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The impact of a stable temperature environment on embryo development and subsequent pregnancy outcome

AA Nkuhlu, M Jacobson, L Gobetz, S Volschenk, C Venter, Y Unterslak, D Mortimer

VITALAB Centre for Assisted Conception, Morningside, Johannesburg, Gauteng

INTRODUCTION:
Although 37°C is generally used for all aspects of human IVF, there are limited studies on possible adverse effects of temperature on embryo development. Nevertheless, controlling temperature in the IVF laboratory is thought to be one of the most crucial aspects of the entire programme, from oocyte retrieval through to embryo transfer and embryo biopsy, to reduce environmental stress and optimize embryo development.

AIM:
To investigate the effect of thermal stability on human embryo development.

MATERIALS AND METHODS:
All IVF and ICSI cases from April 2014 – June 2015 were included, regardless of age, and including both donor and non-donor oocyte cycles. Embryos were cultured in micro-droplets of Life Global Total medium under oil in either Cook MINC or Planer/Origio BT37 benchtop incubators using 5% oxygen at 37°C. Data were analyzed retrospectively relative to the introduction of a warmer for the follicle aspirate tubes and a controlled environment workstation (Cell-Tek chamber: Tek-Event, Round Corner, NSW, Australia) for egg search and handling.

RESULTS:
Cycles were divided into 3 groups: **Group 1**, without tube warmer or Cell-Tek (April – June 2014; n=186); **Group 2**, with tube warmer but without Cell-Tek (July – Oct 2014; n=259); and **Group 3**, with both tube warmer and Cell-Tek (Nov 2014 – June 2015; n=308). There was a similar age distribution of patients in all groups. Outcomes were compared using Fisher's Exact Test (MedCalc, www.medcalc.be).
Pregnancy rates (ßhCG positive) were significantly higher in Groups 2 and 3 (41% and 40%) than in Group 1 (34%; both $P<0.05$). There was a corresponding trend towards a higher implantation rate (number sacs/number embryos transferred) in Groups 2 and 3 (30% and 28%) than in Group 1 (24%; $P=0.06$). Also, there was a higher proportion of 8-cell embryos on Day 3 in Group 3 (766/1870 [41%]) than in Groups 1 and 2 (333/924 [36%], $P=0.01$; and 474/1398 [34%], $P=0.0001$; respectively).

CONCLUSION/DISCUSSION:
Given the important goal of mimicking the in vivo environment, most clinical IVF procedures are performed at human core temperature (37°C). However, it is not always possible to prevent temperature fluctuations, particularly during oocyte retrieval and gamete and embryo manipulation. We investigated the effect of introducing improved temperature control during these processes, and found that there were significant benefits. When the tube warmer was introduced, there was a significant improvement in pregnancy rates resulting from thermal protection of the oocytes during retrieval. Similarly, a controlled environment workstation for gamete and embryo manipulation was associated with a significant increase in embryo quality, measured as the proportion of 8-cell embryos on Day 3. Therefore, controlling thermal stresses imposed upon gametes and embryos is critical in optimizing the in-vitro environment and clinical outcomes.