

Experimental extension of the time interval between oocyte maturation and ovulation: effect on fertilization and first cleavage

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Objective: To test the hypothesis that impaired fertility in human patients with high LH concentrations throughout the follicular phase of the menstrual cycle reflects premature maturation of their oocytes.

Design: Previous information that resumption of meiosis is induced by lower hCG concentrations than that required for stimulation of follicular rupture was confirmed and used for establishment of a rat animal model in which oocyte maturation and ovulation can be separated experimentally. In further experiments hypophysectomized, pregnant mare serum gonadotropin (PMSG)-primed, immature female rats injected with 1.1 IU of hCG, a dose found to induce maturation in $72.9\% \pm 6\%$ of the rats with no effect on ovulation, were administered with a second injection of an ovulatory dose (4 IU) of hCG, 24 hours later. The ovulated eggs were subjected to IVF.

Results: Fertilization and first cleavage in oocytes recovered from our experimental animal model were similar to that observed in control PMSG-primed, either hypophysectomized or intact rats, treated by a single injection of 4 IU of hCG.

Conclusions: The extension of the time interval between oocyte maturation and ovulation in the rat does not result in a lower rate of fertilization or a reduced incidence of cleavage. However, an inferior developmental capacity of these embryos cannot be ruled out.

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Key Words: Oocyte maturation, delayed ovulation, fertilization, LH surge

Both oocyte maturation and ovulation are induced by the preovulatory surge of the pituitary gonadotropin, LH (reviewed by Dekel [1]). However, these two biological responses of the mammalian ovary take place at different time intervals after the hormonal

stimulus. In the rat, the first meiotic division of the oocyte is initiated by 4 hours and completed by 9 hours after the LH surge, whereas ovulation occurs only 3 hours later (2, 3). The above-mentioned sequence between oocyte maturation and ovulation ensures that a premature oocyte is not released from the ovarian follicle into the site of fertilization. Furthermore, as the life span of the unfertilized ovum is limited, a strict control of the time interval that elapses between these two events is probably essential for successful reproduction. Our study aimed at examination of this hypothesis. Specifically, our initial experiments were conducted to confirm previous reports that oocyte maturation and ovulation are stimulated by different doses of LH and hCG (4, 5)

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