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Animal Reproduction Science 107 (2008) 1–8

ANIMAL REPRODUCTION SCIENCE

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Review article

Passage of postovulatory follicular fluid into the peritoneal cavity and the effect on concentrations of circulating hormones in mares

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Received 28 December 2007; received in revised form 21 February 2008; accepted 20 March 2008

Available online 26 March 2008

Abstract

Reported data were reviewed and reexamined to evaluate the concept that most of the follicular fluid enters the peritoneal cavity at ovulation in mares and transiently alters the circulating concentrations of LH, FSH, estradiol, and inhibin. A transrectal ultrasonographic study supported the hypothesis that the large volume (40–50 ml) of evacuated follicular fluid passes through the infundibular fimbriae into the peritoneal cavity. A spike in circulating inhibin and a decrease in the rate of reduction in circulatory estradiol occurs at ovulation. Simultaneously, a disruption occurs in the increasing concentrations of the ovulatory LH surge and in the FSH surge that begins before ovulation. The concept was further supported by the present finding that the estradiol content of follicular fluid within a few hours before ovulation is equivalent to the amount reported to be needed for a negative effect on LH and for a synergistic negative effect of estradiol and inhibin on FSH.

Keywords: Follicular fluid; Gonadotropins; Mares; Ovarian hormones; Peritoneum

1. Introduction

Follicular fluid of the preovulatory follicle contains a myriad of biologically active factors and hormones, including steroid hormones (estrogens, progestagens, androgens), peptide hor-

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doi:10.1016/j.anireprosci.2008.03.014

mones (inhibin, activins, follistatin), prostaglandins, cytokines, insulin-like growth factors and their binding proteins, and many other factors (Baka and Malamitsi-Puchner, 2006; Webb and Campbell, 2007). The substances found in follicular fluid determine the fate of the follicle and oocyte by interacting with systemic factors (Webb and Campbell, 2007). The preovulatory follicle has been studied extensively in many species, owing to a single cell, the oocyte, and its fundamental role in perpetuation of the species. However, comparatively scant attention has been paid to the postovulatory fate and function of the substantial volume of follicular fluid and its diverse content of active factors. This review considers the concept that the postovulatory oocyte and follicular fluid follow different routes in mares. The oocyte enters the oviduct, whereas most of the follicular fluid enters the peritoneal cavity and alters the circulating concentrations of LH, FSH, inhibin, and estradiol.

2. Follicle evacuation and infundibular fluid

A portion of the funnel-shaped ovarian end or infundibulum of the oviduct is attached to the cranial aspect of the ovulation fossa (Ginther, 1992). The infundibular processes or fimbriae of the remaining portion are juxtaposed to the remainder of the fossa during ovulation. A preovulatory collection of fluid external to the ovary in the infundibular area has been detected by transrectal ultrasonography (Townson and Ginther, 1989). In a detailed study, a fluid-filled infundibulum was detected by ultrasonic imaging in 46% of oviducts on Day −10, 88% on Day −3, and 8% on Day 7 (Gastal et al., 2007). The fluid pocket ranged from an equivalent of 5–20 mm in diameter (Fig. 1). Floating infundibular folds or fimbriae were detected by ballottement within the accumulation of fluid. The source of the fluid has not been determined but presumably originates from the oviduct, peritoneum, or both. As ovulation approaches, a bulge at the apex of the follicle can be detected at the ovulation fossa by laparoscopy (Witherspoon and Talbot, 1970) or by ultrasonic imaging (Carnevale et al., 1988; Gastal et al., 2006). This thin-walled and relatively avascular portion of the preovulatory follicle (Ginther et al., 2007a) separates the infundibular fluid pocket and the follicular antrum.

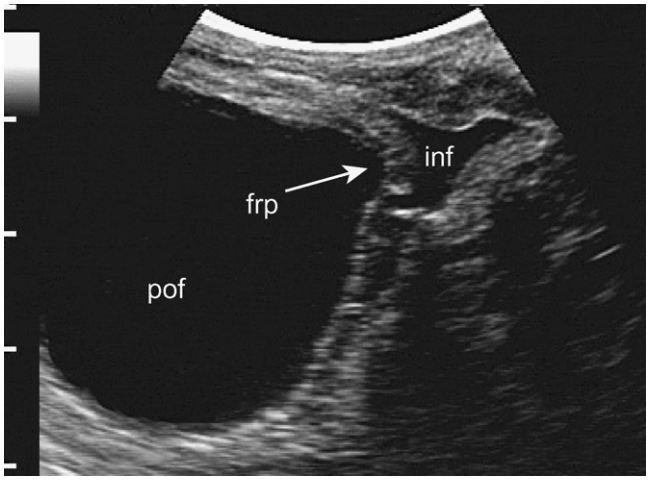

Fig. 1. Ultrasonogram from transrectal imaging, illustrating the preovulatory follicle (pof), apex or future rupture point (frp), and accumulation of extra-ovarian fluid in the infundibular (inf) area. The distance between graduation marks (left margin) is 10 mm.