Original Research

Prediction of Gestational Age in Bitches by Ultrasonic Measurement of Placental Thickness

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Abstract

The objective of the present study was to predict gestational age of female dogs by real time ultrasonography using measurements of placental thickness, evaluating the correlation between observed and calculated gestational age as well as the accuracy of placental thickness measurement (Biometry) with fetal morphologic parameters in bitches. Bitches were divided into 3 groups, small, medium and large and total 30 bitches were taken and examined at 20-30 days, 30-40, 40-50 and 50-60 days interval. Gestational age was calculated by using gestational equations derived from the linear regression analysis. The expression that presents the best correlation coefficient and explanation for thickness of placenta "Y= 0.021x-0.314". Results clearly demonstrated that biometric parameter placental thickness significantly ($p<0.05$) correlated with gestational age ($r =0.973$) and was a reliable index to predict gestational age in bitches.

Key words: Bitch, Correlation, Gestational Age, Placental Thickness, Ultrasound

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Introduction

An accurate method of predicting the date of parturition in the bitch is clinically useful to minimize or prevent reproductive losses by timely intervention. Ultrasonography is one of the modern diagnostic tools to detect reproductive tract status of canines. It is gaining popularity as it is quick, reliable and safe to make early pregnancy diagnosis possible besides permitting an assessment of the viability and growth rate of fetuses at the same time (Qazi Mudasir Javeid *et al*., 2013). The major problem in accurately determining the day of whelping from last mating is non-co-ordination with internal endocrine events such as LH surge. Hence gestational length varies from 63 ± 7 days from mating. Foetal age, which can be used to predict

parturition dates, can be estimated with reasonable degree of precision from foetal measurements made by scanning with modern ultrasound machine. The echobiometry is an important technique to study gestational structures and anatomical assessment of the fetuses throughout development and not just for predicting gestational age (Miranda *et al.*, 2010). In addition, it is the most sensitive and specific method in the evaluation of gestational age (Feliciano *et al*., 2015).

The placenta is the first fetal organ to develop and has primordial and critical functions. It mediates implantation and establishes an interface for the exchange of nutrients and gas in the maternal-fetal circulation, affecting the local immunological mediators, the maternal cardiovascular system, and metabolic functions (Cross, 2005). The thickness of the placenta may assist in the diagnosis of gestational age in large bitches (Maldonado, 2002). The objective of this study was to verify if the evaluation of placental thickness by ultrasound correlates with gestational age in bitches of different breeds and sizes and to evaluate preciseness of the measurement of placental thickness (biometry) with fetal morphological parameters.

Materials and Methods

A study was conducted in 30 pregnant bitches including several breeds, age and parity at TVCC, College of Veterinary Science and Animal Husbandry, OUAT, Bhubaneswar. Bitches were divided into three groups, based on body weight: small (5-15kg) medium (15-25Kg) and large-sized (25-35 Kg). Small size breed i.e. (Pug, Spitz), medium size like (Labrador, Rotwiller, Germansephard) and Large sized breed like (Sentbernard and Greatdane) were selected for this research purpose. Pregnancies were evaluated and placental thickness was measured by ultrasound examination starting from 20 days upto 60 days of gestation (20-30, 30-40, 40-50 and 50-60 days). Each bitch was evaluated four times at 10 days interval.

All examinations were performed after clipping the hair from the umbilical scar to pubis. The bitches were fastened for at least four hours for better visibility. Bitches were evaluated in dorsal, right and left lateral recumbency. Ultrasonic assessment of the placental thickness was performed in a longitudinal view perpendicular to the placenta's plane, next to its central area, measuring the outer layer by the help of a Prosound alpha- 6LT ultrasound unit with a multi- frequency convex probe of 3-10 MHz. The data were subjected to linear regression analysis and correlation. The linear expression of curves adjustment with the formula (Y= 0.021x-0.314), was used for calculation of gestational age, in which "Y" represents the placental thickness (cm) and "x" the gestational age (days).This linear expression was applied for all measurements in three body weight groups and was correlated with the gestational age reported by owners using SPSS version 10. The level of significance was studied at 95% level.

Results and Discussion

Placental thickness of 30 bitches were evaluated, of which 10 (33.33%) were of small size breeds, 10 (33.33%) of medium size and 10 (33.33%) of large size breeds. Mean ± SE of placental thickness at

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different stage of gestation period of all bitches is presented in the Table 1. At 20-30 days and 40-50 days of gestation period the placental thickness varied significantly (P<0.05) between small, medium and large sized breeds.

Table 1: Mean ± SE of placental thickness (cm) at different stage of gestation period

Gestational age (days)	20-30(days)	30-40(days)	40-50(days)	50-60(days)
Small size breed	0.335^{a}±0.007	0.420^{a}±0.004	0.637^{a}±0.005	0.845±0.009
Medium size breed	0.345^{ab}±0.005	0.440^{b}±0.005	0.650^{ab}±0.007	0.849±0.008
Large size breed	0.366^{b}±0.004	0.454^{b}±0.004	0.671^{b}±0.004	0.864±0.006
Total(30)	0.348±0.004	0.438±0.003	0.652±0.004	0.852±0.0.004

**Means with different super scripts differ significantly (p< 0.05)*

However at 30-40 days of gestation period there was no significant difference between the medium and large sized breeds of dogs, but the placental thickness varied significantly (p< 0.05) between small and medium sized breeds. At 50-60 days of gestation period no significant difference was found between different breeds of dogs with respect to placental thickness. The relationships between gestational age reported by owners and gestational age calculated by the linear expression (Y= 0.021x-0.314) and their respective " r" values are shown in Table 2. There was a significant positive correlation (P< 0.01) between observed and calculated gestational age in all stages of gestation.

The calculated gestation period using the linear expression formula (Y= 0.021x-0.314) according to (Maldonado *et al*., 2012) has shown the similar trend of variation in placental thickness at different gestation period as reported by the owner which has been described earlier in Table 1.Mean ± SE of Total observed gestational age is 41.83 ± 0.99 and calculated gestational age 42.24 ± 0.86, highly correlated (r= 0.973**) at 0.01 level.

Table 2: Mean ± SE of observational and calculated gestational age

Gestational Age (Days)		Small	Medium	Large	Total
20-30 days	**Obs**	27 ± 0.557	26.8 ± 0.592	28.6 ± 0.498	27.466 ± 0.341
	Calc	30.90^{a}±0.342	31.38^{ab}±0.238	32.38^{b}±0.226	31.55±0.190
r value	-	-	-	-	**0.730****
30-40 Days	**Obs**	36.3 ±0.422	37.0 ± 0.516	38.2 ± 0.611	37.16 ± 0.325
	Calc	34.95^{a}±0.223	35.90^{b}±0.274	36.57^{b}±0.215	35.80±0.181
r value	-	-	-	-	**0.675****
40-50 days	**Obs**	45.6 ±0.805	46.6 ± 0.896	47.7 ± 0.514	46.6 ± 0.451
	Calc	45.28^{a}±0.284	45.90^{ab}±0.347	46.90^{b}±0.218	46.03±0.202
r value	-	-	-	-	**0.669****
50-60 days	**Obs**	56.3 ±0.989	56.2 ± 0.553	55.9 ± 0.936	56.1 ± 0.474
	Calc	55.19±0.455	55.38±0.391	56.09±0.311	55.55±0.229
r value	-	-	-	-	**0.760****

**Means with different super scripts differ significantly (p< 0.05)*

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Discussion

From this study it is observed that the linear curves adjustments are applicable to bitches of different breeds and sizes. According to Maldonado *et al*. (2012) placental thickness is a significant parameter in the determination of gestational age, using the linear expression- (Y= 0.021x-0.314). The majority of the bitches used in this study had large number of litters, so that several measurements were taken for observation of homogeneity within each litter, with regard to the evaluated placental thickness.

Parameters usually studied within the period from 20-30 days are gestational sac, foetal adhered to the dorsal gestational sac, heart rate and jaw mineralization (Zambelli *et al*., 2006 and Miglino *et al*., 2006). It was found that within this period, placental thickness would measure an average of 0.348 cm and, therefore would refer to 31.5 days of pregnancy, according to the linear equation. Within 30-40 days period of observation, different foetal parameters are visualization of ribs, thoracic, lumbar and cervical spine and head. As there was significant correlation between the observed and calculated gestational age, hence the linear expression equation Y= 0.021x-0.314 can successfully applied for calculation of gestational length using the measured placental diameter through ultrasonography.

Conclusion

It is concluded that it is possible to determine the gestational age with regard to placental thickness measured by ultrasound in bitches of different breeds and sizes. Evaluation of gestational age by placental biometry showed satisfactory precisions with regard to fetal morphological parameters and showed high degree of correlation with gestational age.

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