STATUS QUO – OR IS IT TIME TO RECONSIDER THE VITRIFICATION METHOD RELATIVE TO THE RISK OF EMBRYO DISEASE TRANSMISSION IN CRYOSTORAGE?

P- 135

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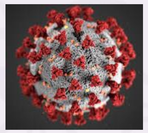
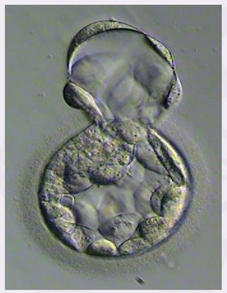
Introduction

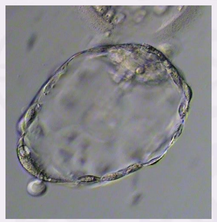
The current global pandemic has triggered concerns regarding the potential infectivity of the SARS-CoV-2 virus to blastomeres known to possess ACE-2 receptors. In 2010, Pomeroy and coauthors reviewed the negligible risks associated with the potential cross contamination of human reproductive tissues, gametes and embryos in cryostorage. The purpose of this investigation is to explore changes in ART lab practices over the last decade that could warrant a reassessment of the latter AAB/CRB embryo cryopreservation guidelines relative to disease transmission potential.



Study

Retrospective analysis of clinical practices that may alter the way we look at acceptable risks in embryo vitrification (VTF) and cryostorage methods. Specifically, we will investigate the effectiveness of a validated closed VTF system relative to zona pellucida (ZP)-intact and non-intact blastocyst cryopreservation. Additionally, we will discuss the merits and need for safer cryostorage systems.





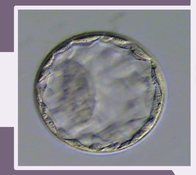
For more discussion on this topic, see: Schiewe & Pomeroy, JARG (2020) and I³ Webinar Session #31 09/01/20

Methods

Human blastocysts were vitrified in a closed, aseptic device system and rapidly-warmed and sucrose diluted using standard procedures. From 2009 to 2012, 90% of all vitrified blastocysts had an intact ZP without the need for pre-VTF collapsing due to the use of I.C.E. non-DMSO solutions (>7.9M glycerol/EG). Between 2012-2014 we transitioned into 100% of all embryos experiencing laser ZP ablation and or blastocyst biopsying procedures by 2015. The latter trophectoderm exposed blastocysts were effectively contained in flexipettes which were weld-sealed into CBS straws without risk to possible pathogen exposure in liquid nitrogen cryostorage. Chi-squared analysis was used to assess differences ($p<0.05$) in survival and pregnancy outcome data.

Results

The routine application of ZP-exposed trophectoderm and blastocyst biopsying improved ($p<0.05$) our survival rates from 95% (1066 of 1126 blastocysts) to 99.4% (3352 of 3373 blastocysts) with increased ($p<0.05$) embryo implantation efficiency (46% vs 69% implantation) using fewer blastocysts/FET (1.91 vs 1.07, respectively).



Discussion

The protective barrier of an intact ZP to potential pathogen exposures is no longer a clinical reality for cryopreserved blastocysts. Although we agree that the relative risks of embryo disease transmission in cryostorage remain negligible, why take any risks when highly effective closed VTF systems (ICE straw, HSV, µS-VTF, VitriSafe) have been established over the last decade? Alternatively, we question whether the use of LN_2-vapor storage tanks for open-VTF systems alleviates potential airborne viral cross-contamination, while they most certainly create a greater risk for potential embryo wastage as discussed by Pomeroy et al. (2010) and overtly realized by recent tank failure experiments and known catastrophic events where response time is critically important.

We have experienced that embryos vitrified in an insulated straw environment, like microSecure, are SAFE & SECURE under all conditions, and are more resistant to detrimental additive temperature fluxes that can occur under sub-optimal cryostorage handling procedures, including those conditions where TE-exposed blastocysts experience high levels of complete survival & implantation.

Based on the Pomeroy et al., 2010 paper the risksof embryos to disease transmission, including SARS-CoV-2, likely remain negligible. However, keep in mind that the decades of science behind understanding disease transmission potential were based on applied research with Zona-intact eggs and embryos. An exposed trophectoderm may indeed be more vulnerable to infection, thus the use of closed system VTF is indeed the best lab practice. This Good Tissue Practice is aimed at protecting us from others pathogens in the future.

So, we ask, is it time to reconsider the status quo of embryo good tissue practices when viral pandemics are a reality?