

Preliminary Study of the Early Ultrasonic Diagnosis of Pregnancy and Fetal Development in the Dog

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Abstract: The aim of the present study was to follow up the potential of routine ultrasonographic diagnostics of pregnancy in dogs depending on the first mating. Ultrasonographic examinations of 17 pregnant bitches with known breeding dates were made on successive days to establish the identifiable characteristics of pregnancy. Subsequent serial examinations were made to sonographically characterize normal canine prenatal development based about the first mating. An enlarged uterus, gestational sacs and fetal poles were recognized as the features of early feline pregnancy and were first seen at 16 and 21 days, respectively. Cardiac activity was detected earliest on gestational day 22 and recognizable canine fetal morphology appeared at day 28. Generalized fetal movements were first noted at day 28. It was concluded that the diagnosis and accurate dating of early pregnancy in the domestic bitch may be accomplished with serial ultrasound evaluation.

Key words: Pregnancy, diagnosis, ultrasound, dog

INTRODUCTION

The use of B-mode ultrasonography for imaging the reproductive tract in a number of species, including dogs (Carniel, 1987; Cartee and Rowles, 1984). In the bitch, the early use of ultrasound was confined to the diagnosis of pregnancy. However, more recently the full value of ultrasound imaging in dogs has been documented and the technology is now finding wide applicability in monitoring fetal development, in timing gestation and predicting parturition, in diagnosis and management of reproductive tract disease and in supplementing breeding soundness examinations (Allen *et al.*, 1989; England, 1992; England and Allen, 1989, 1990).

The aim of this study is to review the uses of ultrasonography in early and fetal monitoring development.

MATERIALS AND METHODS

The study was performed on a total number of 17 female. The age of animals was from 15 month to 7 year and the weight from 17. 8-30 kg. The bitches were housed in Batna area; all bitches were clinically healthy, without history of previous gynecological diseases. The pregnancy was detected using a transabdominal echography performed 15 days after the first mating with

a SIEMENS Sonoline adara, Germen equipment and convex 5 MHz transducer. The pregnancy was detected after visualization of gestation sacs and embryos and detection of cardiac function.

RESULTS

The ultrasonography performed between 16 and 21 days after the first copulation, detected pregnancy in all bitches (Table 1). During this period the uterine vesicle (gestation sac) appearance: a spherical anechoic cavity. At this stage the embryo is no visible (Fig. 1). The ultrasound monitoring of the embryo could be followed as from 22 days post mating:

- Twenty days Post Mating (PM), no ultrasound image of the embryo could be obtained on the 17 bitches (Fig. 1).
- Twrnty two days post mating, the embryonic mass is visible within the vesicle attached to the periphery and is measured as 4 mm long. In the real-time images, the embryonic heartbeat was visible as an hyperechoic flickering element within the embryo. The diameter of the gestational sac is 9 mm (Table 2).
- Twenty five days post mating, the embryo appears as an echogenic bipolar. The embryo is 1 cm long. The yolk sac membrane appears as an obvious echoic irregular line (Fig. 2 and 3).

Table 1: Early diagnosis of pregnancy, at the first ultrasound examination

Ultrasound pregnancies bitches																Median	
Detection of the conceptus	17	16	17	19	18	16	17	18	19	21	18	20	21	19	18	20	18.5

Table 2: Ultrasonographic Evolution of morphological development of the embryo

L'Embryon	Ultrasound pregnancies bitches																Median	
embryon mass	22	21	23	22	22	21	23	22	22	23	22	21	21	23	22	21	21	21.8
embryon Form of 8	27	28	29	27	28	28	27	29	28	28	29	27	28	28	29	30	28	28.1
thoracic limb	28	29	30	30	30	29	30	30	31	30	30	30	31	29	31	30	30	29.8

Table 3: First ultrasound signs of fetal vitality.

Embryo vitality	Ultrasound pregnancies bitches																Median	
Heart beat	22	23	23	22	22	21	22	22	23	23	21	22	23	22	21	22	22	22.1
Mobility	28	29	32	32	32	31	32	28	30	30	28	29	31	32	28	30	30	30.1

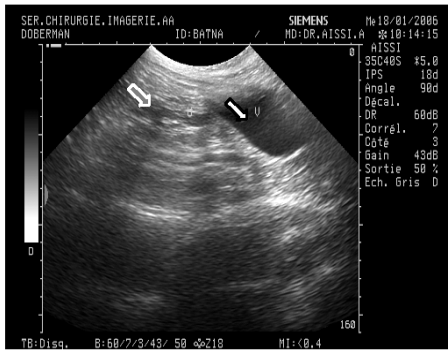


Fig. 1: Day 20 Sonogram of a pregnant bitch showing the anechoic fluid within a gestational sac in the uterine lumen (gray arrow), in longitudinal plane, at Day 20 after first mating and the bladder at right of image (white arrow)

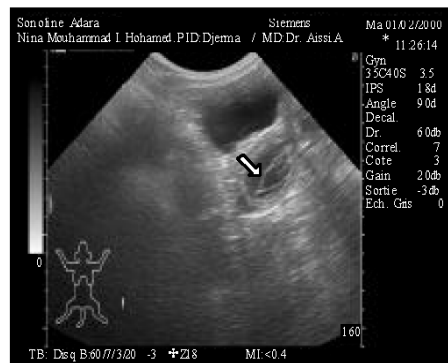


Fig. 3: Embryo and embryonic membranes (white arrow). Abdominal sonogram of a pregnant bitch 24 days after mating, showing an anechoic (black), chorionic-fluid filled vesicle within a uterine horn. The uterine horn appears round in this transverse section and is located in the right half of the image



Fig. 2: Day 24 vesicle and embryo (white arrow). Sonogram of a third Day 24 pregnant bitch showing cross section of embryonic mass at the periphery of the gestational sac. In this image, the uterine horn and vesicle are located dorsal to and thus below, the large anechoic urinary bladder (gray arrow)



Fig. 4: Day 28 Sonogram of a pregnant bitch 28 days after first mating, showing the fetus in longitudinal section from the head (right to caudal abdomen (left))

- Twenty eight days post mating, during this period the embryo form 2 loops of number 8 (Table 3), size and density the same (Fig. 4).
- Thirty days post mating, showing the fetus in dorsal section the neck does not appear in this section and an anechoic space is seen between the head and the top of the torso and the thoracic limb buds.

Table 4: First observation of the abdominal organs

bitches	Ultrasound pregnancies bitches													Median				
Heart	25	26	25	24	27	30	25	27	28	26	26	30	27	27	29	30	32	27.2
bladder	35	37	35	36	36	37	38	35	36	35	34	36	35	36	36	38	35	35.8
Estomac	32	35	34	32	33	34	35	32	33	33	35	36	35	33	34	36	35	33.9
Umbilical vein	35	36	36	36	35	34	37	36	36	35	35	37	34	36	35	36	38	35.7

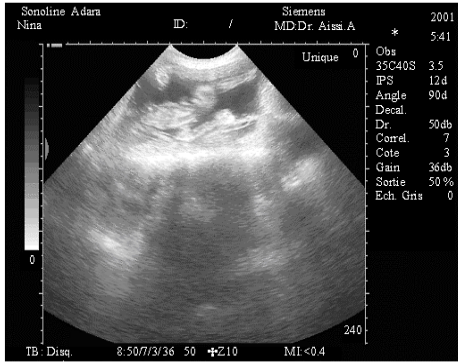


Fig. 5: Day 32 Sonogram of a pregnant bitch 35 days after first mating, showing the fetus in longitudinal section from the head (right to caudal abdomen (left)). The developing long bones in the fore-limb buds are visible as bright spots

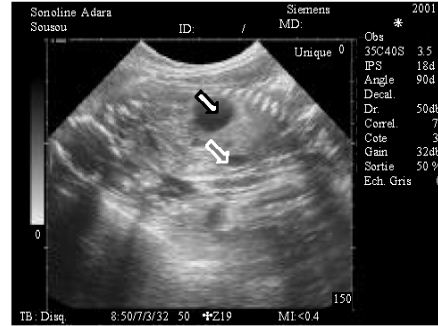


Fig. 7: Day 35 fetal stomach (white arrow) and gall bladder (gray arrow). Sonogram of a bitch days pregnant, containing a dorsal sonic section through the fetus from the upper thorax (right) to the lower abdomen (left)

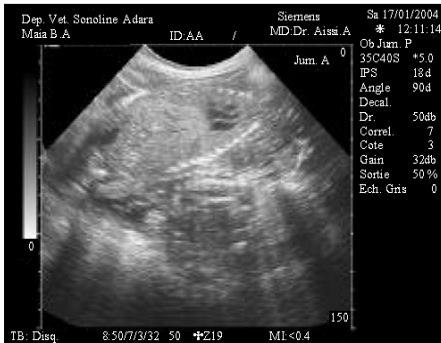


Fig. 6: Day fetal heart (white arrow) and liver (gray arrow). Sonogram of a bitch days pregnant, containing a dorsal Sonic section through the fetus from the upper thorax (right) to the lower abdomen (left)

- Thirty two days post mating, sonogram of the posterior limbs; at this stage the embryo has acquired the phenotypic characteristics of the species (Fig. 5).

Ultrasound Evolution of the fetus: The ultrasound monitoring of pregnancy in bitches is marked by observation, vitality and mobility and the visualization of the anatomical regions. The first movements observed 28 days and at the 32 days post mating, we are seeing movement of limbs.

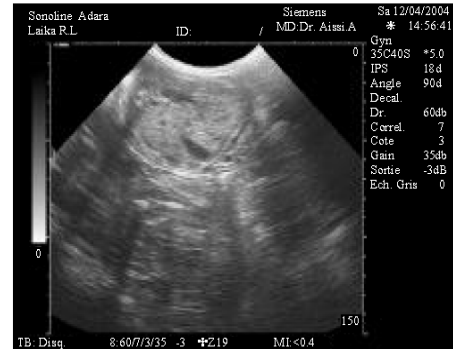


Fig. 8: Day 32 fetal abdomen in transverse section. Sonogram of fetus in transverse plan at the level of the abdome. The fetal diameter is 4. 55 cm. The fetus is located within the zonary placenta, which appears as a 1 cm thick ring of echoic tissue surrounding the fetus

Observations of abdominal organs

Heart: The heart beats are recognizable from 22 days after mating; with no define structure heart cavities appear gradually between 25 and 30 days post mating (Fig. 6).

Bladder: the first ultrasound observation a 36 days post mating as an anechoic sphere (dark) in caudal part of the abdomen (Table 4).

Stomach: observed a 32 days post mating. It forms an anechoic sphere (Fig. 7).

Umbilical vein: the first ultrasound observation a 35 days post mating as an anechoic structure (Fig. 8).

DISCUSSION

At Day 20 - 21 after ovulation, i.e., Day 22 - 23 after the LH surge, the conceptus and the embryo may be identified within the fluid filled vesicle (Carniel, 1987; Chocart *et al.*, 1995; England and Allen, 1990). However, elongated vesicles without visible embryos may be seen as late as Day 23 after the LH surge and 21 days after ovulation (Cancannon *et al.*, 2001). In this present experiment study the detection of pregnancy in bitches observed an 16 and 22 days after the first copulation. Concannon *et al.* (2001) and Yeager and Cancannon (1990), indicate that the initial diagnosis of pregnancies bitches is possible at 19-20 days after the LH surge, also specify that this result is a discovery uterine vesicle between 13-21 days after the first mating, this study according the observations of Pollet on pregnancies bitches of various breeds in consultation submitted by the owner, a diagnosis of pregnancy is positive after 16 days of the first mating.

Ultrasound imaging has been widely accepted as a routine method of pregnancy evaluation in many species since it allows the confirmation of pregnancy. it is important to remember that pregnancy does not necessarily commence upon the day of mating in the bitch (Concannon *et al.*, 2001) and that events should be related to day of the pre-ovulatory LH surge or to the time of ovulation which occurs 2 days after the LH surge (Concannon *et al.*, 2001; England and Allen, 1989). This is especially true in the bitch where a pregnancy may result from mating as early as 5 days before ovulation or as late as 5 days after ovulation.

Signs of fetuses' vitality are given by the cardiac activity and mobility (Concannon *et al.*, 2001; Chocart, 2002). In this study the first heartbeats is observed between 25 and 30 days after mating. The heartbeat is usually first seen on the day that the embryonic mass is first seen (i.e., Day 24), or on the following day (i.e., Day 25 after the LH surge). Usually, by 2 more days, at 26-27 days after the LH surge, the time at which the heartbeat can be first detected varies with the instrumentation, the thickness of the body wall and other factors (Concannon *et al.*, 2001). It is usually very easy to detect by Day 28 after the LH surge. Thus, 4 weeks after the estimated time of the LH surge, 26 days after ovulation, or one month after mating are appropriate times to schedule an initial ultrasound examination for pregnancy evaluation.

With the ultrasound, fetal heart cavity is visible from 27 days after mating and the organs (liver, stomach, umbilical vein) is visible from 36 days after mating. The first visualization of the heart cavity is manifested from 37 days after mating reported by Cartee and Rowles (1984).

The early pregnancy and fetal development and organs observation in pregnancies bitches from 35 days after copulation reported by Bondestam *et al.* (1984).

CONCLUSION

Ultrasonography examination is a rapidly advancing diagnostic technology that has much to offer to the theriogenologists and practitioners specializing in canine reproduction. Ultrasound imaging has a major role in the documentation of normal physiological events as well as the diagnosis and staging of pregnancy. In addition, it is particularly suitable for the detection of pathological changes within the reproductive tract that may be demonstrated by changes in the size, shape, margination or internal architecture of the reproductive organs.

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