Cesarean section

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Abstract

The purpose of this article is to remove the surgeon's anxiety and stress associated with performing a cesarean section procedure. In many small animal practices the arrival of a cesarean section heralds total disruption of the daily schedule. Procedural organization into a standard protocol results in a structured flow of tasks that is easily managed throughout the event. The procedure is broken down into several stages with licensed veterinary technicians (LVTs), assistants and doctors trained in a flow pattern that assigns specific duties to key personnel. Thusly assigned, staff members not involved in the procedure can proceed uninterrupted in the daily functions of the clinic. Protocols for emergency and planned cesarean sections will be discussed.

Keywords: Cesarean section, surgery, obstetrics, anesthesia, canine

Stage 1: Scheduling the cesarean section

Emergency cesarean section

No scheduling except a short warning – go to Stage 2.

Elective cesarean section

Using the luteinizing hormone (LH) surge is an excellent method to schedule the cesarean section date. The LH surge occurs when progesterone concentration is approximately 2 ng/ml and marks the initial stage of ovulation in the bitch. Most bitches will whelp at 65 days after the LH surge.[1] Because LH is not measured for all breedings; other methods must be used to determine the date for an elective cesarean section.

We routinely schedule surgery for 59 to 60 days from first breeding date. However, setting the surgery date from day of insemination is not accurate due to the level of maturation of the ova at the time of the breeding. Pregnancy term is 65 days after the LH surge; if the bitch is bred late in the cycle her delivery date is still at 65 days after the LH making pregnancy term several days shorter. When LH is not measured we recommend breeding between days 3 and 6 of estrus, most frequently day 3 and 5 after progesterone reaches 2 ng/ml.[2] When comparing progesterone concentrations with measurement of the LH surge we have found that the LH surge is consistently occurs when progesterone concentrations are 2.0 ± 0.3 ng/ml. If the LH surge is not detected when progesterone reaches 2 ng/ml it may be necessary to utilize another laboratory or method of measurement.

Because serum LH assays are not performed at all breedings, we schedule an ultrasound examination at 23 days following the first breeding date. We confirm pregnancy and we measure the width of the fluid edges of the gestational vesicle at the longest axis of the vesicle. At 23 days we expect the vesicle size to be 1.2 ± 0.2 cm in diameter; the gestational vesicle is still quite round at this stage. At 25 days ultrasound examination reveals gestational vesicles of 2.5 to 2.8 cm diameter giving a noticeable difference in vesicle size between breeding dates. The 25 day gestational vesicle will be oval compared to the 23 day gestational vesicle. Giant breeds may have slightly larger vesicle size at 23 days after a known breeding. Another benefit of the 23 day ultrasound examination is that the gestational vesicles are plainly separated making an accurate puppy count possible. Our puppy counts at 23 days average 80% to 90% accuracy. Fetal death and/or resorption may be found as well as signs of fluid in the uterus that may indicate early signs of pyometra. When scheduling cesarean sections we set the date at 59 to 60 days after breeding[3] to allow for full development of the pups and to avoid the bitch going into labor prior to performing the cesarean section. Labor prior to surgery may increase the stress level of the bitch and cause lowered oxygen saturation of the pups during induction. We may have the owners call daily with resting rectal temperature starting at 55 days after breeding. If the resting rectal temperature drops below

99°F for more than several hours we may schedule surgery directly. Whelp Wise[4] abdominal monitoring is another alternative that may be used to help determine the onset of labor. Because most of the bitches we see have been monitored by progesterone measurement and ultrasound examination early in the pregnancy we have only used Whelp Wise monitoring with bitches that have had a history of dystocia prior to the scheduled cesarean section.

Owners are told to arrive with suitable materials to transfer pups home in any weather. Usually this includes hot water bottles, towels or blankets and a box or cooler that is of sufficient size for the expected litter. We do not recommend using electric heating pads because of the risk for severe burns.

Stage 2: Bitch has arrived at the clinic

The bitch is weighed and given a physical examination. Blood is drawn for a serum chemistry panel. Pre- anesthetic medication is then given. The pre-anesthetic is a mixture of glycopyrrolate and butorphanol.* Glycopyrrolate, an anticholinergic agent, is used because of lowered transplacental passage compared to atropine. Butorphanol is given as initial sedative with pain control to potentiate anesthetic induction allowing lower maintenance levels of inhalation anesthetic. If fetal compromise is suspected, and questions arise about the health of the pups, we will perform an immediate ultrasound examination. A rapid scan is done and heart rates are checked with a Doppler ultrasound to determine if the litter is alive or dead.[5] When heart rates of <170 beats per minute are found we will proceed to surgery as rapidly as possible and will inform the owners that the pup(s) is in fetal distress. If fetal distress is noted the bitch is immediately put on an oxygen mask for 5 minutes. We do not administer the pre-anesthetic medication and go directly to surgery.

If the bitch is anxious she will remain with the owners in the examination room for 5 to 10 minutes allowing time for the pre-anesthetic medication to take effect. The bitch is then transferred to the pre-surgical preparation area. If the owners are inexperienced, we have them wait in the examination room until the bitch anesthetized and on the surgery table. Owners are allowed to watch the surgery from the treatment room through a window into the surgical suite.

Stage 3: Pre-oxygenation and anesthetic induction

The bitch is moved to the surgical preparation area and oxygen therapy is administered using a mask for at least 5 minutes before induction. During pre-oxygenation, an intravenous catheter is placed and the lactated Ringer's solution drip rate is adjusted for the patient's body size, hydration and stress level. Bitches weighing less than 30 pounds are anesthetized with sevoflurane administered by mask because we have found that anesthesia can be induced rapidly and these bitches rarely go through an excitement phase during induction. Fractious bitches or bitches weighing over 30 pounds often have severe and prolonged excitement phases if induced with inhalation anesthetic agents, especially if no pre-anesthetic medication is used. The result of several minutes of excitement and the need for physical restraint may deprive the pups of oxygen until the bitch is intubated and positive ventilation is initiated. The use of ketamine and diazepam for induction is strongly discouraged due to transplacental passage of diazepam. This may cause fetal death or result in extremely challenging neonatal resuscitation. Reversal agents are available for pups that recover poorly, but this raises the question of why should the pups need extra resuscitation efforts, and why have the unnecessary risk of neonatal death due to transplacental sedative agents. The availability of more suitable agents makes the use of ketamine and diazepam unnecessary. Bitches that weigh over 30 pounds are induced with propofol, intubated, and then maintained on sevoflurane. Pulse oximitry and blood pressure are monitored. Once the patient is anesthetized the surgical site is shaved and prepared with an initial scrub; the bitch is then transferred to the surgical suite.

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* Mixture and dose for pre-anesthetic: Butorphenol 10 mg/ml (14ml), glycopyrrolate 0.2 mg/ml (21 ml), given im at 0.5 ml/15 pounds.

Stage 3: Surgery

The surgical field is draped with an initial layer of sterile towels followed by a paper barrier drape. The abdominal incision is routinely made from the umbilicus caudally allowing exposure of the uterus. Initial evaluation of the uterus is done quickly and a pup is exteriorized within a section of the uterine horn. We do not completely exterioirze one or both horns of the uterus before delivery of the first pup. Typically the first uterine incision is placed longitudinally at the middle of one uterine horn allowing for rapid removal of all pups. We routinely remove all pups and all placentas using a single incision in each horn of the uterus. The debate exists as to whether single or multiple incisions are the best for bitch and pups; some surgeons recommend a single incision in the body of the uterus instead of incisions in the horns of the uterus. We have found that a single incision in the uterine body dramatically increases surgical time for large litters and causes difficulty with complete removal of placentas. Leaving placentas during the procedure has not been shown to be detrimental, however, with incisions in both horns, delivery time is dramatically reduced and the removal of all placentas is easily accomplished. If the bitch has not gone into labor before surgery the body of the uterus may be quite small and the chance of surgical damage to the cervix is considerable because the incision needed for puppy removal may include the cervix.

The pup is removed from the uterus and the chorionic and amniotic sacs are opened with fresh gauze. The mouth is cleared and the hard and soft palates are examined for clefts. A gauze pad is placed in the mouth and gentle pressure is placed on the hard and soft palate to clear the nose and throat of mucus. The pup is then examined for any obvious birth defects. A hemostatic clip is applied to the umbilical cord 1 cm from the pup's abdominal wall, a hemostat is placed 1 to 2 cm distal and the umbilical cord is sectioned at about 1 cm from the hemostatic clip. The pup is handed to an assistant on a sterile towel and taken from the surgical suite. The pups are dried with towels and a blow dryer. The nose and mouth are cleared with suction if necessary. The pups are then transferred to a pre-warmed incubator. Swinging of pups is not allowed.[6] When necessary, we use a 25 ga needle in the philtrum to stimulate breathing (Jenchung – GV26). Doxapram is not used due to increased central nervous system oxygen requirements secondary to the medication. All placentas are removed, typically without complication. Traction on the umbilical cord as the only method for placental removal may not be sufficient due to the chorionic attachment. In many bitches the chorionic sac is tightly adherent to the wall of the uterus making removal of the placental tissues difficult. When necessary, we have found that taking the edge of the chorionic sac and gently removing the sac to the level of the placenta will greatly simplify placenta removal. Each pup and its corresponding placenta are removed until the first horn is empty. The second horn is then exteriorized for removal of the remainder of the pups. When the last pup has been removed we give oxytocin (2 to 4 units sq depending on size) and buprenorphine[7] (0.075 mg/10 pounds im). Recent problems with the availability of pain medications may dictate the drug(s) to be used. Because buprenorphine is administered after removal of all pups reversal agents are unnecessary. The uterine incisions are closed using 3-0 or 2-0 poliglecaprone 25 (Monocryl™, Ethicon, Somerville, NJ) in a continuous inverting pattern. Before the uterus is replaced in the abdomen it is critical that a full uterine examination is completed. The uterus is examined both visually and manually for any leakage, both ovaries are visualized and a digital examination of the pelvic area is done to be absolutely certain that all pups have been removed. The uterus is replaced and the muscle fascia is closed with polydioxanone (PDS II™, Ethicon) in a continuous pattern. The subcuticular layer is closed using poliglecaprone 25 in a continuous pattern with deep bites taken to ablate dead space. No skin sutures and no skin glue are used in the procedure. Skin sutures are a potential source for irritation and transdermal contamination.

Stage 4: Recovery and client education

The bitch is moved from the surgery table to a blanket on the floor of the recovery area. After consciousness returns we introduce the pups to the bitch and have all pups nurse under supervision before sending the patient home. During this time a physical examination is performed on the pups and bitch and the pups' palates are checked again and their hearts ausculted.

We have an LVT discuss detailed discharge instructions with the owners. The bitch may be ataxic for several hours and although aggression is rarely associated with current anesthetic agents we still recommend that the bitch be watched closely for the first 12 to 24 hours and not be left alone with her pups until she is completely awake and caring for the pups. All pups must gain weight daily after the first 24 hours. We strongly recommend that all pups be weighed twice daily and the weights recorded for daily evaluation. Pups may lose weight in the first 24 hours but must gain daily starting on day 2. Pups that do not gain weight daily are immediately started on supplemental feeding. We strongly recommend tube feeding and have owners return for a training session. The owners are then told to go home and watch a tube feeding video that we have on our website. We also have a feeding chart that can be downloaded for quick reference on feeding volumes and times.

We have found that dividing the cesarean section into several stages allows for efficient processing of the bitch requiring surgical delivery. The stages also allow for focused training of staff members; this greatly alleviates the stress related to a relatively complicated procedure.

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