

Surgical Management and Decisions in Problem Birthing

David E. Anderson, DVM, MS, Diplomate ACVS
College of Veterinary Medicine
The Ohio State University
Columbus, Ohio 43210

Cesarean Section (Hysterotomy)

Cesarean section is one of the oldest and most common surgical procedures requested for veterinarians to perform. There are three main goals of the Cesarean section: 1) survival of the dam, 2) survival of the calf, and 3) maintenance of fertility. Cattell *et al* reported on results of 133 C-sections in cattle. Approximately 91% of the cows and 95% of the calves that were alive at the start of surgery survived. Approximately 30% of the cows suffered an illness (poor appetite, fever, metritis, diarrhea) after surgery. Only 22 beef and 24 dairy cows were re-bred after surgery. Calving to first service interval was 81 ± 29 days for dairy cows, calving to conception interval was 99 ± 18 days for beef cows and 110 ± 43 days for dairy cows, services per conception was 1.2 ± 0.4 for beef and 2.1 ± 1.4 for dairy cows, and pregnancy rate was 91% for beef cows and 72% for dairy cows. Dawson reported that approximately 100% of calves alive at the start of the surgery survived, 6% of cows died within 5 days after surgery (Salmonella, peritonitis, toxic mastitis, fatty liver), and 78% of cows were successfully re-bred. de Kruif *et al* reported the results of C-section in 128 cows and reported wound complication rates for these cows. Retained placenta was diagnosed in 9% of cows after surgery and 2 cows died from peritonitis or intra-abdominal hemorrhage. Incisional infection was diagnosed in 15% of cows; irrigation of the abdominal incision with 10% povidone-iodine solution during closure of the wound failed to prevent incisional infection. de Kruif also reported on peritonitis and incisional infection after C-section caused by *Actinobacillus lignieresii* that had been spread by an experienced veterinarian possibly as the result of poor self hygiene prior to surgery and inadequate sterilization of surgical equipment.

Cesarean section may be performed via paralumbar fossa (left > right), low flank or ventrolateral incision (left > right), lateral oblique, paramedian incision (right > left), Marcenac's approach, or ventral

midline laparotomy. Paralumbar fossa and lateral oblique celiotomy are usually performed with the cow standing; all other techniques are performed with the cow recumbent. The uterus should be exteriorized from the abdomen if possible. This is critical if extensive attempts at manual correction of dystocia have been tried or if the fetus is emphysematous. I routinely close the healthy uterus with No 2 chromic cat gut in a double layer using Cushing's suture pattern (the Utrecht suture is a Cushing pattern turned to a 30 to 45 degree angle away from the incision). I always perform a double layer closure because this is rapid, easy, and the suture line is less likely to leak uterine fluids during contraction / involution of the uterus. When the health of the uterus is in question (vascular damage from uterine torsion, bruising because of excessive handling, or emphysematous calf), I close the uterus with a monofilament absorbable suture material (No 1 monocryl or PDS). These suture materials will maintain tension strength despite regional inflammation. De Wit performed hysterotomies in 202 cows and compared hysterotomy closure with vicryl (a braided absorbable suture; n=103) to that using 9 metric plain cat gut (n=99). Cows were examined by rectal palpation 5 weeks after surgery. There was no difference between these two suture materials and no adhesions were detected in 45%, slight adhesions in 38%, and severe adhesions in 18% of cows. The uterus should be thoroughly lavaged clean of all blood clots prior to being replaced into the abdomen. For paralumbar fossa and lateral oblique incisions, I close the peritoneum and transversus muscle in one layer and the internal and external abdominal oblique muscles as a second layer using No 3 chromic cat gut suture. For ventral midline and paramedian incisions, I close the abdominal wall with No 2 PDS or Vicryl suture. The skin is closed using No 3 vetafil (braunamid) using a Ford (Mayo) interlocking suture pattern.

I prefer to place an OB solution into the abdomen (lavage the uterus and ovary regions) in an attempt to

limit post-operative infection and adhesions. This solution is composed of 1 liter isotonic saline solution containing antibiotics (K-penicillin G 22,000 U/kg, Na-ampicillin 20 mg/kg, or Na-ceftiofur 1 mg/kg), anti-inflammatory drugs (flunixin 1 mg/kg), and anticoagulants (heparin 20 units/kg) and is infused into the abdomen immediately prior to closure of the incision. The use of this solution is empirical but was based on research results reported with anti-adhesion research in multiple species. Carboxymethyl cellulose (CMC 14 ml/kg body weight, IP) has been evaluated and advocated for prophylaxis against post-operative adhesions. Post-operative adhesions after hysterotomy and CMC were similar to exploratory celiotomy without hysterotomy. To date, no clinical research has documented any beneficial effect of any prophylactic treatment against adhesions to the uterus or ovaries in cattle. I prefer to administer antibiotics for 3 days after C-section. Antimicrobial therapy should be directed against the most common bacteria resident in the normal post-partum uterus (*Actinomyces pyogenes*, *E coli*, *Fusobacterium nucleatum*, *Proteus mirabilis*, *Bacteroides melanogenicus* in one study where approximately 50% of cows were culture positive) such as procaine penicillin G (22000 U/kg, IM or sc, q24hr), Na-ceftiofur (1 mg/kg, IM or sc, q24hr), or tetracycline (20 mg/kg, IM or sc, q24hr). For cattle perceived to be of high value, I also administer flunixin meglumine (1 mg/kg, IM or sc, q12hr) for 48 hours to limit adhesion formation.

Emphysematous Calf

Cesarean section for correction of an emphysematous calf is indicated when fetotomy is not possible (either because of the size and friability of the uterus or because of desiccation of the uterine environment). The principal goal of this surgery is survival of the dam; maintenance of fertility is of secondary concern because of the life-threatening nature of this disease. **The most important rule in the management of emphysematous fetus is not to panic.** By the time the cow is presented with an emphysematous fetus, the question of how quickly the calf is removed from the uterus has very little impact on the likelihood of survival of the cow. Priority should be given to cardiovascular stability of the cow and maintenance of shock. An emphysematous fetus usually results in profound toxemia and bacteremia which causes fever, hypotension, poor perfusion of vital organs, and shock. I prefer to administer flunixin meglumine (1 mg/kg body weight, IV), hypertonic saline solution (5 ml/kg of 5% HSS, rapid IV bolus), and Na-ceftiofur (2.2 mg/kg, IV). After administration of HSS, intravenous fluids may be administered at a high rate (10 to 20 liters per hour for a 1000 pound cow) if the cow is in cardiovascular shock or may be adminis-

tered at 3 times maintenance rate (4 liters per hour for a 1000 pound cow) if the cow is relatively stable.

Although I have successfully performed left paralumbar fossa C-section in cattle with emphysematous calves, I prefer to perform these C-sections via ventral midline approach. Alternatively, a low-flank, paramedian, or Marcenac's approach may be used. I prefer a ventral approach with the cow recumbent because the uterus may be more completely exteriorized so that contamination of the abdomen is minimized. The principal disadvantage of paralumbar fossa C-section is poor exteriorization of the uterus. Low-flank C-section performed with the cow in lateral recumbency and oblique celiotomy improves uterus exteriorization but remains suboptimal for the emphysematous fetus. Ventrolateral and paramedian C-section are performed with the cow recumbent and improve the ability to exteriorize a greatly enlarged uterus, but exteriorization is still difficult. The principal disadvantage of ventrolateral and paramedian C-section is post-operative incisional complication. These techniques may have a higher risk of incisional hernia or dehiscence because of the limited holding strength of the fascia of this portion of the abdominal wall (thin fascial layers, muscle layers interposed between each fascial layer). Ventral midline C-section offers equal ability to exteriorize right or left horn pregnancy and has the advantage of greater holding strength of the *linea alba*. The hysterotomy is completed as above, but with the uterus isolated from the abdomen using sterilized towels, plastic sheeting, or other draping materials. After the calf and placental tissues are removed, the uterus should be thoroughly lavaged with isotonic solutions (I prefer saline solution: 9 grams of salt per liter of water). If abdominal contamination has occurred (a common problem), the abdomen should be lavaged as thoroughly as possible with sterile isotonic saline solution (15 to 30 liters). Then, the OB solution is placed into the abdomen and the incision closed as described above.

Uterine Laceration

Uterine lacerations may occur during unassisted delivery, forced manual extraction of a calf, or during fetotomy. Uterine lacerations occurring during unassisted delivery or manual extraction when no intrauterine infusions have been used may be treated conservatively by administration of high, frequent doses of oxytocin (60 units, IM, q2 hours x 4 treatments). The purpose of this treatment is to contract the uterus sufficiently to allow a rapid fibrin seal to form and to prevent prolapse of intestines into the uterus. If the uterine laceration is diagnosed immediately after formation, the laceration may be closed either by trans-cervical blind suture placement (risking entrapment of intestine or

bladder) or by prolapse of the uterus and direct suturing. Delayed diagnosis of uterine laceration or uterine laceration in the presence of poor cervical dilation requires a laparotomy for suturing the uterus. I prefer to perform this procedure via paralumbar fossa laparotomy on the side of the most affected uterine horn (most lacerations occur in the uterine body near the brim of the pelvis). Suture selection is similar to that used for hysterotomy (above).

Uterine Amputation

Uterine amputation is rarely indicated, but may be necessary for cattle with either chronic uterine prolapse or uterine prolapse compounded by extensive trauma, laceration, or avascular necrosis. Many techniques have been used for amputation of the uterus, but little documentation of success can be found in the literature. However, two technique principles prevail; 1) external ligation of the uterus en mass and 2) dissection and segmental ligation of the uterus. External ligation of the uterus en mass involves placement of a tight ligature (elastic tubing, wire, suture material) around the base of the uterus at the vulva (after ensuring that bladder or intestine is not present within the lumen of the prolapse) and either amputating the uterus or allowing the uterus to slough. Dissection and segmental ligation refers to opening the prolapsed uterus to ensure that no entrapped viscera are present, then placing overlapping mattress sutures around the circumference of the uterine body, and finally suturing the lumen of the prolapse closed. I prefer the latter technique because the suture closure is more secure and the remaining segment can be returned to within the pelvic cavity (thus minimizing risk of damage to the urinary system).

Uterine Torsion

Uterine torsion usually occurs at the termination of gestation (81%) in cattle, does not have a clear age or season predisposition, and can often be corrected without surgery. In a study of 164 uterine torsions in cattle, Brown Swiss cows were at higher risk and Hereford, Angus, and Jersey cows were at lower risk of uterine torsion compared with Holstein cows. Clinical signs included fever, tachycardia, tachypnea, anorexia, straining, and vaginal discharge. When the uterus can

not be corrected by rolling (~7%), when the cervix does not dilate sufficiently to deliver the fetus (~20%), or when fetal proportion or anomalies prevent delivery of the fetus (~89% of calves are larger than average), C-section is indicated. I prefer to perform left paralumbar fossa laparotomy regardless of the direction of the torsion (most are counter-clockwise, 60 to 70%, as viewed from the rear of the standing cow). Although many authors advocate correcting the torsion prior to hysterotomy, I perform hysterotomy immediately upon exteriorization of the uterus. I have found that, in many cases, hysterotomy is more easily performed before correction of the uterus. Cow survival is expected to be fair to good (~78%), calf survival is expected to be poor (24% alive, 14% emphysematous fetus), and retained placenta is common (57%).

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