# COLOUR DOPPLER INDICES OF OVARIAN ARTERY IN RELATION TO OVARIAN ACTIVITY IN CROSSBRED CATTLE

**S. SATHESHKUMAR[1]*, A. SIVAKUMAR[2], S. RAJA[3], P. JAYAGANTHAN[4], V. PRABAHARAN[5] AND R.C. RAJASUNDARAM[6]**

*Teaching Veterinary Clinical Complex*
*Veterinary College and Research Institute, Orathanadu - 614 625*

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**ABSTRACT**

Crossbred cattle exhibiting estrus or post-partum anestrus were subjected to colour doppler ultrasonography to evaluate the blood flow parameters viz., peak systolic velocity (PSV), end diastolic velocity (EDV), pulsatility index (PI), resistivity index (RI) and doppler pulse duration (DPD). The comparison of blood flow parameters of cattle in estrus (n=12) revealed that PSV and DPD indices in dominant follicle and ipsilateral ovarian artery were highly correlated ($p<0.05$). The blood flow assessment of ovarian artery in anestrus (n=9) and estrus (n=9) cattle suggested higher ($p<0.05$) values of PI, RI and DPD in anestrus cattle. In brief, anestrus crossbred cattle had deficient blood flow in ovarian artery as indicated by low velocity, increased flow resistance and slow pulsation.

**Keywords**: Anestrus, Cattle, Colour doppler, Doppler indices, Ovarian artery

Post-partum anestrus (PPA) due to multiple factors including nutrition is a major reproductive disorder in crossbred cattle (Kumar *et al*., 2014). The advent of colour doppler imaging facilities can provide new insights into infertility disorders. Ovarian vascular perfusion plays a major role in delivering nutrients, hormones and growth factors to the highly vascularised ovarian structures (follicle and corpus luteum; Gaytan *et al*., 1999). A deficient blood supply to the ovaries could disturb the follicular development, maturation and ovulation leading to anestrus. Therefore, the present study was aimed at documenting the relation between blood flow to ovarian artery and dominant follicle as well as doppler indices of ovarian artery in anestrus crossbred cattle.

The crossbred cattle with non-expression of behavioural estrus and absence of corpus luteum (as assessed by gyneco-clinical examination and ultrasonography) till day 90 postpartum were considered anestrus, whereas, normal cyclic cattle exhibiting estrus within day 90 postpartum served for estrus group. Animals (n=12) diagnosed in estrus were subjected to colour doppler imaging ultrasonography (Esaote, MyLab30 Vet Gold, Italy equipped with a 7.5-MHz trans-rectal linear probe). The doppler signals of ovarian artery ipsilateral to ovary with dominant follicle were identified and blood flow parameters viz., peak systolic velocity (PSV), end diastolic velocity (EDV), pulsatility index (PI), resistivity index (RI) and doppler pulse duration (DPD) were measured in ovarian artery and in dominant follicle. Furthermore, the differences in blood flow parameters of ovarian artery in estrus and anestrus cattle (n=9 each) were also recorded as described previously.

For statistical analysis, the blood flow parameters of ovarian artery were correlated with the dominant follicle as well as the data on blood flow parameters of ovarian artery in estrus and anestrus animals were analysed by student's *t*-test and ANOVA with completely randomized design using SPSS.10.0® software.

The analysis of data revealed that PSV and DPD indices were correlated ($p<0.05$) between estrual dominant follicle and ipsilateral ovarian artery (Table 1).

[1]Associate Professor, [6]Professor cum Head; [2,3,4,5]Assistant Professor, Department of Veterinary Gynaecology and Obstetrics; *drsatheshkumar6@rediffmail.com

**Table 1: Correlation between blood flow parameters of estrual dominant follicle and ipsilateral ovarian artery as well as between ovarian artery in estrus and anestrus cattle**

| | **Peak systolic vol.**, m/s | **End diastolic vol.**, m/s | **Pulsatility index** | **Resistivity index** | **Doppler pulse duration**, m/s |
|---|---|---|---|---|---|
| **Dominant follicle *vs.* ipsilateral ovarian artery** (n=12) | | | | | |
| Ovarian Artery | 0.32±0.01[a] | 0.07±0.01 | 1.48±0.18 | 0.73±0.05 | 922.9±32.8[a] |
| Dominant Follicle | 0.15±0.02[b] | 0.05±0.01 | 1.08±0.11 | 0.65±0.03 | 936.2±50.3[b] |
| **Estrus *vs.* anestrus cattle** (n=9 each) | | | | | |
| Anestrus | 0.31±0.01 | 0.09±0.02 | 1.53±0.25[c] | 0.71±0.05[c] | 1096.8±63.3[c] |
| Estrus | 0.34±0.02 | 0.12±0.01 | 0.89±0.12[d] | 0.60±0.03[d] | 833.3±19.5[d] |

[a vs. b, c vs. d] $p<0.05$, within a column

This suggested that the follicular development is highly supported by a vascular network. In a previous study, there was a significant difference in detectable blood flow between the ovulatory follicle and subordinate/ atretic follicles (Satheshkumar *et al*., 2012). In fact, blood supply to individual follicle is critical for follicular development and for allowing it to acquire ovulatory capacity (Acosta, 2007). The present study in crossbred cattle confirmed that blood flow in ovarian artery increases the perfusion to intra-ovarian arteries and the ovarian follicles.

Between anestrus and estrus cattle, the blood velocity parameters were lower ($p>0.05$) in the former group (Table 1). However, the PI, RI and DPD indices were higher ($p<0.05$) in anestrus than in estrus group (Table 1). Thus, low velocity, increased flow resistance (indicated by high PI and RI) and slow pulsation (indicated by high DPD) of the blood flow in ovarian artery of anestrus animals can be affecting the vascular perfusion of follicles.

In brief, ipsi-lateral ovarian artery blood flow is significantly correlated to follicular vascular perfusion and altered blood flow parameters of ovarian artery proved to be a causative factor for poor follicular development in anestrus cattle.

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**REFERENCES**

Acosta, T.J. (2007). Studies of follicular vascularity associated with follicle selection and ovulation in cattle. *J. Reprod. Dev.*, **53**: 39-44.

Gaytan, F., Morales, C., Garcia-Pardo, L., Reymundo, C., Bellido, C. and Sanchez-Criado, J.E. (1999). A quantitative study of changes in the human corpus luteum microvasculature during the menstrual cycle. *Biol. Reprod.*, **60**: 914-919.

Kumar, P.R., Singh, S.K., Kharche, S.D., Govindaraju, C.S., Behera, B.K., Shukla, S.N., Kumar, H. and Agarwal, S.K. (2014). Anestrus in cattle and buffalo: Indian perspective. *Adv. Anim. Vet. Sci.*, **2**: 124-138.

Satheshkumar, S., Asokan S.A., Brindha, K., Kathiresan, D. and Kumanan, K. (2012). Angiogenic characterization of follicular and luteal structures in crossbred cattle using colour Doppler imaging ultrasonography. In: Proceedings of ISSAR National Symposium at Khanapara, Assam (India) held on November 21-23, 2012. pp 248.