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Haematology profile of dogs with primary uterine inertia#

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Abstract

Primary uterine inertia is the inherent inability of the uterus to contract and expel a fully grown foetus after the end of the gestation period, through a normal birth canal, in the absence of obstructive dystocia.There are conflicting reports regarding the blood parameters in parturient animals,and animals with dystocia and its role in uterine inertia are not well documented. Haematology analysis was performed in dogs with Complete Primary Uterine Inertia (CPUI, n=9) and Partial Primary Uterine Inertia (PPUI, n=6), as well as control animals with the Foetal Cause of Dystocia (FCD, n=7).Blood samples were collected from the study population and total leucocyte count (TLC), total erythrocyte count (TEC), differential leucocyte count (DLC), erythrocytic indices, haemoglobin and haematocrit values were estimated in an autoanalyzer. Haematology analysis revealed no significant difference between the groups. Differential leucocyte counts exhibited lymphocytosis across the groups suggestive of the active immune response related to CL lysis,a characteristic associated with the termination of the pregnancy in canines. Erythrocyte count, haemoglobin concentration and haematocrit revealed anaemia across the group.The study characterised the haematology profile of prepartum canines, which indicated anaemia associated with haemodilution and lymphocytosis associated with active immune status. It also proved that the haematology profile doesnot have any significant role in the pathogenesis of canine uterine inertia.

Keywords: *Haematology profile, uterine inertia, canine, dystocia*

Dystocia or difficult birth is an emergency condition in small animals which if not managed properly can result in foetal loss as well as loss of the breeding females. Nearly 60 to 80 per cent of dystocia end up in Caesarean (Suprith *et al*., 2020). As pet breeding is increasing year after year the problems faced by the pet breeders need to be addressed. Among all the causes of dystocia, maternal cause in which contribution of uterine inertia is 14 to 49 per cent (Egloff *et al*.,2020). Uterine inertia is the inherent inability of the uterus to contract and expel a fully grown foetus after the end of the gestation period, through a normal birth canal, in the absence of obstructive dystocia (Johnston *et al.,* 2001).

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The origin of uterine inertia is multifactorial in nature. Haematology parameters can provide some insight into the physiology as well as the pathology involved in this condition. Authors have reported that the development of anaemia in late gestation is normal in dogs (Concannon *et al*., 1977; Johnston *et al*., 2001).While some believes that the haematocrits should remain in the normal reference range and dogs with anaemia should be investigated for other diseases (Dimco *et al.,* 2013; de Cramer *et al.,* 2016; Arlt, 2020). There are reports of inflammatory agents, cytokines and inflammatory system in general; playing a major role in lysis of corpus luteum and uterine contraction development (Zatta *et al*., 2017). A positive clinical outcome can be expected once the obstetrician has an understanding of the haematology profile in dogs suffering from different causes of dystocia. In view of the above observations, the present study was designed to evaluate the haematological profile of animals with uterine inertia and foetal cause of dystocia.

Materials and methods

The study population consisted of healthy female dogs of small to medium-sized breeds (Beagle, Golden retriever, Bully and Labrador Retriever) weighing between 15-35 Kg with litter size more than 3 and parity at least one. Female dogs presented at Teaching Veterinary Clinical Complex, Mannuthy and University Veterinary Hospital, Kokkalai with signs of the prolonged first or second stage of labour were considered for the study.

On presentation of cases, the history was collected with respect to age, parity, nature of previous whelping, incidence of dystocia, medicines administered and surgeries performed. Animals aged between 16 months to 6 years were included in the study population. Breeding dates and expected date of whelping were recorded. Information on behavioural aspects of whelping such as pawing, anorexia, lethargy and nesting behaviour was gathered. The presence of green discharge, copious white discharge or presentation of water bag was considered as the initiation of the second stage of whelping (Pretzer, 2008).

The body temperature, resting heart rate, respiratory rate, colour of mucous membranes and bodyweight of the animal were recorded. Vaginoscopic examination of the birth canal was performed using a fibreoptic vaginoscope/ Sigmoidoscopes (Welch Allyn®, Skaneateles Falls, NY), after lubricating with obstetric cream and the status of cervical relaxation was noted down, to ensure the initiation of the second stage of labour.

Transabdominal B mode scanning was performed (Esaote My Lab X8, Genova, Italy Giannico *et al*., 2015) using electronic convex and linear multifrequency transducers ranging from 2.5 to 14.0 MHz frequencies, according to the size of the animal. Biparietal diameter (BPD) was measured (Lorigados and Pinto, 2013) and gestational age was calculated to ensure foetal maturity. Foetal heart rate was detected to evaluate the degree of foetal stress. From evaluation, all the animals which have completed the gestational age as per breeding date, BPD, and foetal heart rates above 180 bpm indicating the absence of extreme foetal stress were selected for the study.

Dogs that initiated the second stage of labour, as indicated by green discharge from marginal haematoma, the discharge of foetal fluids, or open relaxed cervix with gestational sacs expressed on vaginoscopy were selected for the study. Dogs were divided into three groups based on the criteria of uterine inertia by Bergstrom *et al.* (2010) and Tamminen *et al.* (2019). Dogs without any straining even after four hours of green discharge or copious mucoid vaginal discharge and failed to expel a puppy was considered as complete primary uterine inertia (CPUI, n = 9). Dogs that had expelled at least one foetus and a delay of two hours without any progress of labour, without foetal obstruction were considered as the partial primary uterine inertia (PPUI, n = 6).Dogs with no progress of labour due to an oversized/ malpresented foetus, or foeto-maternal disproportion, with active uterine contractions, were grouped as the foetal cause of dystocia (FCD, n = 7) and taken as control animals.

Blood samples were collected in EDTA vials (Ultimate moulds and products, Thrissur, Kerala) from all the experimental

dogs, and total leucocyte count (TLC), total erythrocyte count (TEC), differential leucocyte count (DLC), erythrocytic indices, haemoglobin and haematocrit values were estimated in an autoanalyzer (Mythic18 Vet, Orphee, Geneva, Switzerland). Data was analysed using univariate ANOVA with Fishers LSD as the post hoc test.

Results and discussion

Leucocyte count in the dogs with dystocia did not reveal any abnormality. Comparison of WBC count revealed no significant difference (P>0.05) between the three groups. The values ranged from 11.51 x 10^3/µL in CPUI to 13.68 x 10^3/µL in PPUI and 13.23 ± 2.28 x 10^3/µL in FCD. (Table. 1)

White blood cell concentration was in the normal range (5.0 -14.1 x 10^3/µL) in FCD, CPUI and PPUI as per Cynthia, 2010. There was no significant difference (P>0.05) in WBC count between FCD, CPUI and PPUI groups (Table 1). Doxey (1966) and Kimberely *et al.* (2006) reported higher WBC count in the advanced stage of gestation but it was not increased beyond the normal reference range. A similar observation was made in the present study where all the groups exhibited a leucocyte count close to the higher margin of the reference range. Frehner *et al*. (2018) reported a WBC count of 14.5 ± 3.6 x10^3/µL in uterine inertia as well as obstetric dystocia cases, which was close to the observations recorded in the present study. This high leukocyte count could be associated with the inflammatory environment at the time of parturition, characterized by decreased progesterone and increased cortisol and prostaglandins concentrations. (Dimco *et al.,* 2013; Frehner *et al.,* 2018).

Differential leucocyte counts revealed lymphocytosis in all the groups, the normal range was 8-21 per cent. In CPUI, PPUI and FCD it was higher than the normal range. (Table. 1). There was no significant difference between groups in the differential count of lymphocytes(P>0.05). The result of the present study disagreed with the findings of Dimco *et al.* (2013) who observed lymphopaenia in pregnant dogs attributed it to physiological stress. However Shravya *et al*. (2018) observed a similar lymphocytosis in bitches with dystocia which were subjected to caesarean. Lymphocytosis could be due to the immune response created against the corpus luteum in active CL lysis associated with periparturient luteolysis which involves different cytokines and lymphokines (Zatta *et al*., 2017).

Differential monocyte count was within the normal range (2-10 %) for the species in all the groups. Differential monocyte count in CPUI, PPUI and FCD groups was 7.00 ± 0.81, 6.74 ± 1.35 and 8.13 ± 0.89 per cent respectively. The differential count of monocytes did not reveal any significant difference between the groups. Frehner *et al.* (2018) and Dimco *et al.* (2013) observed a monocyte count of 6.5 per cent and 5.1 per cent , respectively in pregnant dogs.

Differential granulocyte count was within the normal range (58-85 %) in CPUI

Table 1. Complete blood count of dogs affected with uterine inertia

Variables	Normal values (Cynthia, 2010)	CPUI n = 9	PPUI n = 6	FCD n = 7	F-value (P-value)
WBC 10^3/µL	5-14.1	11.51 ± 0.80	13.68 ± 1.90	13.23 ± 2.28	0.586^{ns} (0.567)
LYM (per cent)	8-21	30.76 ± 3.05	26.92 ± 4.68	27.67 ± 5.37	0.258^{ns} (0.776)
MON (per cent)	2-10	7.00 ± 0.81	6.74 ± 1.35	8.13 ± 0.89	0.514^{ns} (0.607)
GRA (per cent)	58-85	62.24 ± 3.64	54.98 ± 12.14	64.28 ± 5.80	0.45^{ns} (0.645)
RBC 10^6/µL	4.95-7.87	4.71 ± 0.20	4.72 ± 0.25	4.84 ± 0.32	0.073^{ns} (0.93)
Hb g/dL	11.9-18.9	10.33 ± 0.56	10.22 ± 0.58	10.83 ± 0.96	0.189^{ns} (0.829)
HCT (vprc)	35-57	31.22 ± 1.65	29.62 ± 1.62	30.72 ± 2.32	0.172^{ns} (0.844)
PLT 10^3/µL	211-621	314.11 ± 49.01	278.2 ± 37.43	383.17±71.35	0.776^{ns} (0.476)

Non-Significant (P>0.05), CPUI- Complete Primary Uterine Inertia, PPUI- Partial Primary Uterine Inertia, FCD- Foetal Cause of Dystocia

(62.24 ± 3.64 %) and FCD groups (64.28 ± 5.80 %) whereas it was lower than the normal range in the PPUI group (54.98 ± 12.14 %). However, no significant difference was detected between CPUI, PPUI and FCD groups. This finding disagreed with the observations of Dimco *et al.* (2013) and Frehner *et al.* (2018), who observed granulocytosis and attributed it to the inflammatory environment associated with the pregnancy and reduced progesterone concentration.

The RBC count in CPUI, PPUI and FCD group was 4.71 ± 0.20 x 10^6/µL, 4.72 ± 0.25 x 10^6/µL and 4.84 ± 0.32 x 10^6/µL, respectively. All the values were marginally lower than the average value of the RBC count for the canine species (4.95-7.87 x 10^6/µL). There was no significant difference in RBC count between the groups (P>0.05)(Table.1). Pregnancy associated anaemia has been reported by Doxey (1966) Tietz *et al*. (1967) Concannon (1986) and Kimberely *et al. (*2006). The reason for this anaemia was attributed to haemodilution associated with fetomaternal circulation, as observed by Concannon (1986), Verstegen-Onclin and Verstegen (2008), and Frehner *et al*. (2018)

Haematocrit is the ratio of the volume of red blood cells to the total volume of blood. Haematocrit values did not differ significantly between the groups (P>0.05). The lowest haematocrit value was for partial primary uterine inertia (29.62 ± 1.62 %) and the highest value was for complete uterine inertia dogs (31.22 ± 1.65 %). All the haematocrit values were marginally lower than the average value for the species (35-57 %).

Haemoglobin concentration didn't differ significantly between the groups (P>0.05). The highest percentage of haemoglobin was in the FCD (10.83 ± 0.96 g/dL) and the lowest was in PPUI (10.22 ± 0.58 g/dL). In CPUI the haemoglobin concentration was 10.33 ± 0.56 g/dL. In all the three groups haemoglobin concentration was lower than the normal range (11.9-18.9 g/dL).

The reduction in haemoglobin and haematocrit associated with pregnancy has been reported by Doxey (1966), Tietz *et al.* (1967), Concannon (1986) and Kimberely *et al.* (2006). De Cramer *et al*. (2016) and Frehner *et al*. (2018) reported mean haematocrit values as 44.2 ± 4.2 and 45.3 ± 5.9 per cent respectively, and were in the lower reference range for the canines. However in the present study, the haematocrit values were much lower than the reported values. A relative reduction associated with pregnancy can be attributed to fetomaternal circulation linked haemodilution, as reported by Concannon (1986), Verstegen-Onclin and Verstegen (2008), and Frehner *et al*. (2018)

Frehner *et al*. (2018) reported haemoglobin values 15.3 ± 1.9 g/dL, which was higher than the present study. Kimura and Kotani (2018) reported a reduction in the haematocrit and haemoglobin values in pregnant bitches. On the other hand de Crammer *et al*. (2018) demonstrated that haematocrit values in the pregnant dogs were on the lower margin of the reference range and stated that there was no true anaemia associated with pregnancy and anaemias associated with pregnancy should be investigated for other reasons.

In all the groups the platelet count was within normal reference range for the species (211-621 x 10^3/µL). Platelet count did not differ significantly between the groups (P>0.05). The platelet count was in descending order in FCD (383.17 ± 71.35 x 10^3/µL), CPUI (314.11 ± 49.01 x10^3/µL) and PPUI (278.2 ± 37.43 x 10^3/µL). Thrombocytosis has been reported by many researchers in periparturient animals (Kimberely *et al*., 2006; Mattoso *et al.,* 2013; Kimura and Kotani, 2018). Frehner *et al.* (2018) reported an average platelet count of 460 ± 86 (range-292–568) (x10^3/µl), which was higher but was within the normal reference range. The present study agreed with this report, where there was a higher platelet count but within the normal reference range. Frehner *et al.* (2018) concluded that haematology changes in WBC, differential count, RBC and Platelet count are normally encountered in the haematology profile of free whelping dogs, thereby implying that dystocia has no further effect on them as long as the bitches are healthy.

Conclusion

The haematology profile between the dystocic dogs with primary uterine inertia and foetal cause was without significant variance. The WBC count and differential count except lymphocyte count was in the normal range across the group. Differential count exhibited lymphocytosis across the different groups suggestive of an active immune response related to CL lysis and termination of pregnancy characteristic of canines. RBC count, Haemoglobin concentration and Haematocrit revealed anaemia across the group which is characteristic of the pregnancy-associated haemodilution due to foetal circulation excess fluids.The study characterised the haematology profile of prepartum canines, which indicated anaemia associated with haemodilution and lymphocytosis associated with active immune status. These findings in the haematology profile of spontaneous whelping healthy dogs as well as dogs with dystocia, does not have any influencing role in canine uterine inertia.

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Conflict of interest

The authors declare that they have no conflict of interest.

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