Use of Color-Doppler Ultrasonography to Monitor Follicle Dynamics in Horses

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ABSTRACT

Background: Recently, transrectal Doppler ultrasonography has been utilized increasingly for research and clinical studies of ovarian and follicle hemodynamics in large farm animals. High-resolution ultrasonographic machines with B-mode (gray-scale) and color-, power-, and spectral-Doppler modes have brought a powerful dimension to the evaluation of the equine preovulatory follicle during recent years. These technologies have permitted the development of more in depth scientific and clinical studies with regard to the characteristics of the preovulatory follicle and the ovulation process. The striking similarities between mares and women in follicle dynamics and hormonal changes during the interovulatory interval and the ovulatory follicular wave, in ultrasonographic changes of the preovulatory follicle before ovulation, and in reproductive aging processes highlight the relevance of the mare as an important experimental model for the study of folliculogenesis in women.
Review: The use of color-Doppler technology to evaluate the vascularity of the follicle wall in mares started in 2004. Follicle blood-flow assessment by Doppler ultrasonography has been used in mares to study: (a) follicle selection, (b) anovulation during transitional seasons, (c) first versus later ovulations of the year, (d) follicle maturity and proximity to ovulation, (e) oocyte recovery rate, maturity, and quality, (f) normal vs. abnormal ovulation (septated evacuation) or anovulation (hemorrhagic anovulatory follicles -HAFs or luteinized unruptured follicles -LUFs), (g) the relationship of circulatory hCG antibodies on follicle vascularity, maturity and oocyte qualities, (h) age-related effects, and (i) potential for pregnancy establishment. Greater vascularity of the preovulatory follicle has been associated with greater follicle diameter (women, mares, heifers), retrieval rate of oocytes (women, mares, heifers), retrieval rate of mature oocytes (mares), *in vitro* fertilization rate (women, heifers), pregnancy rate (women, mares, heifers), and a lower incidence of triploidy (women). In addition, follicles with greater blood flow have resulted in better embryos and more pregnancies after embryo transfer in women. This presentation will focus on the main findings of our experiments that used B-mode and color-Doppler ultrasonography during the preovulatory period to study the morphological and blood flow/perfusion changes of the preovulatory follicle in mares. The topics to be addressed in this presentation will be: ultrasonographic characteristics of the preovulatory follicle; B-mode echotextural changes of the follicle wall; blood flow and perfusion changes of the follicle wall; signs of impending ovulation; prediction of impending ovulation; types of preovulatory follicle outcomes (ovulation, septated evacuation, HAF, atresia); follicle blood flow during evacuation; entry of follicular fluid into the abdomen; infundibular fluid; early corpus luteum blood flow; vascularity of the preovulatory follicle versus fertility; and the influence of hCG antibodies on follicle blood flow and oocyte quality.
Conclusion: Results of recent studies have demonstrated the potential of Doppler ultrasonography for providing clinical information on the status and future success of a follicle to ovulate and its oocyte to become fertilized and to generate an embryo/pregnancy. The equine model allows hypothesis testing using the three Doppler technologies for examining the ovaries and may provide additional information that can also be considered useful for other farm animal species and in human clinical medicine. This presentation is directed to equine theriogenologists and scientists who are involved in monitoring, managing, and manipulating ovarian function in mares.

Keywords: color-Doppler, equine, follicle, ovary, ultrasonography.

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