

THE DOPPLER INDICES OF CANINE UMBILICAL ARTERY AT THE SIXT WEEK OF GESTATION

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The aim of this study was to evaluate the umbilical artery Doppler exams performed in the second trimester in dogs. In this study, blood flow of canine fetal umbilical artery was investigated at the week 6 of gestation. Doppler sonography exams were performed in six healthy German shepherd bitches bred in the same dog farm. At the sixth week of pregnancy, the bloodstream was examined in the fetus for each dog by the use of the pulsed-wave Doppler ultrasonography. Pulsatility index (PI) and resistance index (RI) were recorded from the mid-cord site of the free floating umbilical cord. The mean PI and RI levels of the umbilical artery were 1.74 ± 0.11 cm/s, 0.84 ± 0.02 cm/s, respectively. None fetal stress symptoms were observed during Doppler examinations. All parturitions were between 59th–65th days spontaneously. Although obstetrics Doppler exams have been done recently in canine practice, it is thought that it would be a reliable diagnostic application in future. In conclusion, this work provides baseline information for the follow-up canine fetal hemodynamic in the second trimester, which is essential for the use of fetal monitoring

Key words: Doppler indices; umbilical artery; pregnant dog

ИНДИКАЦИИ ПО ДОПЛЕР НА КУЧЕШКАТА УМБИЛИКАЛНА АРТЕРИЈА ВО ШЕСТАТА НЕДЕЛА ОД ГРАВИДНОСТА

Целта на оваа студија беше да се проценат испитувањата по Доплер на умбиликалната артерија изведени во второто тримесечје кај кучиња. Протоколот на крвта низ кучешката фетална умбиликална артерија беше испитуван во шестата недела од gravidноста. Сонографските испитувања по Доплер беа изведени кај шест здрави кучки од расата германски овчар, одгледани во иста фарма за кучиња. Во шестата недела од gravidноста протоколот на крвта беше испитуван во фетусот на секое куче, со употреба на пулсирачка Доплерова ултрасонографија. Индексот на пулсирање (PI) и индексот на отпор (RI) беа регистрирани за средниот дел при слободното флукутирање на умбиликалниот канал. Средните вредности на PI и RI на умбиликалната артерија беа $1,74 \pm 0,11$ cm/s и $0,84 \pm 0,02$ cm/s, соодветно. Не беа забележани никакви симптоми на фетален стрес за време на испитувањата. Сите породувања беа спонтани меѓу 59-тиот и 65-тиот ден. Иако испитувањата по Доплер во кучешката породилна пракса се вршат од неодамна, се претпоставува дека во иднина ќе биде возможна нивната дијагностичка апликација. Како заклучок, ова испитување обезбеди основна информација за кучешката фетална хемодинамика во второто тримесечје, што е значајно за вршење мониторинг на фетусот.

Клучни зборови: Доплер; индикации; умбиликална артерија; gravidно куче

INTRODUCTION

The Doppler ultrasonography provides real time and physiologic information such as blood velocity, blood direction and blood type (Nicolaidis et al., 2000). Pulsed-wave Doppler exams

are used for studying maternal and fetal haemodynamics and the principal blood flow parameters such as systolic peak velocity (SPV), end diastolic velocity (EDV), pulsatility index (PI) and resistance index (RI). In this noninvasive technique, the most common vessels such as uteroplacental ar-

teries, umbilical cord, aorta and caudal cava vein of the fetus are investigated (DiSalvo et al., 2006; Scotti et al., 2008).

Although Doppler exams have been done in different animal species recently, it is thought that it would be a reliable diagnostic tool in future. In the last ten years, some researchers have reported Doppler sonography results from mare (Bollwein et al., 1998; 2004), cow (Bollwein et al., 2000; Panarace et al., 2006), ewe (Panarace et al., 2008), bitch (Nautrup, 1998; Köster et al., 2001; Alvarez-Clau and Liste, 2005; DiSalvo et al., 2006) and queen (Scotti et al., 2008) in different reproductive stages. Researchers reported that the umbilical artery waveform has systolic and diastolic phases after the 5th–6th week of gestation (Nautrup, 1998; DiSalvo et al., 2006). The pulsatility and resistance indices of umbilical artery started to decrease significantly in this stage and the fetal blood flow coming from the umbilical cord increases. The aim of this work is to investigate the hemodynamic characteristics of the umbilical artery to obtain more functional information in the 6th week of pregnancy in healthy bitches.

MATERIAL AND METHODS

Six healthy German shepherd bitches were used in this study. The bitches of 2–5 years old and with an average weight of 31.9 were examined. The pregnancy was detected on the 25th–30th day after the first mating by ultrasonographic examination (MyLab Vet30- ESAOTE®, Italy) using a microconvex probe of 6.6 MHz. The sixth week of pregnancy (day 37th–42th) was confirmed based on fetometric exams by using the biparietal diameter (BPD) and the fetal trunk diameter (FTD) with the B-mode USG reported in literature (England et al., 1990). Before examination their left lateral skin was shaved and positioned in lateral recumbency to avoid maternal aorta compression. Firstly, the umbilical artery was visualized by the Color-Doppler application and then the Pulsed-Wave Doppler USG was performed. The mid-cord site of the free floating umbilical cord was examined from the most caudal fetus of the left uterus horn. The measurements of PI and RI were recorded after the waveforms of at least three consecutive cardiac cycles were observed (Table 1). The cause of considering the possible side effects (thermal and cavitation effects) of Doppler sounds

on tissue, Pulsed-Wave exams did not last thirty seconds and interrupted for a minute. During exams, the fetal heart rate (FHR) was also followed for detecting the fetal stress. All examinations, measurements were disregarded while the angle of insonation was >20°.

RESULTS

The umbilical waveform was characterized by a simultaneous presence of the arterial and vein flow. The umbilical artery blood flow waveform was observed with systolic and diastolic phases. The indices of PI and RI were presented in Table 1. The mean PI and RI levels of the umbilical artery were 1.74 ± 0.11 cm/s and 0.84 ± 0.02 cm/s, respectively.

Table 1

The individual umbilical artery velocities and the mean level of PI and RI (cm/s) at sixth week of gestation (cm/s)

No	PI	RI
1	1.76	0.85
2	1.47	0.76
3	1.98	0.89
4	1.92	0.86
5	1.94	0.86
6	1.35	0.79
The mean level of indices	1.74 ± 0.11	0.84 ± 0.02

The FHR was measured above 200 beat per minute and it was concluded as no fetal stress symptoms during Doppler examinations (Zone and Wanke, 2001). Parturitions were between the 59th–65th days spontaneously.

DISCUSSION

The Doppler ultrasonography is currently used routinely to diagnose and to monitor the maternal and fetal well-being. In veterinary medicine the Color and Pulsed-Wave Doppler USG has been investigated for ten years. There are only two reports about this technique done in pregnant bitches (Nautrup, 1998; DiSalvo et al., 2006).

The detecting of the umbilical cord is possible via ultrasonography after the days 40th – 46th of pregnancy (Johnston et al., 2001). These days have clinically importance because of the possibility of the first use of the Doppler sonography. In this study, it was detected after the 36th day and visualized by Color-Doppler exams. The umbilical artery blood waveform was observed with systolic and diastolic peaks and the mean PI and RI were 1.74 ± 0.11 cm/s and 0.84 ± 0.02 cm/s, respectively. These observations are in accordance with literature data in canine and feline pregnancy (Nautrup, 1998; DiSalvo et al., 2006; Scotti et al., 2008).

The fetal size and the formation of skeleton rapidly increase during the last 3 to 4 weeks of gestation in bitches (Johnston et al., 2001). Therefore there is an increase of the amount of nutritional requirements in fetuses which were growing. The resistance in umbilical vessels started to decrease significantly in this stage and the fetal blood flow coming from umbilical cord increased. The increase of fetal nutritional requirements may be related to these results.

In conclusion, the Doppler sonography could be performed after the 6th week of pregnancy and permits observation of the umbilical artery flow characteristics in bitches. This application is practical, rapid and has results concerning the first week which has possibility for monitoring of the fetal growth.

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