

## OBSTETRIC DOPPLER ULTRASOUND FINDINGS IN A GERMAN SHEPHERD BITCH AT PREGNANCY AND PUERPERIUM

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Doppler sonography was performed in a 1.5 year old healthy German shepherd bitch at late pregnancy and puerperium stage. Maternal and fetal arteries were examined by color Doppler and pulsed-wave Doppler ultrasonography. In the last two weeks of pregnancy, pulsatility and the resistance index were decreased in vessels. None fetal stress symptoms were observed during Doppler examinations. Parturition was in the 65<sup>th</sup> day spontaneously and six healthy puppies were born. After parturition, pulsatility and the resistance index was also recorded from artery from the uteroplacental site. While decreasing of the uterine thickness, there was a mathematical increase in pulsatility and resistance during the first thirteen days. It seemed that the Doppler sonography was an important diagnostic method to evaluate prenatal growth and fetal stress in this case. Besides this, the Doppler ultrasonography can be used to study the characteristics of pregnant uterine vessels flow and their progressive changes during puerperium in the bitch.

**Key words:** ultrasonography; Doppler; canine pregnancy

## АКУШЕРСКИ НАОДИ СО ДОПЛЕРОВ УЛТРАЗВУК КАЈ ЖЕНКА ОД РАСАТА ГЕРМАНСКИ ОВЧАР ВО ТЕКОТ НА БРЕМЕНОСТА И ПУЕРПЕРИУМОТ

Извршена е Доплерова ехографија кај женка од расата германски овчар, стара 1,5 години, во доцна бременост и во текот на пуерпериумот. Артериите на мајката и ембрионот беа испитани со Доплерова колор и пулсно-брановидна ехографија. Во последните две недели од бременоста вибрациите и индексот на отпор во вените беа намалени. Не беа констатирани симптоми на стрес за време на истражувањата со Доплерова технологија. Раѓањето се случи спонтано, во 65-тиот ден, при што се родија шест здрави кученца. По раѓањето исто така беа забележани вибрации и индекс на отпор од артеријата во утероплацентата. Додека се намалуваше дебелината на матката, имаше математичко покачување на вибрациите и отпорот за време на првите тринаесет дена. Се чини дека во овој случај, Доплеровата ехографија беше важен дијагностички метод за одредување на претпородилното растење и ембрионалниот стрес. Покрај ова, Доплеровата ултраехографија може да се користи за проучување на протокот на крвта во крвните садови на матка со плод и нивните прогресивни промени за време на пуерпериумот кај женка.

**Клучни зборови:** ултраехографија; Доплер; бременост кај кучиња

### 1. INTRODUCTION

The Doppler ultrasound of the genital system provides real time and functional information such as blood velocity, blood direction and blood type and has important clinical implication in gynecolo-

gy in human and animal species (Nautrup 1998; Nicolaidis et al., 2000; Bollwein et al., 2004). A color-Doppler superimposed a color image of the blood vessels and was used to measure the changes in the blood flow. Pulsed-wave Doppler exams are used for studying maternal and fetal haemodyna-

mics 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, most common vessels such as uteroplacental arteries, umbilical cord, aorta and caudal cava vein of the fetus are investigated (Disalvo et al., 2006; Scotti et al., 2008).

In human medicine, Doppler USG is used routinely for studying maternal-fetal well being and involution in the postpartum period (Aardema et al., 2001; Mulic-Lutvica et al., 2007). Although Doppler exams that have been done in different animal species are new, it is thought that it would be a reliable diagnostic tool in the future. In the last ten years, some researchers 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. There are two studies that have been done in bitches for monitoring pregnancy (Nautrup, 1998; DiSalvo et al., 2006), but there are no data about pulsed-wave Doppler records from uterine arteries in the puerperal stage in these reports

In this study, pulsed-wave Doppler findings of maternal and fetal arteries at late pregnancy and puerperal stage in a healthy bitch were reported and presented by our clinic.

## 2. A CASE REPORT

A 1.5 year old healthy German shepherd bitch weight of 30 kg was examined. Her pregnancy was detected on 25<sup>th</sup> day after the first mating by ultrasonographic examination (MyLab Vet30-ESAOTE®, Italy) using a microconvex probe of 6.6 MHz. 45<sup>th</sup> day of pregnancy was confirmed based on fetometric exams by using a biparietal diameter (BPD) and a fetal trunk diameter (FTD) with B-mode USG reported in England et al. (1990). Before examination her left lateral skin was shaved and positioned in lateral recumbency to avoid maternal aorta compression. Color-Doppler and Pulsed wave-Doppler were performed every other day for umbilical artery and uteroplacental artery-fetal aorta from 45<sup>th</sup> and 52<sup>nd</sup> days

respectively. The blood flow of the uteroplacental artery, the umbilical cord and the fetal aorta were recorded. The uteroplacental artery neighboring the gestational sacs, the mid-cord site of the free floating umbilical cord and the fetal aorta in thorax were examined. Firstly, the arteries were visualized by Color-Doppler application (Figure 1) and then Pulsed-Wave Doppler USG was performed (Figure 2, 3). The measurements of SPV, EDV, PI and RI were recorded after the waveforms of at least three consecutive cardiac cycles were observed from the most caudal fetus of the left uterus horn (Table 1). After parturition, Doppler USG exams were performed on the artery in the same uteroplacental site of uterus during involution (Figure 4). All examinations and measurements were disregarded while the angle of insonation was  $>20^\circ$ .

In the late pregnancy, the PI and RI of the umbilical artery and the uteroplacental artery were decreased. The levels of PI (1.13–2.04 cm/s) and RI (0.72–0.90 cm/s) were measured in the fetal aorta. Fetal stress symptoms were investigated by the fetal heart rate (HR) in all visualized fetuses during examinations. It was observed that the HR of fetuses measured above 200 bpm and concluded as no fetal stress symptoms (Zone and Wanke, 2001). 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 were interrupted for a minute. Moreover, the whole examination lasted between 30–60 minutes. During the examinations, none significant changes were observed in the fetal heart rate taken from the sample fetus compared to others.

Between 61 and 65<sup>th</sup> days, ultrasonographic examinations were interrupted until the parturition cause of the bitch refused the examination related to the prepartal anxiety. Parturition was in 65<sup>th</sup> day spontaneously. Six healthy puppies were born in the second phase which lasted six hours.

The uterine thickness and the blood waveform of the artery localized in the uteroplacental site were measured at 1<sup>th</sup>, 4<sup>th</sup>, 7<sup>th</sup> and 15<sup>th</sup> day of the postpartum for evaluating the postpartum involution. The increase of PI and RI of the uterine artery was rapid at 4<sup>th</sup> day postpartum and kept on its high level compared to the previous parturition. Besides, the thickness of the left uterus horn decreased from 36 to 18 mm at 15<sup>th</sup> day.

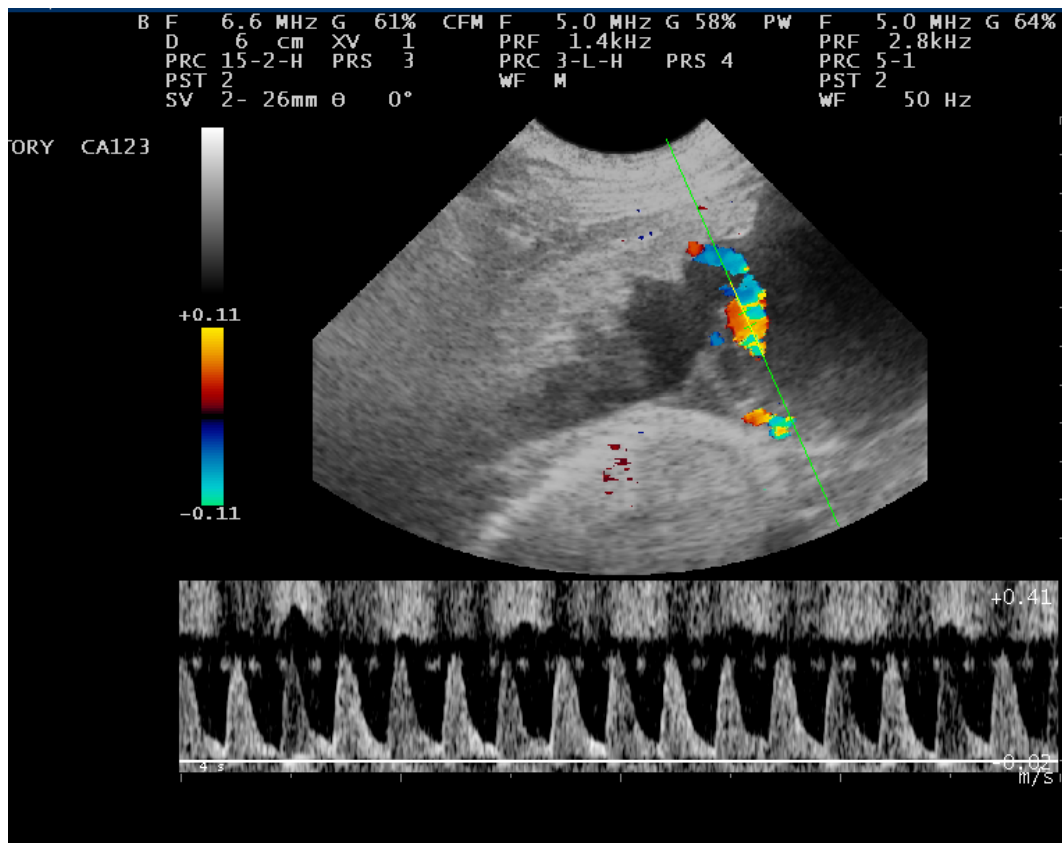


Fig. 1. The Color-Doppler image of artery and venous umbilicalis on 46<sup>th</sup> day

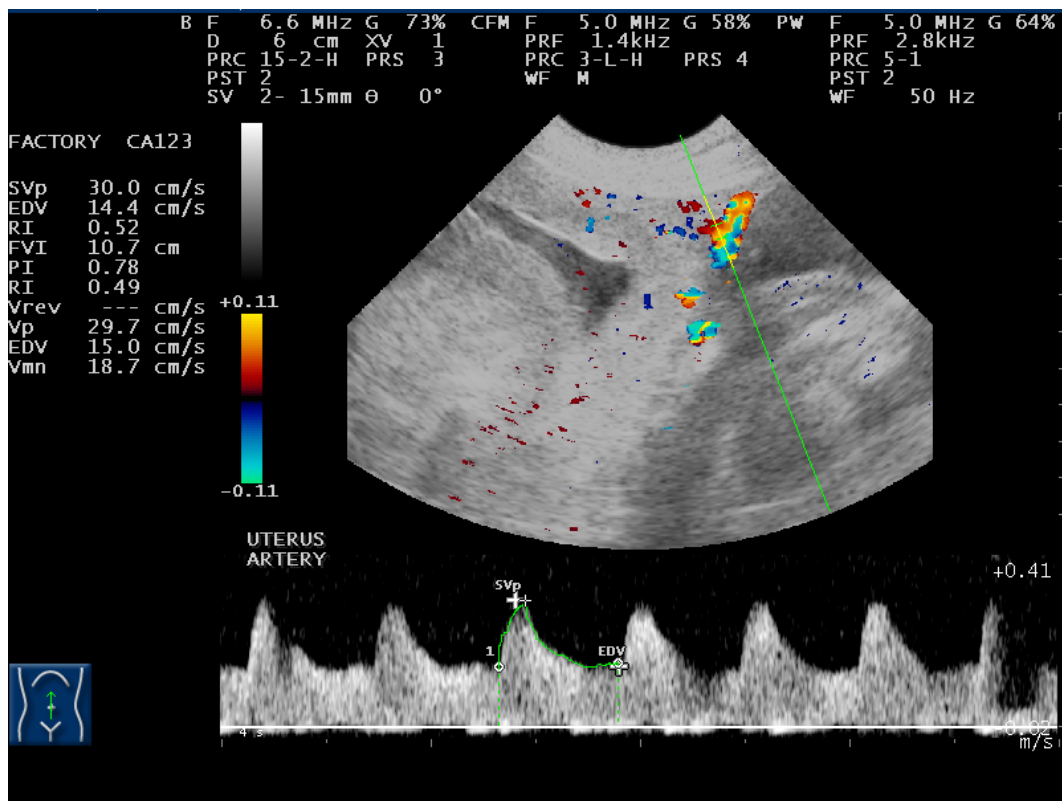


Fig. 2. The Pulsed-Doppler image of uteroplacental artery on 52<sup>th</sup> day

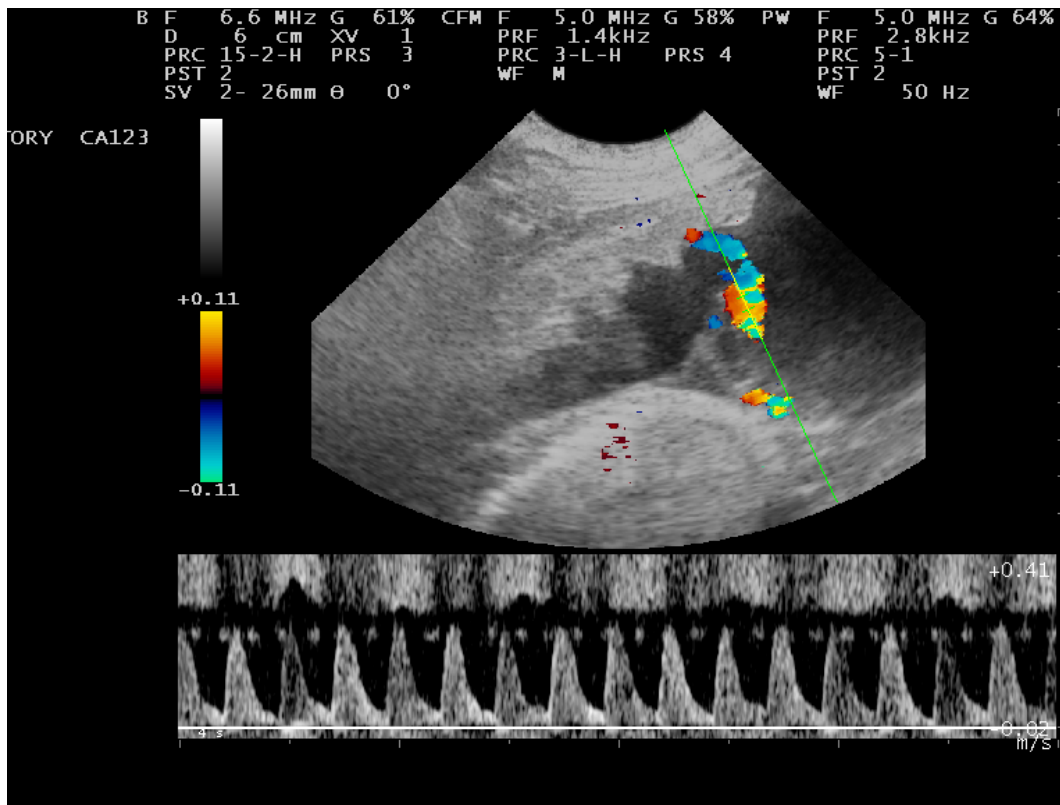


Fig. 3. The Pulsed-Doppler image of fetal aorta on 58th day

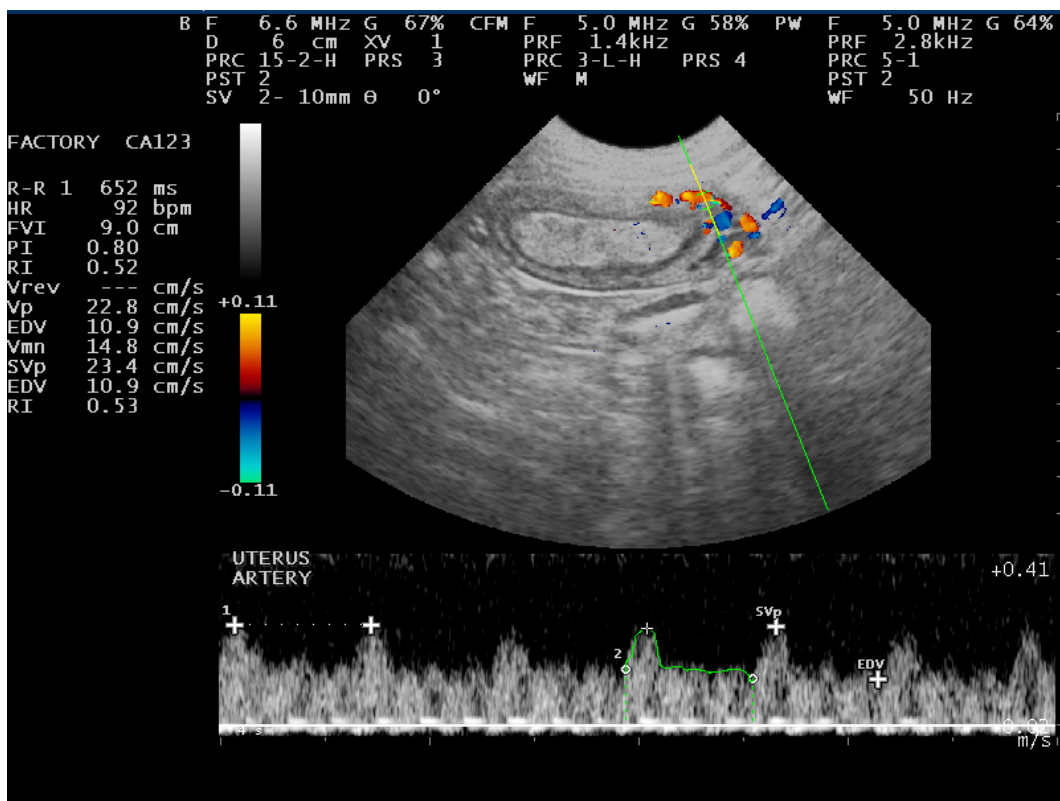


Fig. 4. The Pulsed-Doppler image of uteroplacental artery on 7th day postpartum

Table 1

*Blood flow velocities (cm/s) in the umbilical artery (UM), the uteroplacental artery (UA), the fetal aorta (FA) and uterine thickness (UT) (mm)*

	UMB -SPV	UMB -EDV	UMB -PI	UMB -RI	UA- SPV	UA- EDV	UA- PI	UA- RI	FA- SPV	FA- EDV	FA- PI	FA- RI	UT (mm)
45. d	25.00	3.40	1.92	0.86									
46. d	24.00	4.10	1.54	0.83									
48. d	22.80	3.70	1.75	0.84									
50. d	–	–	–	–	–	–	–	–					
52. d	18.70	3.40	1.56	0.82	30.00	14.40	0.78	0.49	20.30	3.10	1.58	0.85	
54. d	41.70	3.70	1.30	0.74	–	–		–	24.00	2.50	2.04	0.90	
56. d	22.20	5.60	1.27	0.75	–	–		–	35.00	7.50	1.49	0.79	
58. d	20.00	5.60	1.28	0.72	31.80	17.20	0.62	0.46	36,50	11.6	1.19	0.68	
60. d	29.40	9.10	1.11	0.69	25.60	14.10	0.60	0.45	35.60	10.0	1.13	0.72	
pp 1.d					30.60	15.90	0.74	0.48					36
pp 4.d					37.80	15.90	0.94	0.58					30
pp 7.d					22.80	10.90	0.80	0.52					28
pp 14.d					19.40	9.70	0.77	0.53					18

### 3. DISCUSSION

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). In this case, the uteroplacental and umbilical blood flow low resistance and had decreasing gradually during the last two weeks of pregnancy in accordance with these literatures.

The detecting of umbilical cord is possible via ultrasonography after the days 40<sup>th</sup>–46<sup>th</sup> of pregnancy (Johnston et al, 2001). These days it has clinical importance because of possibility of the first use of the Doppler sonography. In this study, it was detected after the 45<sup>th</sup> day and visualized by Color-Doppler exams. 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). The resistance in umbilical vessels started to decrease significantly at this stage and the fetal blood flow coming from the umbilical cord increased. The increase of fetal nutritional requirements may be related to these results.

Fetal aorta blood waveforms had also low resistance and had decreased approach to vaginal delivery. Cause of pulsed-wave sample volume

was taken by the caudal segment of aorta thoracalis, SPV and EDV values were lower than literature data (DiSalvo et al., 2006).

The measuring of the uterine thickness and blood flow from artery in the uteroplacental site were useful for monitoring involution in this case. Rapid decrease of about 50 percentile at the 15<sup>th</sup> day compared to the first postpartum day determined by the B-mode was observed. Besides, Doppler flow resistance indices are higher than those reported in the late pregnancy. The resistance of the uterine artery was decreased during the first two weeks. This data are in accordance with the report (Mulic-Lutvica et al., 2007) done in women in early puerperium. After parturition the monitoring of canine uterine status can be performed via this diagnostic method. The relevant clinical points of this study, early diagnosing of subinvolution of placental sites and acute metritis during the postpartum stage may be detected by using the Doppler USG in future.

As a result, the Doppler USG in the pregnancy and postpartum may be an important diagnostic method to evaluate prenatal growth, fetal stress and involution of uterus in this case, as it is routinely used in women to identify the most common obstetrical pathologies.

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