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Popular Article

Follicular Dynamics in mares

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Introduction

The most dynamic, continually changing, macroscopic system in the body of a mare involves the cohorts of antral follicles that grow and regress in waves during the estrous cycle. During a specific wave, one of the follicles is empowered to become the ovulatory follicle. This phenomenon is known as follicle selection. Follicle selection has aroused the interest of biologists since at least the 1960s and can be considered one of the most enduring mysteries in reproductive biology of the monovular species. In recent years, the mare has become an increasingly productive model in this research area.

A. Interovulatory interval

The interovulatory interval begins at an ovulation associated with an estrus and ends at the ovulation of the next estrus. The days between ovulations are a far better reference for most follicle research purposes than days of the estrous cycle. This approach eliminates ambiguity associated with variations in methods of detection and definitions of estrus and minimizes error due, for example, to silent estrus. The mean length of the interovulatory interval is 21 or 22 days in horses and 24 days in ponies (Ginther, 1992).

1. Follicular wave

Follicular wave refers to several follicles that emerge and initially grow in synchrony. Various numbers and types of follicular waves develop during an interovulatory interval. In a major wave, the largest follicle of the wave attains the diameter of a dominant follicle (≥ 28

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mm). In minor waves, the largest follicle does not become dominant. Mean maximum diameter of the largest follicle for minor waves has been reported as 22 or 23 mm.

2. Dominant and Sub-ordinare follicles

Deviation is characterized by continued and preferential growth of one, occasionally two, members of the wave. The favored follicle is termed the dominant follicle. The physiologically selected dominant follicle grows to a large diameter (≥ 28 mm) and then either regresses (anovulatory major wave) or ovulates (ovulatory wave). The remaining follicles (subordinate follicles) undergo atresia. Thus, a selection or deviation mechanism is part of the definition of a major wave.

B. Follicle Dynamics during the Ovulatory Follicular Wave

1. . Emergence

The future dominant follicle emerged at 13 mm on 7 days after ovulation and 0.8 days before emergence of the future largest subordinate follicle.

2. Common growth phase and deviation

The growth rate of the two largest follicles (2.8 mm/day) was similar between emergence at 13 mm and the expected beginning of deviation at ≥ 20 mm.

3. The predeviation follicle

0A predeviation follicle was defined as a follicle that met the definition of being part of the ovulatory wave and reached a diameter at the beginning of deviation within the range for the future dominant follicle (19–27 mm) but began to regress before the beginning of deviation (Figure.1). The predeviation follicles had the following average features: 1) earlier emergence than for the future dominant follicle, 2) a growth rate similar to the rate for the

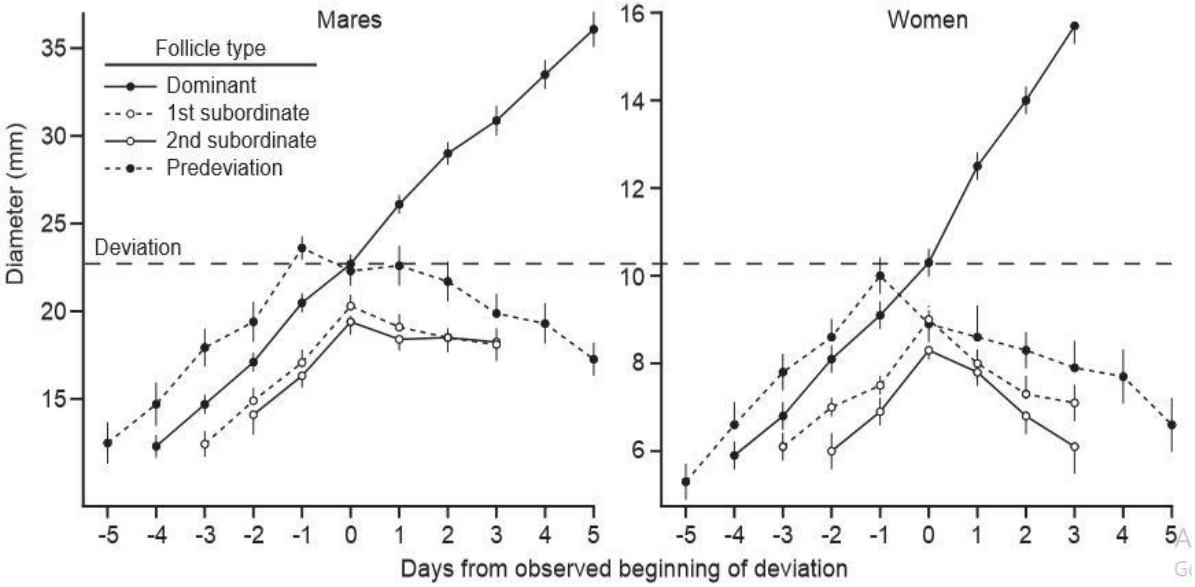

Figure 1. Follicular dynamics comparison in Mare and Women

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future dominant follicle during the common-growth phase, 3) maximum diameter similar to the diameter of the future dominant follicle at the beginning of deviation, and 4) maximum diameter occurring 1 day before the beginning of deviation.

C. **Hormonal and Molecular Aspects of the Follicle Selection Mechanism**

1. Gonadotrophins

The role of FSH after the peak of the surge involves the continued growth and development of all follicles before deviation and the developing dominant follicle after deviation.

2. Estradiol

About a day before the beginning of deviation, when the largest follicle is approximately 18 mm, the follicular-fluid estradiol concentrations began to increase differentially in the future dominant follicle.

3. Androgens and progestins

The androgen concentrations in the subordinate follicles were higher than in the dominant follicle in mares, and progesterone concentrations increased in the future dominant follicle at the beginning of deviation.

4. IGF system

The IGF system includes IGF-1 and -2, IGF binding proteins and IGFBP proteases. In mares the concentrations of free IGF-1 differentially increased in the future dominant follicle before the beginning of diameter deviation concomitant with the increase in estradiol. In addition, when the largest follicle was ablated at the beginning of deviation, free IGF-1 began to increase in the second-largest follicle 12 hours before the beginning of experimental diameter deviation between the two largest retained follicles (Ginther *et al.*, 2002) and was the first noted change among the potential intrafollicular gonadotropin-enabling factors. Concentrations of estradiol, inhibin-A and activin-A also increased differentially in the largest retained follicle, but only after experimental deviation had begun, indicating a key role for the IGF-1 system in the initiation of the selection mechanism in mares.

5. IGF binding proteins and proteases

The functional relationships of IGFs and IGFBPs to the deviation mechanism are further complicated by the presence of specific BP proteases in the follicular fluid. The proteases degrade the binding proteins and thus increase the bioavailability of IGF-1 in the follicles. Proteolytic activity for BP-2, BP-4, and BP-5 has been reported in dominant follicles during the follicular phase in mares.

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6. Inhibin

Inhibin-B concentrations did not change in the future dominant follicle but a decrease in the future subordinate follicle began at the beginning of deviation. When the largest follicle was ablated at the beginning of deviation, inhibin-A concentrations, like estradiol concentrations, increased differentially in the second-largest follicle but not until after an increase in the free IGF-1 and after the beginning of experimental deviation (Ginther *et al*., 2002).

7. Activin/Follistatin

Activins are dimeric glycoproteins and follistatin is a monomeric glycoprotein and both are present in the follicular fluid. Follistatin acts as a binding protein for activin and inhibin.

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