

CHARACTERISTICS OF MIDDLE UTERINE ARTERY AND FETAL UMBILICAL BLOOD FLOW IN PREGNANT MURRAH BUFFALO

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ABSTRACT

Six healthy Murrah buffalo were assessed for middle uterine artery and fetal umbilical blood flow at regular interval from day 18 of gestation onward. Resistance index and pulsatility index of middle uterine artery was invariably similar ($p>0.05$) from day 30 of gestation onward. However, these indices exhibited a decreasing ($p<0.05$) trend till nine-month of gestation in fetal umbilicus. In brief, the doppler indices of fetal umbilicus suggested the decrease in resistance of blood flow to the fetus.

Keywords: Color Doppler, Murrah buffalo, Middle uterine artery, Pregnant, Umbilicus

INTRODUCTION

Trans-rectal doppler sonography is a non-invasive method for the examination of uterine blood flow during pregnancy in cattle (Bollwein *et al.*, 2002). The assessment of uterine blood flow in dairy animals can be suggestive of risk of abortion, abnormalities of placenta and fetus or both (Panarace *et al.*, 2006 a, b) as well as early embryonic death in buffalo (Russo *et al.*, 2009). The doppler evaluation of blood flow is usually carried out by measuring the doppler indices viz., resistance index (RI) and pulsatility index (PI). The resistance index has negative relationship with vascular perfusion; thus, an increase in resistance indicates decrease in vascular perfusion and vice-versa. An increase in PI is indicative of decreased tissue perfusion and vice-versa. The observations on PI are more suitable than RI when flow is absent during all or part of diastole (Dickey, 1997). A previous study has reported that as gestation advances, the PI and RI decreases progressively, thus indicating the decrease in vascular impedance and an increase in fetal circulation (Gupta *et al.*, 2009). The present study in pregnant Murrah buffalo was carried out to assess the RI and PI of middle uterine artery and fetal umbilicus in

pregnant Murrah buffalo.

MATERIALS AND METHODS

The present study was conducted on six healthy and pregnant Murrah buffalo. The 2D B-mode ultrasonography was used to study fetal development.. For 2D ultrasonography, a linear array 5.0-7.5 MHz transrectal-transducer was utilized twice weekly from day 18 to 60 of gestation, later on at weekly interval till day 88 and lastly by using curvilinear transducer at fortnight interval till 9th month of gestation. Sono Scape S6, portable digital Color Doppler ultrasound and Toshiba Nemio-XG 3D ultrasound machines were used for the study.

For the assessment of blood flow to uterus, transducer was used trans-rectally after locating the middle uterine artery that was identified within the mesometrium near its origin at the rudimentary umbilical artery and close to the external iliac artery. The uterine blood flow waveforms were obtained by activating the pulsed-doppler function and placing the doppler gate over the middle uterine artery, adjusted to the diameter of the vessel. Pulse repetition frequency, color gain, and power were adjusted in order to avoid aliasing. Transducer was moved in such a way that Doppler angle made by the blood flow and direction

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of the ultrasound beam were minimum. Keeping the transducer constant, pulsed wave Doppler was started and gate size was adjusted so that sample volume was exactly in the centre of blood flow in the middle uterine artery. After getting waveform of a cardiac cycle, image was frozen and resistance (RI) and pulsatility (PI) index were recorded (Figure 1).

Ultrasonographic examination of umbilicus (Toshiba Nemio 20, Tokyo, Japan) was carried out using a 5.0-7.5 MHz 2D transducer trans-rectally in pregnant animals up to day 88 days and thereafter

using a 2-5 MHz curvilinear array transducer trans-abdominally (Figure 1). The lower ventral and lateral (right and left) abdominal area, lateral and cranial to udder, was used for trans-abdominal ultrasonography. The insonation angle (between the ultrasound beam and the artery) ranged from 45-60°, and RI and PI were calculated over a cardiac cycle. The statistical analysis of the data was carried out using standard procedures.

RESULTS AND DISCUSSION

The present study on healthy pregnant Murrah buffalo revealed that RI and PI values of middle

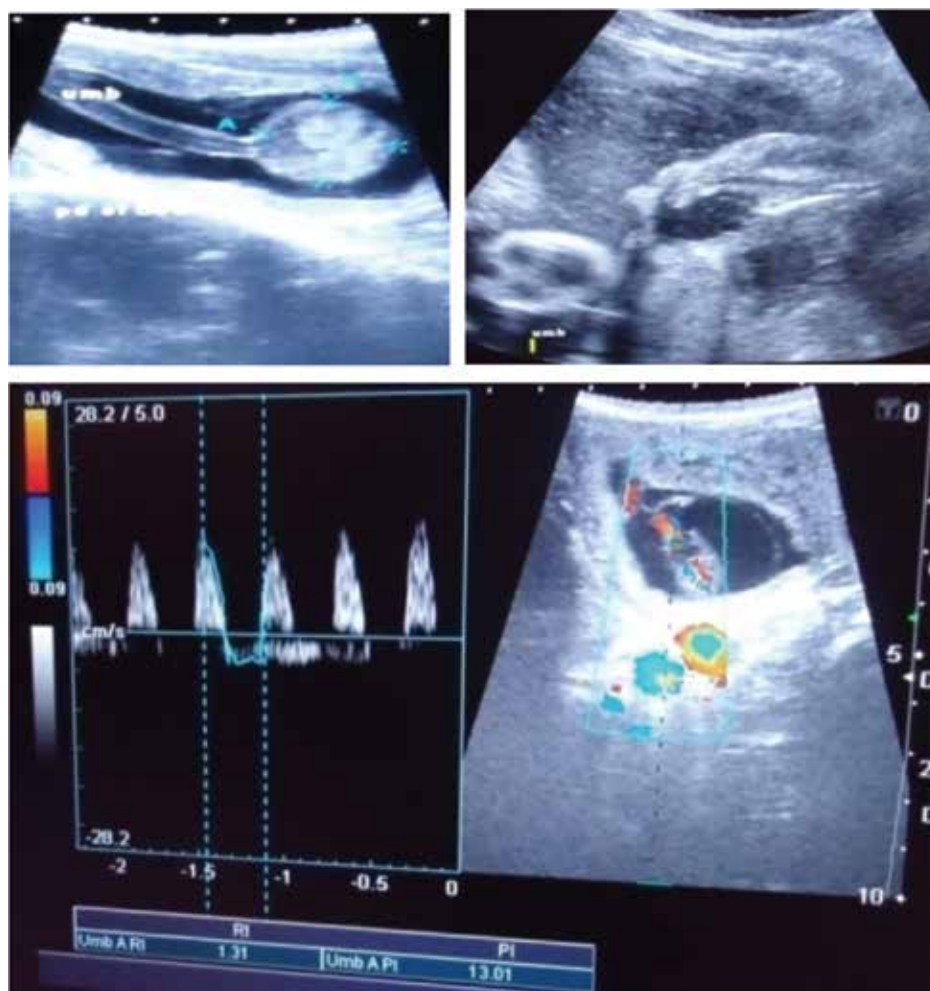


Figure 1: Sonograph showing longitudinal (upper left) and cross-section (upper right) view of umbilicus as well as resistance index and pulsatility index (lower panel) of umbilicus in 47-day pregnant Murrah buffalo

Table 1: Blood flow characteristics of middle uterine artery and umbilicus in pregnant Murrah buffalo

Days of gestation	Middle uterine artery		Umbilicus	
	RI	PI	RI	PI
18	1.26±0.03 ^{bc}	2.38±0.60 ^{ab}	-	-
22	0.71±0.05 ^a	3.23±0.65 ^{abc}	-	-
26	1.05±0.30 ^{ab}	2.10±0.68 ^a	-	-
30	1.74±0.11 ^d	5.09±0.68 ^{cd}	-	-
34	1.90±0.08 ^d	3.97±0.21 ^{abcd}	-	-
38	1.77±0.14 ^d	4.29±0.59 ^{bcd}	1.22 ±0.01 ^{bc}	44.43±1.25 ^f
42	1.89±0.07 ^d	6.99±0.70 ^e	1.33±0.014 ^{bc}	13.40±0.38 ^e
46	1.67±0.15 ^d	5.53±0.97 ^{de}	1.32±0.01 ^{bc}	13.99±0.45 ^e
50	1.61±0.14 ^{cd}	4.05±0.41 ^{abcd}	1.32±0.02 ^{bc}	7.69±1.59 ^d
54	1.70±0.24 ^d	3.97±0.80 ^{abcd}	1.21±0.05 ^{bc}	6.42±1.27 ^{cd}
58	1.86±0.13 ^d	4.59±0.58 ^{cd}	1.38±0.11 ^c	7.36±2.08 ^d
67	1.90±0.07 ^d	4.59±0.40 ^{cd}	1.25±0.03 ^{bc}	6.28±1.31 ^{cd}
74	1.75±0.16 ^d	4.49±0.69 ^{cd}	1.27±0.08 ^{bc}	5.38±0.50 ^{bcd}
81	1.99±0.01 ^d	4.79±0.49 ^{cd}	1.19±0.07 ^{bc}	4.81±0.41 ^{bcd}
88	2.00±0.01 ^d	3.73±0.24 ^{abcd}	1.34±0.16 ^{bc}	6.4±1.18 ^{cd}
6.5M	-	-	1.39±0.18 ^c	3.72±0.65 ^{abc}
7.0M	-	-	1.03±0.11 ^b	2.26±0.31 ^{ab}
7.5M	-	-	1.23±0.12 ^b	3.81±0.99 ^{abc}
8.0M	-	-	1.06±0.05 ^b	2.28 ±0.29 ^{ab}
8.5M	-	-	1.14±0.05 ^{bc}	2.85±0.50 ^{ab}
9.0M	-	-	0.66±0.09 ^a	1.17±0.15 ^a

Values with different superscripts (a, b, c, d, e, f) differ significantly ($p < 0.05$) within a column; Resistance index, RI; Pulsatility index, PI

uterine artery exhibited no consistent pattern and were similar ($p > 0.05$) from day 30 of gestation onward (Table 1). Others reported in cattle that due to an increase in demand of blood by growing fetus, the RI and PI values decrease continuously during the first 8-month of gestation and, thereafter, the values remain relatively constant till calving (Bollwein *et al.*, 2002). The decrease in RI is indicative of reduced resistance to blood flow in the vasculature distal to site of assessment (Silva, 2011).

The trans-abdominal ultrasonography proved to be valuable in measuring the RI and PI values of umbilicus in normal advance pregnant buffalo. The decrease ($p < 0.05$, Table 1) in RI and PI of fetal

umbilicus through the course of gestation was due to an increase in blood flow to the fetus and diameter of umbilical artery. In fact, lowest value of umbilical RI and the highest value of umbilical PI was observed during 9th month of gestation compared to other values during the entire period of study ($p < 0.05$, Table 1). A study in cattle reported that RI and PI values decrease by >50% until 26 week of gestation with no substantial change thereafter (Panarace *et al.*, 2006a).

It can be concluded that as the pregnancy was progressing in Murrah buffalo, the RI and PI values of umbilicus were decreasing indicating sufficient blood flow to fetus and maintenance of normal pregnancy.

REFERENCES

- Bollwein, H., Baumgartner, U. and Stolla, R. (2002). Transrectal Doppler sonography of uterine blood flow in cows during pregnancy. *Theriogenology*, **57**: 2053-2061.
- Dickey, R.P. (1997). Doppler ultrasound investigation of uterine and ovarian blood flow in infertility and early pregnancy. *Human Reprod. Update.*, **3**(5): 467-503.
- Gupta, U., Qureshi, A. and Samal, S. (2009): Doppler velocimetry in normal and hypertensive pregnancy. *International J. Gynecol. Obstet.*, **11**: 2.
- Panarace, M., Garnil, C., Marfil, M., Jauregui, G., Lagioia, J., Luther, E. and Medina, M. (2006a). Trans-rectal sonography for evaluation of uterine blood flow throughout pregnancy in 13 Cows. *Theriogenology*, **66**(9): 2113-2119.
- Panarace, M., Jaúregui, G., Garnil, C., Segovia, A., Gutiérrez, J., Lagioia, J.J., Marfil, M., Rodríguez, E. and Medina, M. (2006b). Color Doppler evaluation of umbilical blood flow during pregnancy in cows. *Reprod. Fert. Dev.*, **19**(1): 323-323.
- Russo, M., Luise, L.D., Rossi, P., Grasso, F.L., Cocchia, N. and Catone, G. (2009). Ultrasonographic appearance of early embryonic mortality in buffalo (*Bubalus bubalis*). *Italian J. Anim. Sci.*, **8**(2): 138-140.
- Silva, L.A. (2011). Local effect of the conceptus on uterine vascular perfusion and remodeling during early pregnancy in mares - New findings by Doppler ultrasonography. *Acta Sci. Vet.*, **39**(1): 123-134.
- Stuart, B., Drumm, J.D., Fitzgerald, E. and Duignan, N.M. (1980). Fetal blood velocity waveforms in normal pregnancy. *British J. Obstet. Gynaecol.*, **87**: 780-785.