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ASPECTS OF ULTRASONOGRAPHIC DIAGNOSTICS OF PREGNANCY IN CATS DEPENDING ON THE COURSE OF REPRODUCTIVE CYCLE

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Summary

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The aim of the present study was to follow up the potential of routine ultrasonographic diagnostics of pregnancy in cats depending on the course of oestrus and the mating. The experiments were performed on 22 cats and the data were collected from a total of 31 oestral cycles and 26 confirmed pregnancies. Pregnancy was detected using transabdominal ultrasonography with an Aloca-SSD 500 equipment and a linear 5 MHz probe. Depending on the reproductive cycle, the animals were divided into 2 groups. The first group included 17 cats with diagnosed pregnancy by the 25th day of the beginning of the oestrus. The second group included 5 cats where the diagnosis pregnancy was preceded by 2 oestruses. Our studies indicated that the course of the oestrus influenced considerably the precision of ultrasonographic diagnostics of pregnancy in cats. In 92.3% of all cases, the first observed copulation could be accepted as the beginning of pregnancy, in 88.4 % - the first mating during the last observed oestrus. In 8% of cases, the time interval between the beginning of gestation and the last mating was shorter compared to the period from the first mating to fertilization.

Key words: cat, oestrus, pregnancy, ultrasonography

INTRODUCTION

Unlike other domestic animal species, the studies on ultrasonographic diagnostics of pregnancy in cats are few (Zammbelli *et al.*, 2004). Its detection is only possible after observing the gestation sacs and heart activity of the foetuses. In practice, where the commonly used ultrasonic probes are with frequency of 5 and 7.5 MHz. this is possible between gestation days 20 and 25 (Leidl, 1993), 24 and 25 (Kahn *et al.*, 1990), or 18 and 25 (Verstegen *et al.*, 1993). In bitches, the ovulation does not occur at a definite moment and thus, the discrepancy between the previously calculated and the real beginning of the pregnancy is not uncommon. However, the data about possible mismatch between the beginning of pregnancy, the oestrus and the mating in cats are scarce (Jantur, 1998). When determining the terms, the various authors have considered the physiological features of the reproductive cycle in cats and particularly, the postcoital ovulation in this spe-

cies (Verhage *et al.*, 1976; Shille *et al.*, 1979; Arnold, 2003) so the first mating for each oestrus has been accepted as beginning of the pregnancy. The more recent studies have determined the correlation between the ultrasound-aided visualization of various foetal and extrafoetal structures (Zambelli *et al.*, 2002a), their dimensions and gestational age (Zambelli *et al.*, 2002b; Zambelli *et al.*, 2004).

The cat is a seasonal polyoestral animal. The heat is accompanied by typical sexual behaviour, described by different authors (Shille *et al.*, 1979; Wildt *et al.*, 1981; Schmidt *et al.*, 1983) and observed by us as well. During the oestrus, the cats are restless, with increased locomotor activity, typical purring and vocalization, rolling on their backs, seeking contact with males, lordosis, carrying the tail to one side. The females become sexually receptive. With time and end of estrus, the receptivity of females suddenly disappears.

In practice, determination of the oestrus and the duration of gestation in cats is difficult. Most commonly the data referring to oestrus and mating are not precise and complete (Grunert, 1993). Unlike the bitches, during the heats domestic cats often leave the home and return back after they end. In other cases, when pedigree animals are bred, the matings are controlled by owners and yet, contradictory information is not uncommon. In our daily clinical practice and during preliminary studies, in some instances the ultrasonographic findings in pregnancy detection do not correspond to the beginning of the oestral period.

Having analysed the data from various sources, Shirley *et al.*, (2001) summarized that the pregnancy in the cat could last from 52 to 74 days depending on whether it was calculated from the first or last observed mating.

Summarizing the cited data, they are to a certain extent inconsistent and mutually incompatible. It therefore imposes the need for an additional particularization of the various means for diagnostics of feline pregnancy, including echography. With this connection the principal aim of the present study was to compare ultrasonography with two accessible practical parameters: beginning and end of the oestrus, limited by the behaviour and the sexual receptivity of female cats during this period.

MATERIALS AND METHODS

The study was performed on a total number of 22 female and 3 male European shorthair cats. The age of animals was from 11 months to 8 years and the weight – from 2.8 to 4 kg. The cats were housed in the hospital of the Department of Obstetrics, Gynaecology and Andrology at the Faculty of Veterinary Medicine, Trakia University between September 2000 and April 2003. All cats were clinically healthy, without history of previous gynaecological diseases. By the beginning of the study, 11 cats have given birth. The animals were housed under natural light regimen in 2 unheated premises (separate for males and females), each with an area of 24 m^2, natural air exchange via a semi-open window of 2 × 1.5 m for each premise. The cats were fed once daily with a commercial dry food and had a free access to drinking water. All cats were numbered and registered in a diary.

Data were obtained from a total of 31 spontaneous oestruses and 26 diagnosed pregnancies. Every day, for two hours, females were allowed a contact with tomcats. The changes in the behaviour were observed. During the oestrus, the females

were mated. The beginning and end of each oestrus, were determined by the first (accepted as day 0) and the last copulation were registered.

The pregnancy was detected using a transabdominal echography performed 25 days after the first mating for each oestrus with an ALOCA SSD 500 Micrus, Japan equipment and linear 5 MHz transducer. The pregnancy was detected after visualization of gestation sacs and embryos and detection of cardiac function. The obtained data were statistically processed using the Microsoft Office Excel 2003 software (mean and standard error of the mean). The average values between groups were compared by Student's t-criterion. The results are given as mean ± SD. They were considered statistically significant at $P \leq 0.05$.

RESULTS

Depending on the course of the oestrus, the animals were divided into 2 groups (Table 1).

The first group included 17 cats with a total of 21 oestruses and as many pregnancies. The average duration of the oestrus in this group was 4.19±1.44 days ($P<0.001$). The ultrasonography performed 25 days after the first copulation, detected pregnancy in all cats. The average time interval between the last copulation and the detection of pregnancy in this group was 19.8±1.17 days ($P<0.001$).

The second group included 5 cats in which the diagnosis of pregnancy was preceded by 2 oestral cycles. During the pause between both cycles, the cats did not show behavioural changes and were not receptive to males. In 3 cats (subgroup A), pregnancy was detected 25 days after the first observed copulation during the first oestrus. In the other 2 cats (subgroup B), pregnancy was diagnosed 25 days after the first copulation during the second oestrus. The average time interval between the first and the last copulation in this group was 16.8±5.4 ($P \leq 0.01$). The difference between groups I and II concerning this parameter was statistically significant ($P \leq 0.05$).

The average time interval between the last copulation and the detection of pregnancy in the animals from group II was 13.2±4.96 days ($P \leq 0.05$). The difference between groups was not significant ($P>0.05$).

Table 2 presents various time intervals referring to the course of oestral cycles, mating and the detection of pregnancies in both groups.

In all cases, cats were bred when in oestrus. The period between the first and last copulation in group I was practically corresponding to the duration of clinically

Table 1. Results of ultrasonographies in cats

Groups of cats		n	$n^{\S}$	$n^{\S\S}$	Ultrasonographic findings I	II
First group		17	21	21	pregnancy	•
Second group	subgroup A	3	6	3	pregnancy	••
	subgroup B	2	4	2	negative	pregnancy

n=number of studied animals; $n^{\S}$=number of observed oestruses; $n^{\S\S}$=number of diagnozed pregnancies; I – 25th day after the first copulation; II – 25th day after the first copulation during the second oestrus; • in the animals from this group, only one oetrus was observed prior to the diagnostics of pregnancy, •• after the detection of pregnancy, a repeated study was not performed.

Table 2. Periods and time intervals referring to oestrus course, observed matings and the detection of pregnancies in animals from both groups (mean ± SD)

Groups		Period, days				
		I	II	III	IV	V
First group (n=21)		25	–	4.19±1.44 a	19.8±1.17 b	-
Second group	Subgroup A	25	8	16.8±5.4*a	13.2±4.96*b	14
	n=3	25	5			15
		25	17			3
	Subgroup B	35	6			25
	n= 2	40	4			25

I – individual time interval between first copulation and detection of pregnancy; II – individual time interval between the first and second oestrus; III – mean time interval between the first and the last copulation; IV – mean time interval between last copulation and detection of pregnancy; V – individual time interval between the first copulation during the 2nd oestrus and the detection of pregnancy; n – number of diagnozed pregnancies in the respective group and subgroup; * means for the 2nd group; the mean values marked with equal letters are statistically significantly different at P≤ 0.05.

evident oestrus. For the second group of cats, this parameter included the duration of the two oestruses and the interval between them.

DISCUSSION

The data from the present experiment show, for the first time, the relationship between the beginning and the end of oestrus and the ultrasonographic diagnosis of pregnancy in the cat. The maximum simplicity of the experimental design contributed to the practical relevance of data, especially when mating continued up to the end of the oestral period.

The detection of pregnancy in cats from the first group, 25 days after the first copulation showed that the ovulation and fertilization in these animals occurred in the beginning of the oestrus. The average duration of oestrus in cats varies from 4 to 6 days (Root *et al.*, 1995) so it could be assumed that for group I, this parameter was within the normal range. As the time from the first copulation of the second oestrus to the detection of pregnancy in subgroup A was very short in the 3 individual cats, 3, 14, 15 days respectively, it was obvious that the oestrus has occurred during pregnancy. This could be possibly due to superfoetation (Hoogeweg & Folkers, 1970), but practically, it is very hard to be proved. There are also reports for cases when the oestral signs during pregnancy were not related to follicular growth and elevated oestrogen concentrations (Tsutsui & Stabenfeldt, 1993).

Most probably, the first oestrus in cats from subgroup B was not fertile. This is not surprising, because Swanson *et al.*, (1994) reported that in natural oestrus and breeding, about 10% of cats did not ovulate and in 20% - no fertilization occurred. If during the oestrus, no ovulation was present, the formed Graafian follicles degenerate within a week (Wild & Seager 1980), and the next oestrus takes place after 5–16 days (Christiansen, 1984). This a characteristic feature distinguishing the reproductive cycle of the cat from that of the bitch. In practice, the pause between two oestruses could not be perceived especially when it is shorter, as in one of our

experimental cats – 4 days. Thus, the supposed duration of the oestrus includes the period from the first to the last observed copulation at all. The observed bigger duration of this period in animals from group II (Table 2) shows that this could be a marker for a certain deviation necessitating a later confirmation of the negative finding of the first examination. Our results showed that if pregnancy was detected during the second examination, performed 20 days after the end of the oestrus, this indicated a second oestrus that was really the fertile one.

The analysis of our data showed a lack of statistically significant difference concerning the time interval from the last copulation to the detection of pregnancy between the animals from groups I and II. The examination performed on the 20th day after the last copulation usually guarantees the detection of gestation in all cases. This could be considered in order to avoid the untimely examination especially in cases of bad-tempered or nervous patients in order to prevent unnecessary stress and at the same time, to facilitate both owners and veterinarians. In these cases however, additional parameters have to be specified: the way of visualization and dimensions of various foetal and extrafoetal structures.

If the first observed copulation is accepted as beginning of pregnancy in our study, it was true for 24 (92.3%) of diagnosed pregnancies and if this is the first copulation of the second oestrus – 23 (88.4%). In two cases or 8% of diagnosed gravid states, the negative findings by the 25th day from the first copulation were false. At the same time, the time interval between the beginning of the pregnancy and the last observed mating in these animals was shorter than the period between the first copulation and the fertilization. These facts showed that even a more strict control could not exclude possible mistakes and incorrect interpretation of results from the ultrasonographic study.

The data obtained in the present investigation proved that from the point of view of the clinical course of the oestrus, an general schedule for the most appropriate time for early ultrasonographic diagnostics of feline pregnancy could not be provided. The oestruses at short intervals or during the pregnancy are the principal causes for mistakes during the echography. For a correct detection of gestation, the last day of the oestrus should be considered. In the future, the observed data should be completed by performance of studies with a higher number of animals under various conditions of housing and various regimen of matings.

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