MULTI-CENTER STUDY: INNOVATIVE CONTROL OF AMBIENT AIR QUALITY IN MULTIPLE IVF LABORATORIES IS ASSOCIATED WITH STATISTICALLY SIGNIFICANT IMPROVEMENTS IN CLINICAL OUTCOMES - ANALYSIS OF 5319 CYCLES

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Abstract:

Objective: Successful preimplantation embryogenesis and the reproductive potential of the human embryo are critically dependent upon a number of variables including the changing organic chemistry of the ambient air (AA) within the IVF laboratory. AA contains dynamic levels of embryotoxic volatile organic compounds (VOCs) and viable particulates (VPs), which play a critical role in preimplantation toxicology and in the influence of AA on epigenetic processes. This report represents the largest cohort study evaluating the impact of comprehensive remediation of airborne pathogens on measures of embryogenesis and patient outcomes in multiple IVF programs using a proprietary air purification system (APS). Using targeted engineered molecular media and genomically modeled biological inactivation, the APS was designed to comprehensively remediate airborne embryotoxic pathogens.

Design: Retrospective analysis with historical controls.

Materials and Methods: Clinical outcome data from all non-donor IVF patients (n = 5319) cycling through 9 independent IVF programs was evaluated over a 24-48 month period. Data was collected for 2761 patients cycling in an environment protected by pre-existing mechanisms of air filtration and 2558 patients after the installation of the APS. Blastocyst conversion rate (BCR) was defined by zygotes reaching the blastocyst stage by Day 5, implantation rate (IR) by positive fetal cardiac activity (FCA) per transferred embryo, ongoing pregnancy (OP) by positive FCA and loss rate (LOR) as an intrauterine gestational sac without subsequent FCA. Multivariate analyses (MVA) evaluated differences in patient demographics, program, and pre- and post-installation variables. Statistical analyses included odds ratios calculated with 95% confidence intervals and $\alpha = 0.05$ using MedCalc Software 13.1.2, Ostend, Belgium.

Results: Embryos cultured after installation of the APS demonstrated a significant increase in BCR (33.7% vs. 54.4% [p=0.0001]), IR (29.7% vs. 41.4%, [p=0.0001]) and OP (42.7% vs. 57.6% [p=0.0001]) from all maternal ages, pre- and post-APS, respectively. Those embryos cultured in the APS-controlled environment demonstrated a significant decrease in LOR (27.7% vs. 20.3% [p=0.0001]). No other variables were significant by MVA.

Conclusions: Embryotoxic VOCs and VPs play a critical role in preimplantation toxicology and in the influence of AA on epigenetic processes. Concomitant with comprehensive removal and control of airborne pathogens within the in vitro culture environment was a statistically significant increase in BCR, IR, OP and a decrease in LOR. Comprehensive control of the AA is critical to successful preimplantation embryogenesis.

Fertility and Sterility, Vol 106, Issue 3 Supplement, pages e27-28. Accepted for oral presentation, 72nd Annual Meeting of the American Society for Reproductive Medicine, Salt Lake City, October, 2016.