Parturition management for small animal reproduction has been documented in breeder and veterinary literature for over 100 years. Until the mid-1990’s this management was based on a “best guess”; using interventions from subjective symptoms or unreliable parameters such as temperature change. In 1997 Veterinary Perinatal Specialties introduced the WhelpWise service providing monitoring equipment and twenty four hour support services to gather and analyze objective data on parturition, with the goal of improving fetal and maternal outcomes. Our data base now exceeds over 26,000 whelpings. Presented here is retrospective data, collected from an international perspective. This data has been collected in a “real world” scenario of breeders’ homes, veterinary offices and service dog organizations.

Our monitored database has included parity, prior dystocias, diet history, progesterone/luteinizing hormone (LH) timing for breeding, X-ray counts, and specific parturition events. The most scrutinized part of our data analysis is maternal/fetal outcomes (live vs. deceased births) and parturition management; evaluating medication doses and frequency and their tocometric response.

WhelpWise is offered as support service for veterinarians, service dog organizations and breeders. The service is only offered in conjunction with the clients’ veterinarian; patient care is guided by specific veterinary orders provided by the veterinarian. The WhelpWise service monitors both uterine contractions, and fetal heart rates using obstetrical equipment specifically designed for remote data collection. Data are collected and transferred to a staffed 24 hour monitoring center for evaluation. Using objective data as the base for interventions, assessments and interventions can now be made on objective data. Clients that utilize the service are interested in bettering maternal and fetal outcomes by being proactive in the management of whelping issues. A significant benefit offered by the service is to be able to safely manage inertia through labor augmentation protocols developed specifically for canines, and designed for safe use in the home setting.

Mortality rates for WhelpWise clients

Maternal mortality rates are not well documented for canine whelpings. One study conducted by Moon et al, showed a 1% mortality rate (9 out of 3,410). For clients on the WhelpWise service we have a maternal mortality rate of .011 (3 out of 26,098 bitches). Two of the bitches died from undiagnosed cardiac issues, the third was an undiagnosed diabetic. While it was frustrating to lose these three bitches, the key for success in all three cases was the identification of massive fetal distress in all three litters. The bitches were immediately referred to emergent veterinary care. Cesarean sections were performed but none of the bitches survived after surgery. Thanks to very timely intervention all the puppies in all three litters survived.

Fetal mortality rates for clients on service average at or just under 4%. This number includes known fetal distress that the owner/veterinarian chose not to intervene with operative management. Mortality rates for service dog organizations averages around 1.5%. Research reports 10-33% fetal mortality rate for those not using service. Our average cesarean section rate for clients that are expecting to free-whelp is 16% (elective cesarean sections are excluded from these data). Reasons for operative intervention when a normal whelping is planned show that cesarean sections are done for abnormal uterine contraction patterns about six percent of the time. These abnormal uterine contraction patterns are frequently caused by a malpositioned fetus, or uterine issues, such as a torsion, an overdistended uterus from polyhydramnios or obstructive dystocia. Ten percent of the cesarean sections were done for fetal distress.
This document will highlight what we have learned with objective measurements during gestation and parturition, and discuss what we have seen to be the most effective management, producing the best outcomes for both normal and high risk pregnancy management.

**Temperature change prior to whelping**

Historically the most common “way” of “predicting” a whelping was to watch for a “temperature drop” and whelping should occur, depending on the source, in 12-24 hours. As described in a prior WhelpWise study, maternal core temperature change occurs in only 33% of bitches, and that change in temperature frequently occurred in an up/down/up/down fashion, not a clear “temperature goes down and stays down” as described in veterinary literature. If a detectable temperature change was noted (decrease of > 1 degree Fahrenheit below normal baseline temperature), delivery of the fetuses averaged 37-48 hours after the change rather than 12-24 hours as veterinary resources describe.

**Length of labor**

Labor, as defined for this retrospective review, is the presence of an organized pattern of uterine contractions. Our definition of “labor” is not related to behavioral symptoms of parturition, temperature changes or the presence of vaginal discharge. When using the uterine monitor to confirm the presence of a labor pattern it is not unusual for a bitch to be extremely symptomatic and not be in labor or conversely in very active labor and have minimal/no symptoms and not have experienced a temperature change. “Labor” is described by a repeatable/predictable pattern of uterine contractions. We have found that labor patterns will vary with breed, litter size, and abdominal mass of the bitch. Uterine contractions are detected by applying an external uterine sensor. This sensor detects changes in intrauterine pressure using a tocodynamometer specifically designed for early gestation human pregnancies. “Contractions” are traced on a linear axis, graphing changes in intrauterine pressure. As the myometrium contracts, the pressure inside the uterus will increase, as the contraction relaxes, the pressure decreases. Uterine activity graphs are documented as time in minutes on the X-axis, and strength of the contraction shown as an increase in pressure in millimeters of mercury on the Y-axis (Figure 1). It is important to note that the bitches are always monitored in a lateral recumbent position. This position will eliminate uterine contractions caused by physical activity. During normal gestation, it is expected that uterine contractions are present in a frequency of one to three per hour beginning about 56 days after the LH surge.

![Figure 1. Uterine contraction normal baseline](image.png)
Figure 2. Labor

Presence of an organized pattern of uterine contractions. Contractions are marked with a “C” and red line. Note the consistency in spacing and strength.

Once first stage labor is established, our data strongly support that deliveries will begin on an average of nine hours from the presence of an organized pattern of labor. The range for delivery times averaged eight to 16 hours, with a significant increase in fetal mortality and need for cesarean sections when labor is extended beyond 14-16 hours of an organized labor pattern. This information supports earlier studies, and reflects the benefits of labor management, when first stage labor surpasses the 14-hour mark inertia is usually the issue. The differences were so clear in fetal outcomes related to prolonged labor versus augmented labor, that augmentation protocols were established early in the development of the service. These protocols were based on the human model of parturition management. In human labor management strongly documents that parturition should follow a specific progression once active labor has been established. This predictable passing through parturition has been called “Friedman’s curve” after the physician who documented that poor fetal outcomes were the result of an ineffective labor; pioneering the concept of human labor management to improve fetal outcomes.

Length of labor before first delivery

Inertia

For the purpose of this retrospective review the term inertia will be used to describe failure to maintain an adequate contraction pattern. Inertia may be the inability to move into second stage labor, or once second stage has occurred, the lack of contractility to continue to deliver pups.
Primary inertia

The incidence of primary uterine inertia has been an extremely rare occurrence (less than .1%). What is demonstrated using the WhelpWise service, is an attempt by the bitch to establish first stage labor. This attempt labor is frequently asymptomatic, and will not be associated with a change in temperature. It is not uncommon for maiden bitches to establish a short episode (three to four hours) of mild contractions that are in a disorganized pattern that will subside and return within 12-24 hours; moving into an active labor pattern. If this attempt to establish labor re-occurs more than twice without progression to active labor we have found that there is a strong correlation with dystocias; either an over distended uterus from polyhydramnios, fetal malposition, or exceptionally large pups being a common cause.

Secondary inertia

Secondary inertia is considered after the bitch has maintained a contraction pattern for more than seven to eight hours and we begin to see a loss of uterine contraction strength, contraction frequency, or combination of both. Using the human model for medical management of secondary inertia, human fetal outcome data consistently show that lack of progression (cervical effacement, cervical dilation and fetal head engagement) with an active labor pattern requires medical intervention, as low Apgar scores are frequently associated with prolonged labor.10-12

Early studies of whelping outcomes associated prolonged active labor with fetal loss. What showed improved fetal and maternal outcomes was early intervention with uterotonics when inertia was detected. Managing the inertia drastically reduced fetal demises from 33% to around 6% in our early monitored clients. Also, noted in the study was an increased incidence of fading puppy syndrome in the unmanaged group (19%) compared to the labor managed group (1%).7 Secondary inertia, or the inability to progress from either stage one labor to stage two, or maintaining an appropriate interval between deliveries in stage two appears to be the primary cause for fetal mortality and morbidity in our client population.

Whelping management protocols have been modified over the last 17 years of data collection, fine-tuning the “art” of whelping management. When inertia is detected early we expect that 80% of our clients will respond favorably to medical management and proceed with a normal, but augmented whelping. Titrating small doses of either oxytocin, injectable calcium, or both, returning the bitch to her “normal” labor pattern without causing uterine hyper-stimulation or uterine tetany has proven to be an effective and safe way to manage secondary inertia.

Evaluating a bitch in labor (subjectively) is very difficult. As demonstrated with the uterine monitor session below, there is absolutely no inherent contraction strength in the labor pattern, but the veterinarian evaluating the case felt that they observed that the “contractions were strong”. What the veterinarian was evaluating was the abdominal expulsive efforts of the bitch, as she was indeed pushing very hard. However, if the contraction strength was increased by labor augmentation, the bitch would require less physical effort to deliver the pups.
Managing inertia

*Injectable calcium.* The use of injectable calcium to assist parturition has been documented as an uterotonic since 1947.\(^{11}\) Uterine muscle is dependent on adequate calcium levels to contract effectively, and creates its own calcium consumptive state.\(^ {5,12,13}\) It is this author’s opinion that frequently calcium levels can be within a “normal” range based on traditional laboratory values, but the bitch may be experiencing a calcium-based inertia, as her calcium levels may have changed (decreased) within that normal range, causing decreased contractility of the uterus. Inadequate calcium levels are also suspect in bitches that will establish a pattern of labor and then stop contracting. Questioning the ability of the parathyroid gland to rapidly respond to a declining calcium level because of fetal consumption, or active labor we have seen that calcium supplementation both oral and injectable have frequently supplied the needed correction to achieve an effective contraction pattern. We have objectively noted that administration of calcium will increase the strength of the contraction rather than the frequency of the contractions. A study of serum calcium levels conducted at the Guiding Eyes, also has documented that low ionized calcium had direct impact on stillbirths.\(^{13}\) Additional studies completed by Hollinhead et al, discussed the issues with the availability of free calcium for adequate labor also being impacted by acute inappetence prior to whelping and respiratory alkalosis.\(^ {13}\)
Figure 5. Session beginning 20 minutes after administration of calcium gluconate 10% SQ

We have objectively measured the effectiveness of calcium use during labor. Optimally, injectable calcium will provide the best route for administration. Dosage range for calcium gluconate has been successful at ½ to 1 cc of 10% CaGl per 10 pounds of (gravid) maternal body weight with exact doses being titrated to the uterine contraction pattern. Calcium gluconate, administered subcutaneously has been safe. We have experienced no untoward side effects in our patient population unless a stronger concentration of calcium has been used (23%). Injection sites using 23% calcium have been very painful for the animal and a corresponding tissue slough have been reported. No cardiac problems have been experienced with the subcutaneous administration of the 10% solution because of the gradual absorption of the medication. We have had no reported incidence of accidental IV infusion.

In our client population, oral calcium supplements have been successful for proactive prevention of a calcium-based inertia for exceptionally large litters or clients that are not feeding a balanced diet. Both groups appear to be somewhat predisposed to calcium imbalances. Beginning oral supplementation of 500-750mg two to three days prior to parturition or as early first stage labor is established does seem to be beneficial, without noted complications of antepartum eclampsia. Presence of adequate vitamin D levels in the diet has also been key to the prevention of calcium-based inertia. The presence of vitamin D is frequently markedly decreased to completely absent for owners feeding the raw diet, and whelping complications related to this perceived imbalance are frequent.

We have not seen a corresponding improvement in contraction patterns from the oral calcium gel products, and have had several dogs using these products experience gastrointestinal bleeding after their use. Many of these “gel” supplements contain toxic levels of vitamin D when dosed by weight.

Questions unanswered: Is there a role for “intelligent” calcium supplementation two to three days prior to a whelp, especially with large litters or inapparent bitches? Would this supplementation improve labor patterns, decreasing inertia? Should supplementation be based on litter size/diet of the dam, making sure that adequate levels of vitamin D are also present in the diet?

**Oxytocin.** Oxytocin has been the most frequently used drug for labor augmentation. Oxytocin dosing prior to the use of the uterine monitor was arbitrary, usually based on animal weight, not uterine contraction patterns. Administering oxytocin in excessive amounts can be detrimental to both labor progression and fetal well-being, as a hyperstimulated uterus does not contract effectively and the constriction of the myometrium will impede blood flow to the fetus. The relaxation phase between each contraction is important to allow blood to circulate to the fetus. Excessive doses of oxytocin can cause uterine rupture. According to our database, effectiveness of oxytocin is related to length of labor, with best response noted after first stage labor has been present for at least eight hours, but not over 16 hours. Administering oxytocin before eight hours of active labor (documented contraction pattern, not symptoms or temperature change) or after 16 hours of labor frequently has minimal effect on the contraction pattern.
From our perspective, oxytocin dosing should always be titrated to the existing uterine contraction pattern, without regard for body weight of the bitch. Our general protocol begins with ½ unit of oxytocin; administered either subcutaneous or intramuscular, depending on the desired rate of response and duration of action. Oxytocin is only administered after eight hours of first stage labor and documented inertia. Expected results with oxytocin would be an increased frequency of the uterine contractions. Because of the short half-life of oxytocin, dosing is usually every 45-60 minutes. If the desired response of increased uterine contractility is not obtained with the first dose, doses are increased in amount until an adequate pattern of contractions is achieved. After administering three subsequent doses of oxytocin, incrementally increasing each dose, critical evaluation is made of the success of the augmentation. Failure to improve the inertia shows a strong correlation that the dystocia will not be successful utilizing a medical approach and surgical intervention is a frequent necessity.

With the presence of close-coupled contractions, a delivery should occur within one hour. Frequently when this type of contraction pattern is noted the presenting fetal part may be palpated on vaginal exam. Note of interest, the bitch was sleeping during this session, showing once again that subjective symptoms are not adequate markers of labor progression. Medication would be contraindicated with this uterine contraction pattern, and the first pup was delivered 15 minutes after the end of the session.

Figure 6. Contraction pattern with fetal/pelvic engagement; oxytocin/calcium contraindicated!

Fetal heart rates

Monitoring fetal heart rates in the home setting provides a window into the uterus and an opportunity to assess fetal well-being on an individual puppy basis. Using a hand-held doppler we have had excellent success teaching owners how to locate individual puppies, and follow the puppies for distress prior to or during the whelping. The range for normal fetal heart rates vary in published literature. Our data base, in place since the mid 1990’s, and being the first to monitor fetal outcomes related to heart rate, consistently documents a normal fetal heart rate range from 180-220 beats per minute (BPM). Fetal heart rates are noted to be over 200 for the most of gestation and declining to 190-200 the week before parturition. As term gestation becomes closer the rates will begin to decline into the 170-200’s as a normal observation. During labor variable decelerations (a rapid decrease and return to baseline) are fairly common and not concerning unless the nadir of the drop is into the 150’s or less, or the deceleration is prolonged or repeats on a frequent basis. A declining fetal heart rate baseline presents the most ominous of the concerning fetal heart rate patterns. Baseline heart rates that are running consistently less than 170, especially below 150 are associated with poor outcomes or the passage of meconium by the pup. Respiratory acidosis is associated with prolonged bradycardia, further depressing the puppy and making them more difficult to resuscitate at birth.

When evaluating fetal heart rates in the veterinary office it is best to let the bitch rest/relax as adrenaline secreted in response to stress will cross the placenta and may give a false sense of fetal well-being if fetal heart rates are assessed immediately upon arrive at the clinic.
High risk pregnancy management

If you ask most canine reproduction practitioners if they feel that the incidence of mid-late pregnancy litter loss is on the increase, I believe that most would say “yes”. The frustrating part of litter loss is that identifying the actual cause of the issue has been elusive. We have correlated uterine activity above the “norm” for gestational age as the primary reason for litter loss. Our overall client base consists of about 30% high-risk premature labor clients, either being monitored because of a problematic history of litter loss or acute premature labor. Documented conditions associated with the increased premature contractions have included uterine infections; both acute pyometra and low-grade metritis, hypolutealism, and uterine contractions associated with no known cause. Regardless of the cause, premature labor has been controllable in most clients. Keys to successful management have been the early documentation of uterine contraction patterns, early intervention, and medication titration to maintain uterine quiescence. Most of our high-risk clients are placed on service after either experiencing a prior litter loss, or having multiple resorptions, or other concerns being identified during the current pregnancy ultrasound. Regardless of the history at the start of service, we have successfully gotten these high-risk pregnancies to term gestation 95% of the time, including bitches that are actively delivering premature puppies. Monitoring the uterine activity and controlling aberrancies is the reason for success. High-risk management is a dynamic process; it is rare that we have a client start service under treatment “X” and not have the treatment plan modified, sometimes daily, to achieve term gestation. Developing a plan of high-risk management without knowing what the end-organ response to that plan is seems to put the practitioner at a disadvantage for prescribing effective medication protocols. Monitoring the gestation with a uterine monitor will give the practitioner an early warning that plan modification may be indicated.

Premature labor

The presence of uterine contractions in an organized fashion in the canine was first documented in 1989 by G.C van der Weyden et al, by surgically implanting electrodes in the canine myometrium.11 van der Weyden’s observation of the presence of one to three contractions an hour seven days before the onset of an active labor pattern has been strongly duplicated in our client population. We consider the occurrence of one to three contractions an hour a normal “baseline” uterine contraction pattern after 53 days after the LH surge. Uterine contractions occurring before day 53, especially with the presence of irritability (contractions that are less than a minute in length) have a high incidence of premature delivery and/or premature placental separation.

Uterine irritability at 27 days after the LH surge, prior history of losing litter around 40-45 days of gestation. Irritability is defined as uterine contractions that are less than 1 minute in duration.

Of particular concern for premature labor management is the presence of a pattern within the uterine contractions or irritability. Once a pattern of contractility is established, frequently the uterine activity will escalate into an active labor pattern within 48 hours if not treated. Clients using the WhelpWise service have a high motivation for success; most of our cases are referred to service because they have already lost litters. Our “failure” rate, or “what happens if you do not treat the contractions” has occurred from clients that are non-compliant with treatment protocols or not started on service in
time. Clients that have not been treated aggressively have gone on to lose a significant number of pups in the litter, or lose the entire litter. Compliant clients have had overall very successful outcomes. It is also very important to note that rarely are there symptoms associated with premature labor, nor is premature labor associated with a decline in maternal temperature.

Hypolutealism

Progesterone decline during gestation leading to active labor and pregnancy loss has been well accepted in veterinary research. Causes of hypolutealism are generally unknown, however a recent study has looked at luteal insufficiency as a consequence of an autoimmune response. While it appears that many in the veterinary community want to categorize progesterone levels into good or bad based on the level, our client population shows that progesterone levels are varied and there may be a trend for a problem at a certain level, but there is not an exact measurement for a problematic progesterone level. Data collected by Sontas et al also shows a “trend” in progesterone levels, but within the study progesterone levels varied greatly.

What we do not see from our database is the correlation of an “acceptable” level of progesterone for a specific point in gestation. Progesterone levels fluctuate over a fairly large range and appear to be influenced by the breed of dog and the number of whelps in the litter. Bitches on service that “should be just fine” with the current progesterone level showing preterm labor that only responds to progesterone supplementation and conversely those that have extremely low progesterone levels being very stable on the uterine monitor.

Using uterine quiescence as a marker for a “safe” progesterone level, we can use the uterine monitor to alert the practitioner that progesterone therapy is not being successful. In our high-risk client population, proactive uterine monitoring; following up with progesterone levels when the uterus is not quiet have provided early evidence that the existing progesterone level, regardless of laboratory value, is not adequate to promote a healthy uterine environment.

Infectious causes of litter loss

As documented in both human and veterinary medicine infection plays a significant role in preterm labor because of the prostaglandin F2 alpha release with resulting leutolysis. The presence of infection can be difficult to ascertain and frequently high-risk bitches, especially those with a prior history of infective loss, may culture out a wide variety of resistant bacterial species. Random antibiotic use should not be considered without first doing a guarded vaginal culture to screen both for the appropriateness of antibiotic therapy as well as correct antibiotic coverage to decrease the chance of resistant microbe development. Data from our clients frequently show that a vaginal culture and subsequent antibiotic treatment on bitches that are not stable frequently benefit from the addition of antibiotic therapy.

Medications for premature labor management

**Terbutaline.** Brethine is one of the most frequently used tocolytic drugs in the treatment of human preterm labor. Terbutaline is in the class of drugs called beta-mimetics. These beta2-adrenergic receptor agonists are sympathomimetic, causing smooth muscle relaxation by decreasing free intracellular calcium ions. Controversy exists in human medicine about the long-term effectiveness of terbutaline; some of this controversy is related to the b-site saturation causing the drug to become ineffective. Titrating terbutaline doses; beginning with the smallest effective dose, proactively monitoring uterine activity, and increasing the doses in very small amounts to control uterine contractility has proven effective in human medicine. We have seen the same clinical course with our clients. I believe that a primary reason for our success with terbutaline is that we do not begin with an arbitrary dose, but rather titrate dosing to control concerning uterine contraction patterns, increasing doses as needed.

**Progesterone supplementation.** In clients experiencing hypolutealism, we have seen the best response and long term stability of uterine contraction patterns when using injectable progesterone
(50mg/ml) in a carrier, usually sesame, apricot, or cottonseed oil. The oil-based medication is absorbed slower and maintains a more constant progesterone level. The efficacy of this type of therapy can also be documented through laboratory testing. Doses have ranged from 1-3mg/kg, given QOD to every fourth day, with dosing schedules determined by both laboratory values and uterine monitor results. Using the uterine monitor provides an early warning system that uterine quiescence is not being achieved with the current dose plan, allowing the veterinarian to evaluate serum levels and adjust doses if necessary. Weaning progesterone as term gestation approaches, using the uterine monitor to adjust doses, possibly add terbutaline to maintain a contraction free uterus also allows a safe taper off the progesterone; promoting a normal transition into lactation and maternal skills.

**Oral progesterone.** Regumate/Prometrium has not shown significant impact in the control of uterine contractions in our client population. Many clients have started on service with Regumate, but within a short period of time will need to be transitioned to the injectable. Some clients have done well with Prometra, an oral progesterone supplement from the human side, but again it seems to be the occasional client that is actually stable on the medication. While oral progesterone supplements may help improve outcomes in a non-monitored litter, frequently there is still puppy loss, or surviving pups are intrauterine growth retarded related to unhealthy placentas from uncontrolled uterine activity. Questions unanswered about the use of oral progesterone supplements and their observed lack of impact on uterine contractility would be the effect of the canine gastric pH and canine metabolic rate on the absorption and metabolism of the oral medications.

In extremely difficult cases of premature labor, the combined use of progesterone, terbutaline and antibiotics have been employed. Management of these exceptionally high-risk clients is a day-to-day observation/documentation/modification of treatments to achieve the goal of term gestation. Unfortunately, because of the multiple dynamics and the multifactorial nature of high-risk pregnancy management, no specific management technique has been successfully extracted from our client base. Each case is managed as an individual.

We do see an increased cesarean section rate for high-risk clients that have been either on progesterone supplementation or on preterm labor management. Most high-risk clients do not want to take the chance of any fetal loss, and will perform an elective cesarean section. Of those that do choose to free whelp, the incidence of fetal distress (70%) or severe inertia (20%) are risks for this group so clients are informed before the parturition date so they can discuss with their veterinarian the potential risks of a free-whelp. Close proximity to 24 hour veterinary care will also play a role in a decision to free-whelp.

**Other observations from our data**

The myths around progesterone

Progesterone testing has provided the canine practitioner with a wealth of information around optimal times to breed, adequate progesterone levels for pregnancy maintenance and a guide for when to perform an elective cesarean section. However, the tendency to try and consolidate data into a “cook book” format frequently encourages the practitioner to only evaluate the number and not the patient. Deviations from the progesterone “norm” that we have noted on clients on service include:

“Ovulation occurs a 5ng”. We have noted that many litters, especially large litters will be at 5ng 24 hours after a positive LH, which if the bitch was to be bred two days later would put her at risk of missing completely or having a much smaller litter than her potential. Conversely, the same is true for those experiencing a slow progesterone rise. When LH timed and the rise is slow the progesterone level day 4-6 may be at 5ng or in some cases lower than 5. Overall, we see the best success for breeding when LH timing is used to time the litter, evaluating that a progesterone rise has occurred but not focusing on “ovulation occurring at 5”. Also when using ovulation timing (OVT) to determine due date it is very important to know where the values are coming from. Progesterone testing is becoming more diversified with the onslaught of progesterone assay machines coming into individual practices. Calibration of these machines is critical, and while the results may say it was a “5”, always compare to a well know laboratory
value such as IDEXX. Also, the incorporation of multiple laboratory sources may only add confusion to OVT so try to keep laboratory tests in the same testing laboratory if possible.

“It’s safe to do a cesarean section if the progesterone is below 2ng”. Veterinary literature is supportive of performing a cesarean section if the progesterone is below 3.4 “the bitch will whelp in 24 hours” or using a “2 or below” as markers that elective delivery will produce pups that are mature enough to survive.27 “Survive”, yes- “thrive”, maybe not. We have had multiple clients that have been on service for preterm labor management that are having the progesterone levels monitored. While not a frequent occurrence we do see progesterone levels even at 45 days of gestation that are below 5ng, and the bitch is stable. It is not uncommon to have progesterone levels running between 2-3ng for the last seven days of pregnancy. If serial progesterone levels are not performed it is difficult to say from one progesterone level that the litter is ready to deliver. Delivering a litter early will contribute to lack of mothering skills, agalactia, and increased bleeding. A recent article from Beccaglia et al strongly suggests that multiple parameters be included in evaluation of the bitch and litter prior to an elective cesarean section.26

Yes- Dopram DOES work!

The most observed cause of neonatal death in our client population is hypoxia related to absent/poor placental profusion during labor, torn or ruptured umbilicus during delivery, or suppression of respirations from either metabolic acidosis or anesthetics. The hypoxic-metabolic-acidotic state creates a vicious cycle of further respiratory depression. Breaking this cycle can be difficult. Establishing respiratory effort is of paramount importance. Because of size and skill limitations, intubations/mechanical ventilation is frequently impossible, especially in the home setting. Supplemental oxygen is helpful, but only if there is respiratory effort. Over-riding the central nervous system’s inability to initiate respirations has been effectively accomplished with clients through the use of Dopram.29,30 Veterinary literature has reported mixed reviews on the effectiveness of Dopram,32 but it has been our experience that it is very useful in stimulating respirations in apneic pups, as long as a heart rate is present.

Human literature reports that doxapram (Dopram) is effective in stimulation of the respiratory center. However, when studied in severely premature infants it has received criticism.31 In this study Doxapram was administered to maintain respirations until the neurologic respiratory center reached maturity as these infants were born between 25-27 weeks of gestation (40 weeks for full term). Side effects noted from the use of the drug showed developmental delays, however the doxapram kept the babies breathing and off of mechanical ventilation. When evaluating the ineffectiveness of the drug it would be important to look at all aspects of prematurity, not just the possibility that doxapram caused developmental delay. Factors not evaluated by the studies were the deleterious effects of long-term mechanical ventilation having more untoward effects than did the doxapram.

For severe respiratory depression we have found the best success with administering Dopram IM, in the caudal thigh muscle, as this is usually the largest muscle mass in a pup. Injecting the drug sublingual can cause extreme pain in the surviving neonate, preventing effective nursing. For mild respiratory depression, oral administration (drops) is mildly effective, but mucosal suctioning frequently removes the drug. Dopram doses are titrated to the level of distress (presence of any respiratory effort, and neonatal heart rate). We typically suggest the IM dose of 0.01cc/4oz of neonatal weigh, watching for the usual Dopram “flush”, a profound redness of the mucus membranes. This flush is positive feedback that the drug is circulating in the system and respiratory effort should soon follow. If the flush is not noted, repeated injections are done until the flush is noted. Additionally, cardiac rate is assessed and CPR performed if the pup is not stabilizing.

Whelping success

Successful management of all aspects of medicine is dependent upon objective information on which to base decisions. Management of diabetic patients require the measurement of objective blood glucose parameters to determine how to dose insulin, orthopedic problems require x-rays or an MRI to assist the veterinarian with their diagnosis. Maternal and fetal management is no different except that you
have two or more patients to manage. Using uterine and fetal heart rate monitoring will help promote successful outcomes for your clients.

References