

Reproductive performance of an Angus cow after removal of a macerated fetus via caudal flank laparotomy and hysterotomy

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Summary

A seven year-old Angus cow in normal body condition was presented with a history of chronic vaginal discharge, failure to cycle and a palpable uterine mass. Clinical examination revealed fetal bones in the right uterine horn and a purulent vaginal discharge. A diagnosis of fetal maceration and metritis was presented to the owner, with surgical removal of the macerated fetus as the only treatment option. A poor prognosis for recovery of reproductive function was given. Due to the past value of the cow as an embryo donor, the owners elected to proceed with surgical intervention. Fetal bones, including one embedded in the endometrium, were removed via caudal flank laparotomy and hysterotomy. Aggressive post-surgery medical treatment of the infected and damaged uterus, combined with five months of sexual rest, resulted in a return to normal fertility.

Keywords: Macerated fetus, hysterotomy, metritis, fertility

Background

Fetal mummification and maceration have been reported in cattle but the incidence has been described as low and sporadic, with an estimated incidence of mummification between 0.43 and 1.8% of pregnancies.¹ In cattle, pregnancy is supported by progesterone produced by the corpus luteum and, after approximately 150 to 200 days of gestation, by the placenta and adrenal glands as well.^{2,3} Bovine fetal mummification most commonly occurs during the fourth through sixth months of gestation with fetal autolysis, resorption of fetal fluid in a sterile environment and without concomitant loss of the corpus luteum or dilation of the cervix.^{1,3} Bovine fetal maceration is also associated with a functional corpus luteum but with further autolysis of fetal soft tissues, resulting in only fetal bones remaining in the uterus.³ Fetal maceration is usually accompanied by a partially dilated cervix, fetid vaginal discharge, metritis and often, clinical illness.^{1,4} Many causes of fetal mummification and maceration have been proposed, including most of those that can cause abortion, such as viral and bacterial infections, genetic factors and developmental abnormalities. However, since the mummification and maceration processes occur long after fetal death, the cause is often not determined.

Diagnosis of either fetal mummification or maceration, through either trans-rectal palpation or ultrasound examination, is not difficult. In cases of fetal mummification, the dam is usually not clinically ill and seldom shows signs of an interruption of gestation. The standard treatment for fetal mummification is the administration of prostaglandin F₂alpha, with expulsion of the fetus expected within 96 hours.^{3,5} For dams that do not respond to initial treatment, prostaglandin F₂alpha can be repeated if a corpus luteum is still present. Alternatively, the combination of estradiol-17beta and oxytocin has been reported to be effective.⁷ Medical treatment of fetal mummification generally leads to a resumption of normal reproductive function.^{1,3-5,7,10} For cases that do not respond to medical therapy, surgical removal of mummified fetuses through hysterotomy via either colpotomy or laparotomy has been successful, with an eventual return to normal reproductive function.^{1,5-9}

The treatment of fetal maceration, on the other hand, is often more challenging. Fetal maceration is frequently associated with clinical signs of anorexia, pyrexia, elevated pulse and respiration, atrial fibrillation, straining, and subsequent development of metritis or pyometra.^{1,4,10} In long-standing cases, fetal bones can become embedded in the endometrium and chronic damage to the endometrium can be significant. Response to prostaglandin or estrogen therapy is often unrewarding. Long term treatment of the infected uterus is necessary and often unsuccessful.¹ The prognosis for a return to normal reproductive function is often poor and slaughter is often recommended.^{1,4}

Case presentation

A seven year-old Angus cow was presented to the theriogenology service at the Veterinary Teaching Hospital at the University of Illinois (UIUC VTH) with a history of vaginal discharge, failure to cycle and a uterine mass. The owner reported that the cow had been used as a successful embryo donor and had been bred by artificial insemination 11 months earlier. She was confirmed pregnant via trans-rectal palpation approximately 60 days after breeding. Four months prior to presentation, the animal developed a partial vaginal prolapse when she was approximately 7.5 months pregnant. The owner placed a Buhner's stitch to prevent a further prolapse and called the referring veterinarian a few days later after he noticed a foul smelling vaginal discharge. The referring veterinarian found a hard mass in the right uterine horn on trans-rectal palpation and vaginal examination revealed an abnormal foul smelling discharge coming from a partially open cervix. Fetal bones could be felt in the cervical canal extending into the lumen of the uterus and were extracted. However, the entire fetal skeleton could not be extracted due to the small diameter of the cervix. The cow was treated with 25 mg dinoprost tromethamine by intramuscular injection and the owner was instructed to have the cow rechecked by the veterinarian in ten days. Instead, the owner administered the same dose of dinoprost tromethamine on several occasions during the three months prior to referral and more fetal bones were reportedly extracted through the cervix of the cow by the owner. More than three months after the referring veterinarian first saw the cow, she was referred to the UIUC VTH.

The cow was examined by the theriogenology service of the UIUC VTH. Body temperature, pulse and respiratory rates were found to be within the normal range. A weight of 1885 lbs. (856.3 kgs.) and a body condition score 6/9 on the standard beef cattle scale were recorded.

A trans-rectal examination, using both manual palpation and a 5.0 MHz real-time ultrasound probe, was performed to evaluate the reproductive tract. The right uterine horn was found to be enlarged (approximately 22 cm diameter) and contracted around a distinct, hard mass midway between the uterine bifurcation and oviduct. The left uterine horn was palpated and found to be of normal size and consistency. Both ovaries had numerous developing follicles, ranging in size from 6 mm to 16 mm diameter. The left ovary had a 32 mm corpus luteum. Vaginal examination with a penlight and speculum revealed the cervix open to approximately 35 mm diameter with roughened and indurated mucosa around the external os of the cervix and grey, fetid discharge coming through the cervix. It was possible to pass two fingers inside the cervical canal and small pieces of fetal bones were extracted. The size of the cervical canal precluded a more detailed examination. A diagnosis of fetal maceration was made and surgical removal via hysterotomy was offered as the only reasonable treatment option. A poor prognosis for the recovery of reproductive function was given based on the long-standing nature of the condition and the potential for widespread damage to the uterine mucosa and subsequent fibrosis. The owners, who wanted to retain the animal as a potential embryo donor, elected to proceed with the surgical option.

Treatment

The animal was restrained in a hydraulic chute with a head gate. Light sedation was achieved by intravenous administration of 10 mg xylazine and 20 mg of butorphanol tartarate via the left jugular vein. The right paralumbar fossa was clipped and prepared for aseptic surgery. After considering the very dorsal position of the right uterine horn containing the mummified fetus in the abdominal cavity, a diagonal incision was planned, starting slightly cranial and ventral to the right ilium and extending to a distance of about 15 cm (Figure 1).

The proposed incision site was infiltrated with 90 ml of 2% lidocaine hydrochloride to achieve local analgesia and the right flank was draped after final skin preparation. The skin, external and internal oblique and transversus abdominis muscles were incised with a scalpel and the peritoneum was opened with Mayo scissors. The abdominal cavity was entered and the enlarged segment of the right uterine horn was gently lifted and exteriorized through the skin incision. The intra-luminal uterine mass was palpated through the uterine wall and the entrance into the abdominal cavity was packed off with sterile laparotomy towels.

The right uterine horn was incised along its greater curvature directly over the hard palpable mass. Fetal skull, along with a segment of the cervical spine, was extracted through the hysterotomy incision. Further exploration revealed numerous parts of the fetal skeleton, including scapulae, additional thoracic and lumbar vertebrae, ribs, and metacarpal bones, all of which were subsequently extracted (Figure 2). Before closure, the uterine lumen was examined through the hysterotomy incision by the surgeons and per vaginum by an assistant to determine if all debris was removed from the uterine lumen. During this exploration and palpation of the uterine lumen, a piece of bone was found to be embedded between the uterine mucosa and the myometrium at the base of the right uterine horn and thus could not be extracted through the original uterine incision. Before attempting to remove this embedded piece, the uterus was flushed with 0.05 % povidone iodine solution using a uterine flushing catheter (Bivona Equine Catheter, Partner Animal Health, London, ON, Canada) inserted into the uterine lumen. Closure was routine using an inverting Utrecht suture pattern and 0 polydioxanone (PDS, Ethicon Inc., Somerville, NJ).

The right uterine horn was then further exteriorized through the abdominal wall incision and the base of the right uterine horn was palpated to localize the embedded piece of bone. An incision was made through the uterine serosa and muscularis directly over the bone fragment and, after some blunt dissection, the bone was loosened from the surrounding fibrous connective tissue and removed. It was observed that the uterine lumen could not be palpated through the serosal surface incision due to proliferation of fibrous connective tissue. The serosal incision was then closed with a Lembert pattern followed by a Cushing's pattern in a double inverting layer pattern using 0 polydioxanone suture material, was rinsed with normal saline to wash away any blood clots and placed back inside the abdominal cavity. The abdominal wall was closed in a standard fashion in three layers, using 1 polydioxanone suture material and the skin in a Ford- interlocking suture pattern with extra heavy polymerized caprolactam.

The cow was administered 25 mg dinoprost tromethamine by intramuscular injection and was also given an injection of long-acting ceftiofur at the rate of 6.6 mg/kg body weight subcutaneously in the middle third of the posterior aspect of the left ear. The cow was released to the owner who was advised to work closely with the referring veterinarian so that postoperative care could be managed effectively. Initial recommendations were for the referring veterinarian to recheck the cow ten days after surgery and communicate his findings to the university theriogenologists.

Outcome

The referring veterinarian performed a trans-rectal ultrasound examination cow ten days after surgery and found that the right horn had decreased to approximately 12 cm in diameter and was fluid filled. Upon manual palpation, mucus and purulent exudate were expressed through the vulva. Palpation and ultrasonography of the ovaries revealed a 35 mm corpus luteum and a 15 mm follicle on the left ovary and no significant structures on the right ovary. There were no alterations in the animal's temperature, appetite or behavior. The cow was treated with long-acting ceftiofur, long-acting oxytetracycline at the rate of 13.6 mg/lb subcutaneously and 25 mg dinoprost tromethamine intramuscularly. The incision site showed presence of a purulent discharge from the most ventral aspect, which was flushed and cleaned with dilute povidone iodine.

At twenty-two days after surgery the referring veterinarian performed a trans-rectal ultrasound examination and found that the right horn had decreased to approximately 7.5 cm diameter, was fluid-filled and felt fibrotic, with thickening of the uterine wall. Examination of the ovaries revealed follicles of various sizes on both ovaries with a mature corpus luteum on the left ovary. The cow was eating, drinking and behaving normally. Blood samples were taken for complete blood count (CBC) and chemistry panel and the uterine discharge was cultured. After consultation with the UIUC VTH theriogenology service, the cow was again treated with short-acting ceftiofur subcutaneously at the rate of 2 mL/100 lbs. per day for seven days and 25 mg dinoprost tromethamine intramuscularly. In addition, the referring veterinarian administered long-acting oxytetracycline. The incision site had healed and sutures were removed.

Hematology and serum biochemistry values were within normal limits. Culture results from the uterine exudate sample revealed a nearly pure culture of *Arcanobacter (Trueperella) pyogenes* infection sensitive to ampicillin. At 30 days after surgery, and after consultation with the UIUC theriogenology service, intrauterine therapy with 3 grams of ampicillin sodium diluted in 80 cc of sterile water was performed by the referring veterinarian and repeated every other day for four treatments. The animal was re-examined after ten days. The right uterine horn was smaller, approximately 5.0 cm in diameter and almost equal to the left uterine horn in size. The right ovary had a palpable 40 mm corpus luteum and a few developing follicles while the left ovary was unremarkable. No apparent uterine discharge was noted at the vulvar commissure and no fluid was noted in the uterus on trans-rectal ultrasound examination. The cow was administered 25 mg dinoprost tromethamine and was turned out in the pasture with a few other cows.

The owner reported observing several periods of estrous behavior over the next 60 to 70 days, consistent with 20 to 22 day estrous cycles. The cow was given reproductive rest for a total of five months after surgery, was subsequently enrolled in the farm's superovulation protocol and flushed, yielding viable grade #1 and #2 embryos. The cow was superovulated and flushed once more, again yielding viable grade #1 and #2 embryos, and was subsequently bred by artificial insemination and became pregnant.

Discussion

When cases of bovine fetal mummification or maceration are diagnosed, veterinarians and owners are faced with three options: cull for slaughter, treat medically by inducing abortion or treat surgically by removing the fetal tissue through hysterotomy.

It has been suggested that the dam's fertility after removal of a mummified fetus via medical induction of abortion is generally good.^{1,3,4,11-16} However, little has been reported in the literature regarding the reproductive capacity of cows subsequent to surgical removal of mummified fetuses. In any surgical approach to the uterus, access can be difficult. The colpotomy approach leaves little room for manipulation or visual inspection of the fetus and is often impractical for large mummified fetuses. The caudal flank approach is often limited by the location of the uterus dorsal in the caudal abdomen, often partially within the pelvic canal, as well as the thickness of the abdominal wall muscles just anterior and ventral to the ilium. In one case series of fourteen cows that had mummified fetuses, five of 11 cows (45%) that had the mummified fetus removed by laparotomy and hysterotomy and none of the three cows that had mummified fetuses removed per vaginam subsequently became pregnant. However, in that report, all fetuses were mummified, not macerated, and there was no indication of significant uterine pathology.⁶

Medical and surgical treatment of bovine fetal maceration have been dismissed as ineffective and impractical because of the amount and severity of uterine pathology associated with long-standing cases of fetal maceration.^{1,3,4} Adding to that argument, many cows with fetal maceration commonly develop endometritis¹⁰ or pyometra, two additional conditions that have been shown to be strongly associated with impaired fertility and increased cull rates.¹⁷⁻¹⁹ As additional support for a poor prognosis for cows with fetal maceration, the authors could find only one report of a cow becoming pregnant after the removal of a macerated fetal bone that was embedded in the endometrium. However, there was no documentation of pregnancy status.²⁰

In contrast, this case provides evidence of better than expected surgical and reproductive outcomes, despite significant uterine pathology in a long-standing case of fetal maceration. Following surgery and intensive postoperative medical treatment, the patient was superovulated and produced viable embryos twice before she became pregnant, all within nine months of initial referral and surgical treatment. Part of the postoperative medical therapy was the extra-label use of aqueous sodium ampicillin as an intrauterine infusion. The authors felt that its use followed the American Veterinary Medical Association's Judicious Use Principles²¹ because its selection was based on culture and sensitivity of the organism isolated from the uterus, because the cow was not lactating, was not going to be slaughtered within thirty days of administration and because the antibiotic has a narrow spectrum and was placed in

direct contact with bacteria in the uterine lumen. The authors believe that the follow-up care provided by the referring veterinarian and the diligence of the owners in committing to long-term therapy were keys to the cow's recovery.

The case presented here suggests that, in cases of fetal maceration, clinicians should not necessarily be pessimistic about an individual cow's chances for recovery of reproductive function, even when complicated by significant uterine damage, metritis and pyometra. Surgical removal of macerated fetal tissue, followed by aggressive medical treatment, can be an effective treatment option for high value cows.

Learning points

- Cows with retained macerated fetuses can regain reproductive function and fertility.
- Surgical removal of macerated fetal tissue, even when complicated by the growth of endometrium over retained fetal bones, can be an effective treatment option for high value cows.
- Patience and long-term postoperative therapy are necessary for recovery of reproductive function.

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Figure 1. Surgical site for removal of macerated fetus.



Figure 2. Macerated fetal bones removed from a seven year-old Angus cow via hysterotomy.

(Editor's note: Photographs in this paper are available in color in the online version of Clinical Theriogenology.)