CHALLENGES IN MANAGEMENT OF CANINE HIGH RISK PREGNANCIES WITH SINGLE PUP SYNDROME

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The practitioner today facing, with issues relative to successful management of high risk pregnancy in dogs with single pup syndrome. To prepare for normal whelping and align medical or surgical care in high risk pregnancy cases, it's mandatory to ensure that fetus has attained, but not exceeded, its maximal gestational age. Use of breeding dates alone does not provide these due dates with adequate accuracy. The need for proper breeding management or ovulation timing in management of high risk canine pregnancies with singleton fetus is emphasized.
Keywords: Canine, High risk pregnancy, Single pup.

High-risk pregnancies are those in which high incidence of maternal, fetal and/or perinatal morbidity or mortality is expected to be higher. A singleton litter is usually a high-risk pregnancy in dog. In singleton pregnancies, there may be inadequate cortisol release from the fetus to initiate prostaglandin F2α production by the endometrium which causes luteolysis, which in turn initiates parturition. Inadequate stimulus from a single fetus to initiate the parturition cascade result in extended duration of pregnancy and possible dystocia from relative fetal oversize and primary uterine inertia (Smith, 2007). Due to the zonary nature of the canine placenta, once a fetus exceeds its due date by more than 2 d, it will demand more nutritional support than the placenta is able to provide, resulting in intrauterine fetal death. Hence, it is critical to ensure that fetus has attained, but not exceeded, its maximal gestational age prior to delivery (Lopate, 2008). The goals of managing high-risk pregnancies from single pup are to optimize maternal, fetal and perinatal health, maintain lactation and maximize the survival of the pup. Fewer complications are related with planned cesarean section over unplanned, emergency cesareans (Smith, 2007). Progesterone receptor antagonist, aglepristone is capable in inducing parturition in dogs (Baan *et al*., 2008). Six case studies is signified in this paper to evaluate the innocuity of elective cesarean and medical induction with progesterone receptor antagonist, mifepristone in comparison to spontaneous whelping in dogs with single pup syndrome.

Materials and Methods

Case 1:

A German shepherd dog aged 2 ½ years with a history of a single breeding and with a serum progesterone concentration of 14.6 ng/ml on breeding date was confirmed pregnant on abdominal ultrasound examination with a singleton fetus on 32nd day of breeding. A radiographic examination on 56th day confirmed the single pup pregnancy and the ultrasound examination revealed a viable fetus with FHR of 232 beats/min. The estimated date of whelping calculated on the basis of fetal head diameter (HD) was 62nd day of mating. However, on 62nd day, there were no signs of impending parturition on vaginal examination with a sigmoidoscope or a temperature drop. The serum progesterone level (Mini Reader, Minitube) was still high (11.2 ng/ml) and the FHR on ultrasound examination was 248 beats/min (Fig.1). Medical induction of whelping was made with mifepristone @ 5mg/kg BW, twice daily orally. Following four doses of mifepristone, a viable pup weighing 490g was delivered without any assistance and the time interval for initiation of whelping following first dose of mifepristone was 49h. The pup was vigorous on 7th day of follow up.

Case 2:

A Rottweiler dog aged 3½ years with a history of breeding twice and with a single serum progesterone concentration of 7. 8 ng/ml on first breeding date was confirmed pregnant on abdominal ultrasound examination with two fetal sacs on 28nd day of last breeding. However, a radiographic examination on 55th day confirmed the single pup pregnancy and the ultrasound examination revealed a viable fetus with FHR of 216 bpm and resorption of other. There were no signs of impending parturition on vaginal examination with a sigmoidoscope or a temperature drop on 64th day of last breeding. FHR on ultrasound examination was 207 beats/min and medical induction of whelping was made with mifepristone @ 5mg/kg BW, twice daily orally. Following four doses of mifepristone, a viable pup weighing 525g was delivered without any assistance and the time interval for initiation of whelping following first dose of mifepristone was 44h.

Case 3:

A 3 ½ year old beagle bitch was presented as a failure to whelp on the expected day. The bitch had undergone serum progesterone measurement twice at the preceding season with a value indicative of ovulation in the second assessment. The ovulation date was identified as day 0 and a pregnancy confirmation was made on day 25 as a single pup with FHR of 241 beats /min, along with distended uterine loops having hypoechoic structures, reduced/ no fluid and absence of fetal heart beats suggestive of fetal resorption (Fig. 2). With no evidence of the onset of parturition on day 62, abdominal ultrasound examination confirmed a single pup with adequate FHR with occasional body movements and a radiographic examination established an over grown fetus. Serum progesterone concentration was 13.9 ng/ml indicating that parturition was not imminent. Dexamethasone @1mg/kg to promote lung surfactant production in the puppy was provided and an elective cesarean was planned the following day owing to the anatomy of the breed and the presence of a large single pup. An elective cesarean was performed under propofol induction and maintenance with isoflurane anesthesia with delivery of a single live healthy pup (340g). Both the dam and pup recovered well.

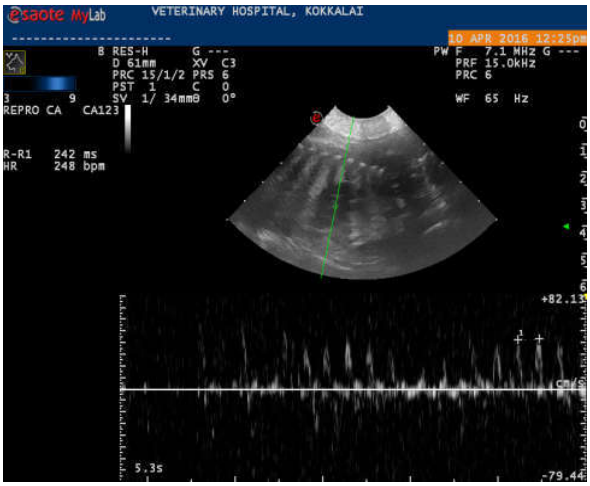

Fig (1): Pregnancy scan of single pup

Fig (2): Normal & Resorpting fetus

Case 4:

A 4 year old pug, pregnant with her third litter, bred twice 65 and 67 days back was presented for no initiation of labor signs. Progesterone concentration was not measured for breeding management. Radiographic examination revealed single, fully grown fetus and viability was confirmed by abdominal ultrasound (FHR-215bpm). Vaginoscopic examination revealed a closed cervix and the rectal temperature was 100.7^{0}F. Serum progesterone was analyzed as 2.5ng/ml. Dexamethasone@1mg/kg was given and an elective cesarean under propofol

induction and maintenance with isoflurane anesthesia was performed the next day which resulted in a live pup (245g) and a healthy dam.

Case 5:

A 4 ½ year old Labrador retriever with history of single breeding 66 days back was presented for no labor signs. Trans-abdominal ultrasound and radiographic examination confirmed a single, viable fetus (FHR-206 bpm). No sign of imminent parturition was evident on detailed gynecological examination and the rectal temperature was normal. Progesterone analysis was not performed as the owner declined it. The dog was again presented on 68th day of its breeding with a complaint of greenish discharge expressed 5 hours earlier and no straining. Ultrasound examination revealed a dead fetus which was then delivered with assistance by forceps following a medical management with dextrose, calcium and oxytocin.

Case 6:

A Rottweiler aged 5 years in its fourth gestation was diagnosed with fetal resorption on 27th day of breeding. Her 1st, 2nd and 3rd breeding dates were 68, 66 and 64 days back. Further ultrasound and radiographic examination on 47th day confirmed a single viable fetus. No sign of impending whelping was evident with respect to temperature dip or vaginoscopic examination. Progesterone estimation yielded a concentration of 14.8 and 6.4 ng/ml respectively on 66th and 67th day of last breeding. Abdominal ultrasound was performed on these days to confirm the viability and validate a FHR above 200bpm. A vaginoscopic examination performed the following day (68th day of last breeding) revealed an intact fetal sac in the anterior vagina, but without any straining efforts by dam. Medical management with dextrose, calcium and oxytocin was resorted to with delivery of a live fetus weighing 630g.

Table 1: Efficiency of different strategies undertaken in canine high risk pregnancy with single pup

Parameter	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Duration of pregnancy from first breeding to treatment / Planned C-Sec/ AW** (days)	62	64	62	67	66	67
Mean progesterone concentration at treatment / Planned C-Sec/ AW (ng/ml)	11.2	-	13.9*	2.5	-	6.4*
FHR before treatment/ Planned C-Sec/ AW (bpm)	248	207	236	215	Nil	224
Time of expulsion of pup from start of treatment	49h	44h	C-sec	C-sec	AW	AW
Viability of puppy after treatment/Planned C-Sec/ AW	Live	Live	Live	Live	Dead	Live

**Elective C-sec performed the following day ** AW: Assisted Whelping*

Results and Discussion

Successful delivery of healthy viable single fetuses in case 1 and 2 following medical induction with progesterone receptor antagonist, mifepristone was the outcome of timely intervention based on anticipating the fetal maturity based on progesterone estimation at breeding act suggestive of ovulation. Medical induction of parturition may be required in cases when the bitch's or the pups' health is under threat. However, the risk of whelping non-viable pups must be considered. Failure of the fetuses to complete maturation will result in their failure to survive postpartum. When timing of ovulation has occurred, it may be safe to induce parturition from day 58 post ovulation as also recorded by Louise (2012). A serum progesterone concentration of 14.6 ng/ml and 7. 8 ng/ml on the breeding dates in these dogs indicates ovulatory progesterone levels. Mifepristone induction has supplementary advantages like less maternal risk from surgery, increased cortisol secretion from partial blocking of pituitary glucocorticoid receptors and increased ACTH & thereby fetal lung maturation. Rise in prolactin secretion from an arrest of negative feedback

at hypothalamic level linked to progesterone, permitting lactation to occur faster as also reorted by Baan *et al*. (2008). But to overcome the drawback of fetal immaturity while scheduling parturition induction with mifepristone, determination of ovulation date might be the standard. In addition, the viability of the puppies in whelping induction with mifepristone can be improved with concomitant administration of PGF2α or uterotonic agents like oxytocin at initiation of delivery, which is likely to aid in rapid expulsion of puppies when uterotonics are employed than when mifepristone is used alone.

Well programmed and timely planned cesarean is effective in maximizing the neonatal survival as observed from the results of puppy survival in case 3 and 4. Fewer complications are associated with planned cesarean section over unplanned, emergency cesareans (as also mentioned by Smith (2007). Most elective cesarean sections are scheduled only after recording the first signs of parturition or until the progesterone level falls below 2 ng/ml, to avoid immaturity of the fetus as also reported by Rosset and Buff (2008). But in dogs with single pup, the decrease in pre partum progesterone is delayed due to inadequate hormonal stimulus. The determination of ovulation date helps in estimating the parturition date or scheduling the elective cesarean section in single pup syndrome. This helps to avoid a cesarean section being performed too early and to avoid prematurity of fetus. Also, cesarean section could be performed on an average of two days before the date of expected parturition, without any harmful consequence for the dam and the neonate as also narrated by Levy *et al.* (2008).

Once a fetus exceeds its due date by more than 2 d, it will demand more nutritional support than the placenta is able to provide, resulting in intrauterine fetal death as also mentioned by Lopate (2008). Also, bitches with singleton fetuses consequently have very large puppies predisposing to dystocia and primary uterine inertia as also recorded by Davidson (2014). The death of fetus in case 5 is attributable to these reasons while the successful delivery of live fetus in case 6 was the consequence of timely presentation of the dog for obstetrical aid and accurate determination of initiation of stage one of whelping by vaginoscopic examination followed with a therapeutic management.

In conclusion, the present case studies established that the incidence of stillbirths in canine pregnancy with single fetus is fairly high, substantiating the need to determine procedures to save them. Well programmed and timely planned cesarean section is effective in maximizing neonatal survival, as observed from the results of this study. However, in dogs with single pup, the decrease in pre partum progesterone is insignificant in planning the cesarean. The safety and dependability of medical induction of whelping with mifepristone as an appropriate management modality to be practiced in whelping management of high risk pregnancy with single pup syndrome, optimizing the outcome of the dam and the neonate was determined in these case studies. Nevertheless, determination of ovulation date might be the norm in planning the cesarean as well as parturition induction with mifepristone without affecting the fetal maturity.

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