Comparison of Traditional Methods for Evaluating Parturition in the Bitch Versus Using External Uterine and Fetal monitors

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Intrapartum uterine and fetal monitoring has been the standard of care in human medicine since the early 1970's, consistently improving both fetal and maternal outcomes. Protocols for human labor management developed by Dr. Emmanuel Friedman M.D. have changed human obstetrics; managing human labor to obtain optimal maternal and fetal outcomes rather than letting "nature take its course". [6,7,8] Transferring human parturition management concepts to veterinary medicine has improved whelping outcomes and provided the veterinarian and breeder with timely objective documentation of the whelping process. [4,12] While the expectation that human standards for obstetrical management being mandated as the standard of care in veterinary medicine is unlikely, promoting expanded levels of care, improving maternal and fetal outcomes rather than accepting the normal fetal and maternal death rate seems prudent. Today's standard of care for determining the process of labor relies mostly on one objective measurement, temperature change, and subjective symptoms such as the presence or absence of whelping symptoms. This information, usually collected by non-medically trained owners has a potential for gross error related to its subjective nature. In contrast, objective data from the uterine and fetal monitors provides objective documentation of the whelping process for each case. This data can be used with a higher degree of accuracy and certainty as to base clinical decisions. Frequently, the breeder does not initiate veterinary contact until problems are already being experienced during the whelping. In contrast, whelpings that are monitored provide the veterinarian and breeder with near real time ongoing objective data for management and support throughout the entire parturition process. In a monitored litter, potential problems are identified early, referring the breeder back to the veterinarian with concrete information on uterine contraction patterns and fetal heart rates. This additional information makes it easier for the veterinarian to manage detected problems rather than trying to acutely manage potentially life-threatening issues in a crisis situation without the information provided by the service.

Home canine whelping management services such as WhelpWise™ have brought a new level of care to veterinary medicine. Designed as a service it provides many benefits for the veterinary community, allowing the breeder to obtain a more detailed level of care if they desire. Placing the owner in the responsible position for obtaining additional support frees the veterinarian from having to obtain yet another piece of equipment for the office and the expanded workload of monitoring and managing whelpings on a 24 hours a day basis. Whelping can be safely managed from the home setting, freeing the veterinary office from time consuming procedures, and decreasing the neonatal exposure to pathogens. Additionally, keeping the bitch in the home setting promotes a sense of security during the whelping and facilitates positive mothering skills. The WhelpWise™ service provides the breeder with a uterine contraction monitor and ultrasound Doppler allowing for objective documentation of uterine contractions and fetal heart rates. This approach to whelping management provides accurate interpretation of the mechanisms and actual presence of labor than does the traditional method of mostly subjective assessments. Information on uterine contractions and fetal heart rates are transferred via phone line to the 24 hour monitoring center for ongoing assessment and evaluation of the whelping process. Complications, such as inertia can be positively identified and drug doses can be titrated to reestablish a normal labor pattern, preventing over or under stimulation of the uterus.

Temperature change in relation to parturition

In many cases the only objective information that the veterinarian will have on the process of parturition will be the decrease in basilar temperature. Throughout veterinary literature the decrease in basal temperature is identified as a predictor of parturition. Concannon et al, describes in a 40 Beagle study that baseline temperature is approximately 100.3 Fahrenheit, with the decrease beginning approximately 24 hours, prior to parturition and the nadir of the decline being measured at approximately 98.6 degrees Fahrenheit, 8 hours prior to actual parturition. [2] As described in the Manual of Small Animal Reproduction and Neonatology, a temperature drop to 36 degrees Celsius (around 97 degrees Fahrenheit), will lead to parturition in 12 hours. [13] While temperature change is indicative of the declining progesterone, thus impending parturition, further studies using non-controlled laboratory situations, incorporating multiple breeds of dogs in the home setting, can be used to confirm the value and the correlation with temperature change and parturition. Additionally, none of these temperature studies looked at maternal and fetal outcomes, simply that parturition should begin.

Retrospective Analysis

Whelping outcome data, uterine contraction and fetal heart rate data, has been collected on more than 2000 whelpings through the WhelpWise™ monitoring service. Questions have arisen as to the value and effectiveness of uterine contraction monitoring versus the traditional mostly subjective methods of managing the parturition process. To answer these questions data was evaluated from a smaller group of 100 clients comparing the relationship to temperature drop and labor onset, temperature drop and delivery of the first pup, and actual length of labor as documented by the uterine monitor. Fetal death rates were also compared to length of labor. The goal with this study was to determine what correlation existed between the traditional method of determining labor onset and progression (temperature drop, symptoms) versus uterine monitoring and detection of actual labor. Data was evaluated in a format to determine if there was a positive predictability of delivery time for the first pup with either method. For the purposes of this retrospective study many clients from the larger group were eliminated because of inconsistent temperature monitoring and/or the inability to distinguish or accurately report the presence of labor symptoms.

Study Design

N=100. Clients recorded basal temperature a minimum of twice daily, around 12 hours apart. Uterine data was collected and transmitted initially twice daily, beginning 4 days prior to the expected due date with additional sessions occurring when baseline uterine contraction patterns began to increase, or if the presence or a change in symptoms occurred. Labor was considered present when uterine contractions were greater than 5 per hour and were consistent in both strength and length. Fetal heart rates were checked daily, and every one to two hours during the active phase of labor. Baseline temperature was recorded as the average temperature reading noted before temperature began to decrease. The lowest temperature recorded was the value that was at least 1 degree Fahrenheit below baseline. This reading included values which reached their nadir after labor was detected by the uterine contraction monitor (UCM). Additional parameters evaluated included the presence of multiple temperature drops of greater than 2 degrees below baseline, the time from the temperature drop to documented labor, the time from temperature drop to delivery of the first pup, and average length of documented labor to delivery of first pup. The presence of symptoms and their correlation with documented labor were also

recorded. Outcome data, such as fetal loss, medications given and amount, and c-section rate were also noted. As this was a retrospective study of a specific population group no control group was utilized.

Comparison of actual onset of labor as detected by the uterine contraction monitor in relation to temperature drop

Basilar temperatures ranged in the study group from 98.4 to 101.7, with a mean value of 100.0. The lowest recorded temperature for each bitch ranged from 97.0 to 101.2 with a mean value of 98.8. These values are graphed as baseline values: Series 1: Averaged baseline temperature Series 2: Temperature nadir. (graph 1) This lowest temperature reading for each bitch was used as the graph point for all nadir measurements.

Graph 1

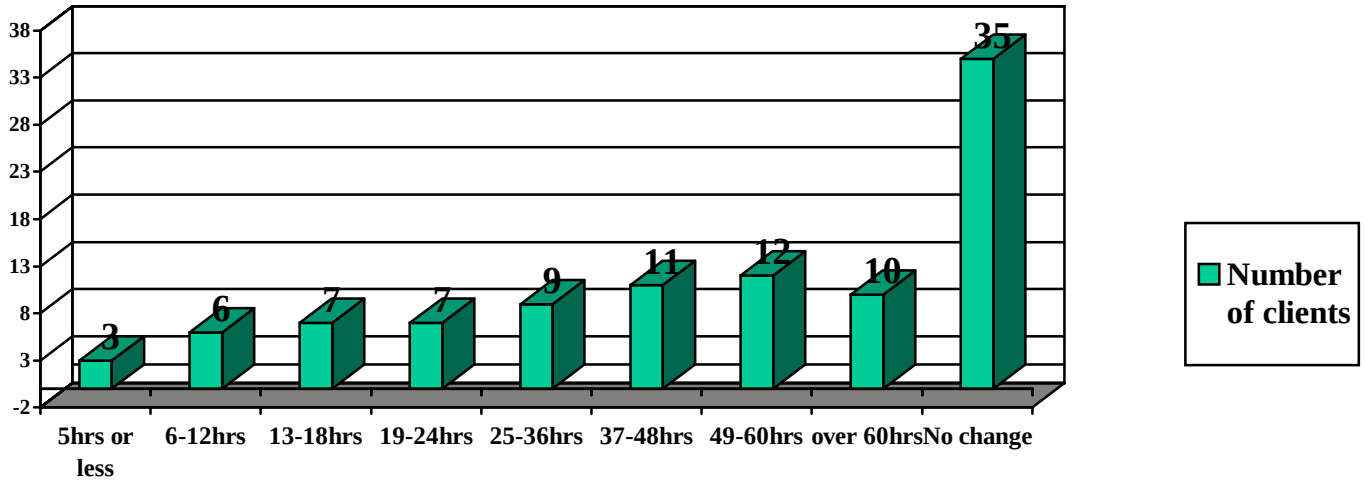
Temperature baseline (series 1) Lowest Recorded Temperature (series 2)

Documented labor onset as it correlates to temperature nadir

Documented onset of labor occurred and was correlated with a decline in temperature. Time is length of time from nadir before documented labor was detected by the UCM. Of particular note is that 35 cases (35%) did not have a temperature change of more than one degree. (graph 2) When evaluating data on each individual case, 32 clients (32%) of the cases had multiple decreases in temperature. (To clarify data; if case is in the 6-12 hour category, temperature nadir had occurred in the time frame of 6-12 hours before labor was documented).

5 hours or less	6-12 hours	13-18 hours	19-24 hours	25-36 hours	36-48 hours	49-60 hours	Over 60 hours	No change prior to labor
3	6	7	7	9	11	12	10	35

Graph 2 Time from temperature drop to labor onset

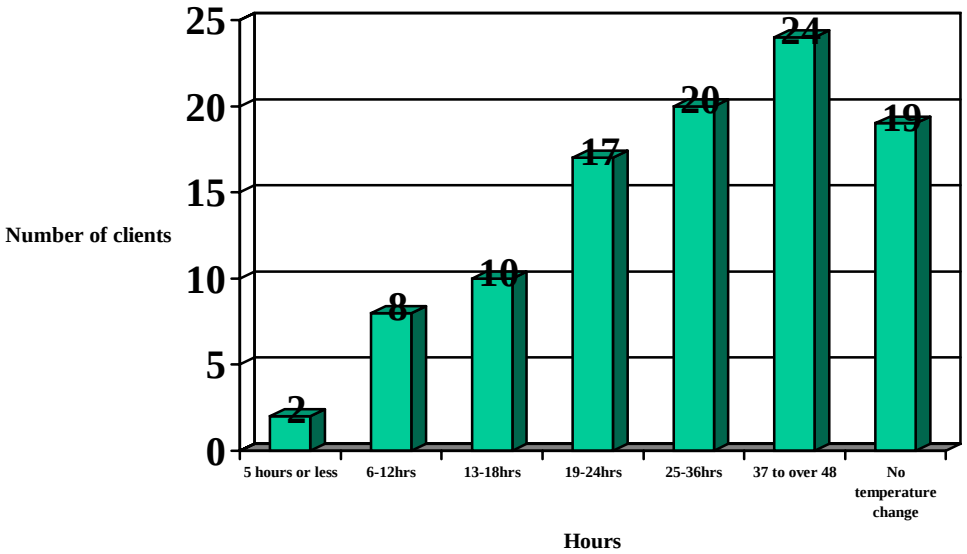


Comparison of time of delivery in relationship to documented temperature drop

Temperature nadir, and its relationship to delivery of the first fetus occurred in the following distribution. In 19 (19%) of the cases no temperature decline of over 1 degree prior to delivery was documented. (graph 3)

5 hours or less	6-12 hours	13-18 hours	17-24 hours	25-36 hours	37 to over 48 hours	No Temperature Change
2 cases	8 cases	10 cases	17 cases	20 cases	24 cases	19 cases

Graph 3 Time of delivery in relationship to temperature drop



Presence of labor symptoms and the correlation with the onset of labor

Symptoms of labor such as anorexia, panting, restlessness, and reclusive behavior are all frequently associated with labor. It is a common belief that symptoms will increase as labor progresses. In cases of an asymptomatic laboring bitch or a bitch with symptoms present before labor is actually present, management errors could be made on either end of the perceived labor spectrum. Correlation of symptoms and the onset of labor again was not a reliable marker for prediction of deliveries. Labor symptoms were not noted at the onset of labor in 37 (37%) of the cases and in 42 of the cases (42%) symptoms were present prior to the onset of labor.

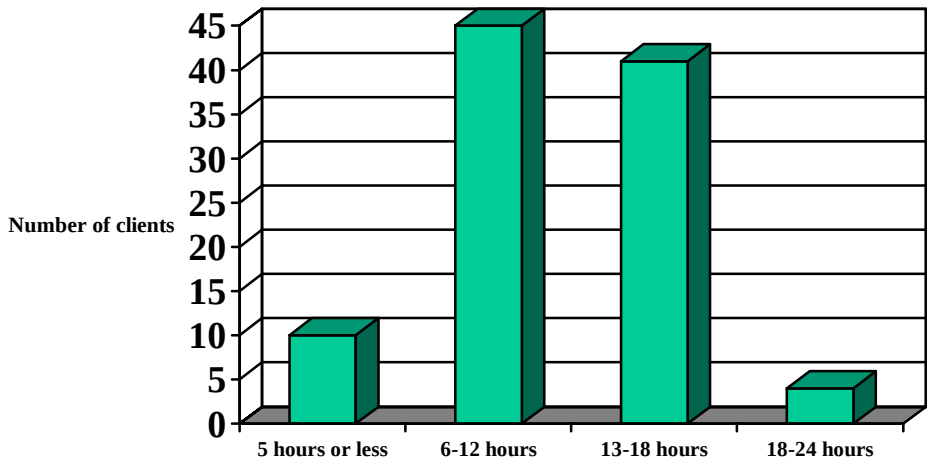
Average length of documented labor using the Uterine Monitor

Average time from documented labor onset to first delivery was 12.1 hours. A correlation was noted with the increased length of labor and the need for pharmacological intervention to treat documented inertias, as well as an increase in fetal death as length of labor increased. Labor augmentation was done on clients demonstrating inertia after 10 hours of first stage labor, potentially shortening the overall perception of labor length in clients whose labor was greater than 10 hours. (graph 4) A much narrower predictive window for time of delivery is noted using the uterine monitor rather than temperature as an indicator of parturition.

Duration of documented first stage labor to the delivery of the first pup

5 hours or less	5-10 hours	11-15 hours	Over 15 hours
9	42	34	15

Graph 4 Documented labor to delivery

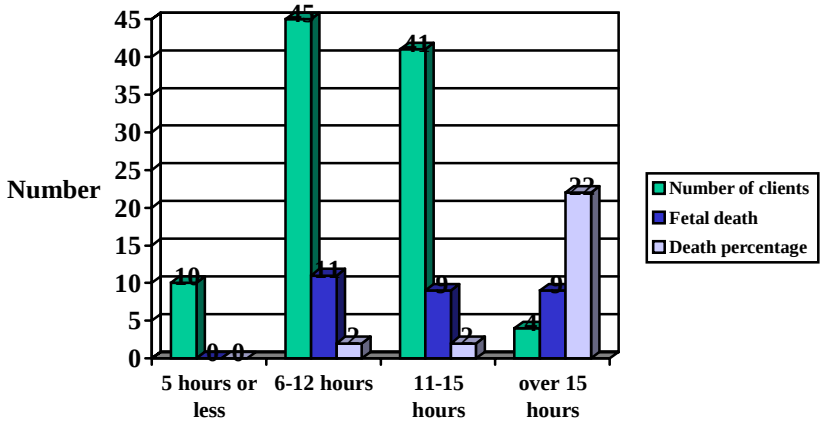


Detection of fetal distress

Fetal heart rate detection was accomplished by using a hand-held ultrasound Doppler. Heart rates were identified by geographic location with the bitch in a lateral recumbent position. While most owners were generally novice at the skill of heart rate detection those clients who practiced

the skill became exceptionally proficient in a short period of time. While some demise pups were not identified prior to delivery, the majority in compromise were identified giving the owner the choice to intervene with operative management if they chose. In many cases the owner did not elect to perform a cesarean section if only one pup was in distress. Other factors such as distance to veterinary facilities and rapid onset of distress precluded timely surgical intervention. Increased intrapartum deaths were noted with increased time in labor, once again confirming the correlation of increased length of labor and corresponding decline in fetal outcomes. (graph 5) Of particular note is the increased incidence of cesarean sections for failure to respond to Oxytocin dosing in cases where a prolonged prodromal phase of first stage labor was present. Veterinarians performing the cesarean sections on these cases anecdotally noted an exhausted myometrium. Additionally the incidence of fetal distress was considerably higher in cases when a prolonged prodromal labor occurred.

Graph 5: Hours in labor related to fetal death



Inertia

Inertia was measured as a decrease in the frequency, strength, or both, of the uterine contraction pattern. Inertia was detected in 56% of the cases. Proactive administration of Oxytocin to shorten first stage labor was utilized when inertia was confirmed by UCM, in cases where at least 10 hours of first stage labor had occurred regardless of whether deliveries had occurred. Micro-doses of Oxytocin were titrated to the contraction pattern, varying significantly with the traditional method of dosing Oxytocin based on weight of bitch. In many cases there was a prolonged period between deliveries, but the contraction pattern as detected by the monitoring equipment remained strong thus medication administration was contraindicated. Calcium (injectable, Calphosan, Calphosol or Calcium Gluconate 10%) was also used. In most cases calcium increased the inherent strength of the contractions while Oxytocin increased the frequency of contractions in most cases. Calcium use as a uterotonic has been documented in veterinary literature since 1947. [1,3] Administering Oxytocin when contractions are strong or administering it in excessive dose will potentially compromise fetuses because of the vascular

constriction to the placentas that occurs when the myometrium is constricted. Secondary fetal acidosis related to oxygen deprivation from either placental insufficiency or placental abruption is one of the primary causes of fetal loss related to parturition. [5,9,10,11] In this study the average TOTAL dose of Oxytocin titrated over the length of the whelping was 4 units, and 3cc's of injectable calcium.

Cesarean section rate, fetal mortality rate

Of the 100 whelpings a total of 776 pups were delivered with 29 pups lost, accordingly a 3.7% fetal mortality rate. A zero maternal mortality rate occurred. The fetal mortality rate is lower in this group than other studies using the uterine monitor, possibly due to a higher compliance level with this specific sample of clients. [3,11] The cesarean section rate was 16%. Reasons for cesarean were: fetal distress; 8 clients (50% of the clients needing a c-section), abnormal uterine contraction patterns; 6 clients (37.5% of the clients needing a c-section), failure to respond to meds/failure to progress; 2 clients (12.5% of the clients needing a c-section). In the group of abnormal contraction patterns the uterine monitor detected a uterine torsion, as well as 4 pups to large to pass through the pelvis or that were malpositioned. In the cases where an abnormal contraction pattern was noted uterotonic drugs were not administered.

Conclusion

As traditional veterinary medicine demonstrates, obstetrical management by primarily subjective means is the standard of care. The perceptions of temperature change as an accurate method to predict parturition has much potential for error. External uterine monitoring provides an objective, reliable predictor of parturition as well as providing the ability to proactively detect and manage problems. As demonstrated by this study, time from temperature nadir to delivery was not consistent; including 19% of the study population that never had a decrease of more than 1 degree from their baseline reading. Documented labor with the uterine monitor provided the best means for predicting parturition, with a consistent average of 12 hours from onset of labor to delivery of first pup. Labor symptoms were also not a reliable indicator.

Improved levels of care can be achieved in the absence of the external monitoring equipment by understanding that no whelping ever "goes by the book" and the importance of closely evaluating the process of parturition before intervening. Arbitrarily giving uterotonic drugs because the bitch has had a temperature drop and has symptoms of labor can be catastrophic if labor is either not present, or has not gone long enough to make the cervix soft enough to facilitate deliveries. Conversely, not intervening because there is the lack of temperature change or labor symptoms can also have an adverse effect. Optimal whelping management would include an assessment of the uterine contraction pattern and fetal heart rates prior to any intervention. Encouraging breeders to be proactive in their care of the bitch during whelping and obtaining the monitoring service may prove beneficial not only from a quality of life standpoint, but may also prove invaluable in the case of a problematic whelping.

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