Developmental pattern of small (1-3 mm) antral follicles in the bovine ovary

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Introduction

- Follicles =4 mm develop in a wave-like fashion (synchronous growth of a group of follicles).
- Knowledge about developmental dynamics of follicles <4 mm may enhance response to superovulatory treatment.
- Precision in estrous or ovulation synchronization.
- Manipulation of ovarian functions for other reproductive technologies.

Objectives

- To characterize the developmental pattern of 1-3 mm follicles using high resolution real-time ultrasonography.
- To determine whether a dominant follicle has a size advantage at its earliest detection at 1 mm.
- To determine if the development of 1-3 mm follicles is temporally associated with increases in circulating concentrations of FSH.

Materials and Methods

Experiment 1

Animals: Hereford-cross heifers (n=18).
Ultrasonography: Every 24 h for one interovulatory interval (IOI) to evaluate changes in the number of 1-3 mm follicles. Data were divided for 2- and 3-wave interovulatory intervals.

Experiment 2

Animals: Hereford-cross cows (n=9).
Ultrasonography: Every 6 h during emergence of 2nd wave (Days 5-13; Day 0=ovulation) to evaluate diameter changes in individual 1-3 mm follicles.
Statistical analyses: Proc. Mixed procedure for repeated measures (SAS, Cary, NC) with Tukey’s post-hoc tests; Pearson’s correlation to determine relationship between FSH and follicle development.

Results

Experiment 1: The number of 1-3 & =4 mm follicles was inversely related in both 2- & 3-wave IOI.

Experiment 1: There was no difference in the number of follicles at wave emergence among waves in 2- & 3-wave IOI except the ovulatory wave in 3-wave IOI.

Correlation with FSH

- Full type: r = 0.81 P < 0.01
- Full type-by-day: r = 0.61
- Dominant follicle: r = 0.76 Sub 2, r = 0.73 P = 0.01
- 1st sub follicle: r = 0.77 Sub 1, r = -0.73 P < 0.01
- 2nd sub follicle: r = -0.78 Sub 2, r = -0.78

Interpretation

Experiment 1

- Development of follicles 1-3 mm in diameter is not random. An inverse relationship between 1-3 mm & =4 mm follicles detected in 2- & 3-wave IOI is indicative of wave-like development.
- Greater number of follicles at emergence of ovulatory wave of 3-wave IOI compared to all other waves; perhaps related to shorter preceding period of FSH suppression.

Experiment 2

Wave emergence was detected 66 h earlier than previously defined wave emergence (i.e. largest follicle, 1mm Vs 4-5 mm).
- The follicle destined to become dominant had a size advantage at its earliest detection at 1 mm; it was detected 6-12 h earlier than its subordinates.
- Follicles 1-3 mm in diameter are exquisitely sensitive to FSH.
- The dominant follicle was larger (P<0.05) than its subordinates within 36 h of its detection at 1 mm.
- The growth rate of the dominant follicle exceeded that of the 1st and 2nd subordinates by 120 h and 108 h after wave emergence at 1 mm, respectively (54 h & 42 h after wave emergence at 4-5 mm).

Conclusion

Small (1-3 mm) antral follicles develop in a wave-like fashion in the bovine ovary.
- Growth of 1-3 mm follicles is temporally associated with rising plasma concentrations of FSH.
- The follicle destined to become dominant emerges with a size advantage over its subordinates.
- Selection of the dominant follicle is manifest earlier than previously reported and is characterized by a progressive hierarchical pattern.

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