Whither human IVF? Fertilisable oocytes selected on the basis of follicular temperature

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Abstract

Bearing in mind specific parallels between cow and human ovarian physiology, as noted in the manuscript, we have measured whether the temperature in a pre-ovulatory follicle is cooler than that in adjacent tissues. Using a novel approach not requiring anaesthetics or surgical procedures, we found that follicular fluid bathing cow oocytes shortly before ovulation is cooler than the neighbouring uterine surface and cooler than deep rectal temperature (the reference body temperature in cattle). By contrast, Graafian follicles of comparable size and ultrasonic image that do not subsequently ovulate do not have a reduced antral temperature. Human pre-ovulatory follicles have previously been reported to be cooler than other ovarian tissues, so the divergence between ovulatory and non-ovulatory follicle temperature suggests a valuable addition to selection procedures currently used in human in vitro fertilisation (IVF) clinics. In future, oocytes to be subjected to IVF might best be those taken from cooler follicles. Follicular antral temperature could become a more sensitive indicator of oocyte potential than a purely morphological assessment.

Background

Techniques associated with human in vitro fertilisation (IVF) have made considerable progress since the original studies of Edwards and Steptoe [1]. Nevertheless, the predictability of ovarian responses to systemic gonadotrophic stimulation remains modest for individual patients, and the quality of oocytes aspirated from supposedly pre-ovulatory follicles is variable [2]. In this latter context of potential fertilisability, we believe that there may be a straightforward means of identifying pre-ovulatory follicles destined to yield oocytes suitable for in vitro procedures.

Here we would like to suggest to the readers of *Journal of Assisted Reproduction and Genetics*, evidence based on our recent studies in cattle implicating the importance of follicular temperature on oocyte quality. Bovine Graafian follicles

commonly attain a pre-ovulatory diameter of 14–22 mm, and the interval between the gonadotrophin surge and ovulation is usually 28–30 h or slightly longer [3]. Such parallels in ovarian characteristics with our own species suggest that recent clinical observations made in European dairy cows could have direct relevance to procedures of human IVF.

Measuring temperature in reproductive tissues

We have had a specific interest in temperature physiology in mammalian oviducts and ovaries for some three decades [4–6]. Perhaps, the most significant finding to come from such studies is that both male and female gametes are subjected to temperatures cooler than those in neighbouring tissues in the hours shortly before the onset of fertilisation [7–9]. In the present context, bovine follicles known to have ovulated within 24 h of measurement had a temperature of 1.54 ± 1.45 °C (mean $\pm$ SD; range 0.60 to 5.50 °C) cooler than that of rectum whereas follicles of similar diameter not having a cooler temperature failed to ovulate within the subsequent 1–2 days [10].

These consistent observations lead to the proposal that if human pre-ovulatory follicles also have a reduced temperature when compared with other gonadal or adjacent reference

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tissues, then measuring the temperature of human follicles at the time of oocyte aspiration could offer a means of identifying viable oocytes. In fact, there is already one report that human pre-ovulatory follicles may be cooler than the ovarian stroma [11]. This temperature difference increased toward ovulation during surgical intervention. However, the present report concerns direct measurement of follicular temperature in animals not subjected to any form of sedation, anaesthetic or surgical procedure by means of a thermistor probe introduced into the antrum under ultrasonic guidance [10].

Conclusion and overall perspective

Reflecting on these observations and their relevance to human fertility clinics, it should be feasible to make relatively simple pipettes that enable follicular antral temperature to be measured at the time of oocyte aspiration. In this manner, and assuming further parallels between human and bovine ovarian physiology, it may become possible to identify oocytes with a high chance of fertilisation and early embryonic development.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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