

Fundamental Cryobiology of Human Spermatozoa and its Relationship to Artificial Insemination Outcomes

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Introduction

Empirical methods of cryopreservation developed in the 1950s are still used today for mammalian sperm preservation. In general, survival (as measured by motility) of post-thaw cryopreserved mammalian sperm is usually 50% or less and exhibits wide variability among species and individuals within species. In some mammalian species (*e.g.*, rat), cryosurvival of sperm is so low that frozen-thawed sperm cannot be used for assisted reproduction.

Cryopreserved human spermatozoa were first used in the 1950s by Sherman (Sherman, 1964, 1973) and several investigators developed efforts to improve methods of human sperm cryopreservation (Sherman, 1978, 1986). However, even decades later, cryosurvival of human sperm from the general population is still low. The conception rates with frozen-thawed human sperm may be lower than those with non-frozen sperm (Corson *et al.*, 1983; Richardson, 1980). More recent data in this regard are not available because it is not currently possible to conduct experiments addressing this issue since the use of non-frozen, non-quarantined human sperm presents is not possible do to the recognized risk of disease transmission. The low survival of cryopreserved human sperm and the associated lower conception rates are likely due to the fact that procedures for cryopreservation have not been optimized.

The process of cryopreservation is comprised of a series of steps in which cells are exposed to non-physiologic conditions. It is possible to divide this series of steps into four major areas: (1) selection of cryoprotective agent (CPA) type and concentration, (2) addition of the CPA, (3) cooling, (4) storage, (5) warming and (6) CPA removal. It is important to recognize that each of these steps is interactive; *i.e.*, the parameters established in one step place constraints upon the other steps. In this context, the decision that is made in step 1 establishes constraints upon all the subsequent steps. Therefore, it is critical to optimize the type and concentration of CPA. However, each of these steps, because they interact with one another, require optimization though knowledge of the underlying fundamental cryobiology of the cell type of interest.

The current state of human spermatozoa cryobiology and preservation will be discussed

References

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