Part 1 -- THE ELECTIVE (PLANNED) C-SECTION

How do you make a million dollars breeding dogs? Start with 2 million dollars. Breeding dogs is not cheap...monetarily, emotionally, or with the amount of time invested. Precious lives are involved. Please breed responsibly.

This is the first of a three part series on C-section delivery in the bitch. My intention is to discuss here the options of Elective (Planned) C-Sections. Next month I will cover Emergency C-sections, deciding to proceed to surgery, risks, consequences, and alternatives. And finally, I will discuss the C-section itself, anesthesia, and neonatal resuscitation.

The origin of the Cesarean Operation, Cesarean Section, or C-section is veiled in historic uncertainty. The procedure is alluded to in Greek Mythology as Apollos delivers Asclepius from the abdomen of his mother. And Romans claim the term in memorializing the birth of Julius Caesar. However, the expression most likely derives from the Latin "caedere: to cut". Originally, the procedure was performed on dead or dying women, sacrificing the life of the mother in an attempt to save the baby. The woman, who would eventually die if she was unable to deliver the baby, subsequently died do to hemorrhage or massive infection before the advent of sterile surgery or antibiotics.

In the bitch, c-sections are done with the intention of saving the life of the bitch and as many puppies as possible. Most often, dystocia (complicated delivery) necessitates an emergency c-section. By this time one or more of the fetuses may be dead or compromised and the mother weak or debilitated. 1.) Predicting dystocia, 2.) Predicting the due date, and 3.) Planning a Cesarean section can prevent fetal or maternal loss; and can eliminate midnight emergency calls to the veterinarian.

Predicting Dystocia:

I am not a prophet nor am I a gypsy; and I do not profess to predict the future. However, I do confess an occasional novena to the gods of probability. Playing the odds, Brachycephalic breeds (breeds with shortened heads/faces such as Bulldogs and Boston Terriers) are at greater risk of dystocia than other breeds. The head of the fetus is often too large to pass through the pelvis of the dam, and lacks the traditional missile-shape which helps to direct the fetus through the cervix and the pelvis.

If I were a betting man, I might also wager that a bitch which has had a previous c-section will likely fail to deliver subsequent litters naturally. So-called "V-BAC" (Vaginal Birth After C-section) in human medicine is discouraged in canine obstetrics. Post-surgical adhesions and scar tissue may inhibit normal uterine contraction, preventing fetal expulsion. Further, we anticipate that the cause of the initial dystocia may recur during future pregnancies. This is especially true of "failure to initiate labor" (technically, Primary uterine inertia), or a developmental abnormality of the bitch's reproductive tract which obstructs passage of the fetus (eg. broken pelvis, vaginal stricture, vaginal scarring, etc.).

Occasionally very large litters will be surgically delivered to eliminate the risk of maternal exhaustion and failure to deliver all of the puppies (technically, Secondary uterine inertia). Conversely, breeders faced with very small or single pup litters may
elect for cesarean delivery to prevent potential dystocia and loss of very valuable pups.

**Predicting the Due Date:**

Puppies require very precise determination of the due date for survival. They will not survive if they are born even 2 days pre-maturely.

Again, I do not possess a crystal ball. Accurate prediction of the due date relies on hormonal evaluation of the bitch BEFORE BREEDING. If an owner determines for any of the above reasons that the bitch will require a cesarean delivery, they should consult a veterinarian to coordinate the breeding with hormone and cytologic evaluation. Serial blood progesterone or blood lutenizing hormone (LH) measurements allow accurate prediction of whelping date. Whelping occurs 65 days after the LH peak, with a variability of 1 day. Armed with this information, your veterinarian can confidently schedule a daytime surgery and safely deliver the pups. If the rise in LH was not determined, it is impossible to safely schedule a planned c-section. That is not to say, however, that the bitch must commence labor before surgery. Your veterinarian can roughly estimate the due date based strictly on cytology, determining the first day of Diestrus (last day of heat). Whelping will occur 57 days after the change in cytology with a variability of 3 days (outside the safety range of 2 days to surgically deliver viable pups). Fetal gestational age can also be calculated by ultrasound measurements during early pregnancy (~day 25-35); again, variability is at least 3 days. As the estimated due date approaches, the breeder must monitor the bitch's progress through pregnancy, mammary development, nesting behavior, drop in temperature, and loss of appetite. Then blood progesterone level can be evaluated. When it drops below 2 ng/ml it is safe to proceed to c-section.

Less preferably, a "planned" c-section can be initiated when the first signs of labor are detected. However, it now becomes an unscheduled, emergency c-section. Failure to initiate labor or delay in performing the c-section risks the loss of part or all of the litter.

Obviously, a little forethought provides a greater safety net and ultimately less stress for the breeder, the surgeon, and the mother-to-be.

**Cesarean Section:**

C-section circumvents the risk of dystocia during vaginal delivery, all but guaranteeing the safe delivery of the entire litter. The bitch enjoys decreased duration of labor, decreased physical exertion, and the benefits of analgesia. The breeder forgoes whelping anxieties. And cost-benefit analysis will reveal that preventing the loss of even one puppy compensates the expense of the timing and the surgery.

Given all these wonderful benefits, why aren't all whelpings scheduled for elective c-section?

The answer to that question is a moral conundrum. Once the monetary component is eliminated, it becomes a question of ethical consideration. 90% of natural deliveries progress without complications. Therefore, elective C-section of all pregnant bitches necessitates 90% of the bitches enduring unnecessary surgery. Is it worth the risks
of surgery to avoid potential complications in 10% of pregnancies? Bulldog breeders have determined that elective c-sections are essential to the breed, their dystocia rate, however, exceeds the 10% natural average.

**Summary:**

Scheduled C-sections are often a feasible and economic option to guarantee delivery of the greatest number of healthy, viable puppies and preserving the life of the dam. A well established veterinary-client relationship should be developed, and forethought and excellent breeding management should be followed to ensure the greatest success.

**Part 2 - THE EMERGENCY C-SECTION**

Breeding dogs is not cheap...monetarily, emotionally, or with the amount of time invested. Precious lives are involved. Please breed responsibly.

This is the second of a three part series on C-section delivery in the bitch. My intention is to discuss here Emergency C-sections, deciding to proceed to surgery, risks, consequences, and alternatives. Next month, I will discuss the C-section itself, anesthesia, and neonatal resuscitation.

Innumerable conceivable (and some inconceivable) situations can arise to prompt an emergency c-section. Below are a few plausible situations to consider. In reality, each situation will be different and multiple factors involved which must be considered in making the decision to proceed to surgery.

A bitch is perceived to be "overdue". Very rarely will a bitch actually exceed normal canine gestation. The problem is determining "normal". Often, the gestation period of the dog is arbitrarily designated as 65 days. Or 62 days. Or 57 days. Even as long as 72 days. Such variability makes it impossible to predict whelping based on breeding dates. Determining the first day of Diestrus (D1) with vaginal cytology allows more accurate prediction of whelping 57 days later. Even then, there is a variability of 3 days (remember, as we discussed previously, delivery even 2 days premature rarely results in viable puppies). The greatest accuracy in estimating whelping date is 65 days after the Lutenizing Hormone (LH) peak, determined by either serial blood progesterone or LH evaluations. This provides accuracy within 1-2 days of whelping. Ultrasound estimation of fetal age base on fetal measurements in early gestation can improve accuracy to within 1 day when combined with the LH peak.

A bitch's temperature will commonly drop 1-3 degrees below its normal range (usually to 98 or 99 degrees Fahrenheit) 24 hours before whelping. This temperature drop is a result of a sudden drop in Progesterone, the hormone responsible for maintaining pregnancy. Bitches will also often go off feed the morning prior to delivery. If a bitch exceeds her expected due date or there are no signs of labor within 24 hours of an obvious temperature drop, Primary Uterine Inertia (PUI) should be considered. PUI is a condition in which the uterus fails to contract sufficiently to elicit labor or deliver the puppies. Causes of PUI are poorly understood, but included chemical imbalances (especially calcium or magnesium), poor quality nutrition (which may result in chemical imbalances), excessive uterine stretching (possibly from very large litters or abnormal fluid retention called Hydrops), or most
commonly for no apparent reason at all (Idiopathic PUI—which may be genetic and is likely to recur on subsequent litters).

Failure to initiate labor is another possibility for an overdue bitch. It is poorly documented, but clinical impression suggests that very small or singleton litters lack sufficient fetal input to trigger the hormonal changes necessary to initiate labor. Whatever the cause, adjunctive diagnostics are warranted to determine if whelping is eminent to prevent delivery of premature puppies. Blood progesterone levels and fetal monitoring (by ultrasound) are most critical. Accurate breeding history, especially LH peak, is also very valuable.

Occasionally, medical intervention will suffice, including calcium or magnesium supplementation. However, most commonly, surgery is required. Administration of oxytocin is rarely successful in treating PUI, and is CONTRAINDICATED in the event that the cervix has not dilated.

Dystocia is the malpositioning or oversize of a puppy which prevents normal delivery. Active abdominal pressing and straining for more than 20 minutes without producing a puppy is highly suggestive of a dystocia. Possible situations causing dystocia include: a puppy too large to fit through the birth canal, 2 puppies entering the birth canal at the same time, abnormal formation of the puppy, abnormal position of the puppy (side-ways in the birth canal or head bent down in the birth canal).

Diagnosis of the cause of dystocia requires vaginal examination and often X-rays. If the puppy is within the birth canal, occasionally vaginal delivery with ample lubrication and gentle traction is successful. If the puppy cannot be delivered within 30 minutes, C-section is recommended. THE USE OF OXYTOCIN IS CONTRAINDICATED IN RELIEVING DYSTOCIA. Stimulation of uterine contraction will increase the pressure against the puppy and may damage the uterus. Increasing uterine contractions will also decrease oxygen perfusion to the remaining puppies.

Secondary Uterine Inertia (SUI) is a condition in which the uterine muscles become exhausted and can no longer contract enough to deliver the puppies. SUI often occurs with persistent contraction during dystocia. It may also result during the delivery of the last puppies in a large litter. This is the only situation, in my opinion, where oxytocin is warranted. And then, if and only if it is certain that the cause of SUI is NOT DYSTOCIA. Calcium supplementation is often necessary in conjunction with oxytocin. If SUI occurs with 3 or more puppies remaining in utero, it may be reasonable to proceed to c-section, as delayed delivery of the remaining puppies may result in fetal hypoxia (suffocation) and death.

Premature placental separation is suspected with the appearance of greenish-black vaginal discharge (Uteroverdin) without delivery of the first puppy. THIS IS AN EMERGENCY! It may be a consequence of PUI or secondary to a dystocia. In either event, at least one and possibly all puppies have decreased oxygen delivery and will soon suffocate. Further diagnostics are seldom warranted and immediate c-section is recommended. Passage of uteroverdin after the first puppy cannot be differentiated from the initial discharge and therefore cannot be used to interpret placental separation later in delivery.

In choosing to proceed to Emergency C-section, it is necessary to determine the risk to the puppies and to the bitch. Maximizing live births is the goal, and the sooner a diagnosis can be made, the better. Proper diagnosis of the cause of failure to deliver
Part 3 - WHEN TO PROCEED WITH THE C-SECTION

Breeding dogs is not cheap monetarily, emotionally, or with the amount of time invested. Precious lives are involved. Please breed responsibly.

As a breeder you may have been or will be faced with the decision to proceed to C-section for management of a whelping bitch. For those of you who would like me to give you the definitive answer as to when to proceed to c-section, proper anesthetic protocol, and best surgical approach; I am sorry to inform you that there are too many variables and too many options for one simple answer.

Veterinarians experienced in dystocia management and cesarean delivery are perhaps the single most important factor for a successful outcome. Expedient delivery increases the survival of pups., shortening the duration of surgery and minimizing the potential for complications.

Fetal oxygenation is the foremost liability during the operation. All anesthetic and surgical decisions pivot around fetal oxygen delivery. Without oxygen, puppies suffocate or become severely debilitated and expire soon after delivery.

Fetal oxygenation can be affected in 3 ways; first, decreased maternal blood flow to the uterus. Uterine blood flow is primarily affected by blood pressure, either being too high or too low. Low blood pressure routinely occurs with the use of any anesthetic. To minimize this effect, maintain the lowest level of anesthesia possible and avoid sedatives such as Acepromazine. Fluid administration before induction of anesthesia and during the surgery will also help maintain normal blood pressures. Finally, avoid hypothermia; low body temperature contributes to low blood pressure. Anxiety, stress, and pain result in high blood pressure, which also decreases perfusion of the uterus. Sedation of animals can minimize this effect but should be done judiciously so as not to adversely affect the fetuses. Avoid use of Xylazine (which increases blood pressure), and Acepromazine (as previously mentioned). Opioids (morphine derivatives) are the sedative of choice. Further, hyperventilation of the dam increases blood pressure and should be avoided.

Second, fetal oxygenation can be affected by decrease concentration of oxygen in the dams blood. This can occur if the dam stops breathing or is unable to take deep breaths. Pre-oxygenating the bitch for 3-5 minutes with 100% oxygen before she is anesthetized maximizes the oxygen concentration in her blood. Positioning the bitch at an angle on her right side (as opposed to directly on her back) will facilitate blood flow to her heart and lungs for re-oxygenation. And administering a deep breath occasionally to the bitch with the ventilator will also improve oxygenation during surgery.

Because it is impossible to directly measure fetal oxygen status, monitoring the blood pressure of the dam and oxygen saturation of her blood provides appropriate estimations of fetal oxygen perfusion. Many veterinary clinics are capable of
evaluating these vital signs with capnographs, oxymeters, and blood pressure monitoring equipment.

Third, fetal oxygenation is affected by the fetuses ability to breathe at delivery. Use of Xylazine and/or Ketamine have been associated with decrease puppy survival, presumably from residual affects on the puppies delaying spontaneous respiration. Stimulation of fetal breathing is best accomplished using gentle, yet vigorous stimulation in towel drying. Clear the airway using an infant suction bulb or a dry cotton-tipped swab, as opposed to swinging the puppy; which may result in neck or head trauma or regurgitation and aspiration of stomach contents. Warming the puppy with a warm hair dryer, incubator, or radiant heat source will also facilitate respiration. If the puppies do not begin breathing within 30 seconds, or the heart rate begins to decrease, provide supplemental oxygen, and attempt positive pressure ventilation with a face mask or intubation. Stimulation of the acupuncture point at the juncture between the base of the nose and upper lip using a 25 gauge needle with rapid, pecking motions may also stimulate respiration. If the heart rate continues to drop and breathing does not ensue, administration of Epinephrine is warranted. Routine use of Doxipram is not advocated: it has not been proven to be efficacious, and may cause cardiac infarction.

Recent studies demonstrate that no single anesthetic drug is superior to another in affecting survival of puppies; with the exception of Xylazine and Ketamine mentioned above. My preferred anesthetic protocol is Propofol induction with gas anesthesia using either Isoflurane or Sevoflurane.

There is no single surgical approach which has been proven more effective then another. The important factor is that the surgeon is competent at the approach she/he elects to use. If hysterectomy (spaying) is elected or required (because of uterine rupture or uterine artery rupture) at the time of c-section, fastidious attention must be paid to ligation of engorged uterine vessels. There is no consequence to the bitch or the puppies if spaying is accomplished at the time of delivery. Anecdotal reports of decreased lactation have been reported; but have no physiologic substance. If the owner elects to delay spaying the bitch, my recommendation is to proceed with the subsequent surgery after weaning the pups and before the next heat ensues.

Post-operatively, greater puppy survival is achieved when the bitch is alert and attentive to the puppies. Maternal stimulation of urination, defecation, nursing, activity and body heat are critical. To this end, decreased exposure to sedatives and anesthetics by lowering doses and decreasing surgery time are most beneficial. Second, use of post-operative analgesics provide pain relief so the bitch will allow the puppies to nurse and be attentive to them. Intra-operative administration of opioids, or post operative use of non-steroidal anti-inflammatories are most effective. Local infusion of a line block over the incision site may provide temporary relief.

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