent, to prevent tension on the surgical repair (Salci and Salci). A girdle type bandage can be used for five to seven days to reduce tension on the incision and reduce post-operative swelling (Noordsy and Ames).

Surgery can be done in the field with sedation, local anesthesia, and appropriate restraint or under general anesthesia in a sterile hospital setting. Xylazine or a combination of xylazine and ketamine are commonly used for sedation. Local anesthesia can be accomplished by doing a lumbar sacral epidural with xylazine and lidocaine or a ring block around the umbilicus with lidocaine. Several factors can influence a practitioner's decision to do one over the other, such as the size and temperament of the calf, difficulty of the procedure, and facilities available to use for surgery. The calf should be held off feed for eight to forty eight hours before performing surgery. The duration of fasting depends on the age of the calf. Neonatal calves with milk as the primary source of nutrition may only be fasted for eight hours to avoid complications of hypoglycemia. However, calves with full rumen development may need twenty-four hours of fasting. The calf should be laid in dorsal recumbancy with the head at the twelve o'clock position and the tail at the six o'clock position. In heifer calves an elliptical skin incision can be made

around the umbilical swelling with caution taken to ensure enough skin is left to close without tension. The subcutaneous tissue is then dissected until the external sheath of the rectus abdominis is located and visualized. A small incision into the abdomen can be made at the three o'clock or nine o'clock position to avoid inadvertent entrance into umbilical structures and allow the surgeon to palpate and retract any structures out of the way while the body wall incision is continued around the hernia sac or mass. Male calves can be more challenging due to the preputial orifice being near the umbilicus. In this case a half moon skin incision is indicated and caudal reflection of the sheath is adequate to allow for appropriate body wall incision. The body wall can be closed the same in males and females. A simple interrupted pattern is adequate to close the body wall and is commonly used with tension relieving suture patterns such as near-far-far-near, cruciate, or mattress patterns. The subcutaneous tissue and skin incision in females can be closed with a simple continuous pattern. In males the subcutaneous tissue can be closed longitudinally where the incision was extended as a paramedian and tacking sutures used to eliminate dead space where the prepuce was reflected. The subcutaneous tissue of the semilunar incision should be closed transversely. The skin then can be closed starting at the cranial most aspect of the semilunar incision on each side working caudally for an even closure (Baird).

Another surgery option to consider is closed herniorrhaphy instead of opening the peritoneal cavity. This technique can be done to avoid potential peritoneal contamination because the abdominal cavity is not being entered. However, this technique is associated more commonly with recurrence of hernias. Closed herniorrhaphy is only an option for correcting small simple umbilical hernias where there are no infected umbilical structures that would require removal. An elliptical incision is made in the skin to view the hernia sac which is inverted back into the abdominal cavity. The edges of the hernia ring are then closed with an

appositional or overlapping suture pattern. A mesh herniorrhaphy may be considered for hernias that exceed fifteen centimeters in diameter or as a second surgery option when a previous closure has failed. The mesh can be placed inside the muscular body wall in a retroperitoneal fashion and secured with mattress sutures. The mesh can also be placed between the incised edges of the hernia ring or used as a patch over the closure of the hernia ring subcutaneously. However, using a mesh procedure will increase the cost of the surgery and will increase the risk of post-operative infection (Baird).

In cases where infection travels up the umbilical vein to the liver, marsupialization of the vein is indicated. Marsupialization can be performed at the cranial aspect of the skin incision or a completely separate incision made through the body wall cranial to the skin incision. Marsupialization done through a separate incision cranial to the skin incision can help decrease complications of the surgery incisional site. The umbilical vein is separated out from the umbilicus and is covered to prevent contamination of the abdominal cavity during the relocation process. A circular skin incision is made cranial to the surgery site skin incision and should be located directly below the liver. An incision can then be made through the rectus sheath and the vein sutured to the external rectus sheath with minimal tension using 10 to 12 simple interrupted sutures. A second layer of sutures can then be done to fix the vein to the skin. Flushing of the vein can be done to establish draining, but should only be done with low pressure so that exudative material is not forced further into the liver and enter blood stream. Owners should be informed that a second surgery may be needed once infection is gone to resect the vein and close the opening of the body wall. This second surgery is not often needed as the vein usually atrophies once the infection is drained and the body wall seals itself (Baird).

Prevention

Good hygiene is critical at calving to prevent ascending infections of the umbilical cord. Dipping the umbilicus is important and it should be fully immersed in antiseptic solution. Seven percent iodine and a half percent chlorhexidine are the most commonly used solutions for navel dipping and are the most effective in reducing cord bacterial growth. Antiseptics containing alcohol are used as well because alcohol aids in rapid drying of the umbilical cord. The umbilical cord should be examined again at twelve and twenty four hours post-calving and should be re-immersed in antiseptic at twenty four hours. This should be repeated once more for a total of three times that the umbilical cord was dipped. Other forms of prevention include using calving areas, such as a barn or lot, which can be observed so that new calves can quickly be treated. These areas must be cleaned and disinfected to ensure it does not become a source of infection throughout the calving season. If this cannot be done it is better to calve on a clean fresh pasture. Colostrum management on farms is also essential because failure of passive transfer can predispose calves to infection. In an ideal situation beef calves nurse the cow multiple times after birth to receive adequate. Dairy calves should be administered colostrum just after birth and again twelve hours later for a total of three liters or one hundred and fifty grams of IgG (Salci and Salci).

Expected Outcome and Prognosis

Prognosis is favorable for recovery, especially for simple hernias or minor infections. If no concurrent problems are present calves recover from surgery and become productive members of their herds. Concurrent disease suggestive of systemic illness such as pyrexia, dehydration, or respiratory problems correlated to a significant increased risk for development of postoperative complications. It is important to attempt to resolve these issues if possible before undergoing surgery (Williams et al.). Calves that have infected umbilical vein remnants

extending towards the liver are at an increased risk of peritonitis and have a poorer prognosis. Resolution of an infection that has reached the liver is more difficult versus a simple extra-abdominal abscess (Hopker). The use of a mesh to repair a hernia showed an increased risk for postoperative complications, but was deemed suitable for larger size hernias, a heavier body weight, or both. Mild swelling and pain are the two most commonly developed complications and usually resolve with no additional treatment besides postoperative non-steroidal anti-inflammatory drugs and antibiotics. Other complications such as re-herniation of large defects, infection due to lack of sterile environment for surgery or post-operative recovery, or dehiscence of the surgical site can be seen but are usually rare (Williams et al.).

Conclusion

In conclusion, umbilical hygiene, anatomy and physiology, and pathogenesis of umbilical lesions should not be over looked by farmers to aid in prevention of umbilical lesions in calves. Remember a good physical examination with palpation of the mass is the most crucial diagnostic with ultrasound utilization for further differentiation of umbilical swellings. Umbilical surgery is the gold standard to repair umbilical masses. Surgery allows animals to be a productive member of their herd. Mild incisional swelling can be expected after surgery and normally self-resolves. Bovine practitioners should feel confident in treating umbilical masses in a field setting; however they should also know when to refer a complicated case for surgery in a hospital setting.

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