

General article

Oocyte freezing: basics, current status and potential applications in reproductive biology

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Abstract

Over the past several decades, considerable effort has been expended toward the successful cryopreservation of various cells. While attempts at cryopreservation have been directed at different tissue types, one of the most vigorously pursued targets has been reproductive tissue. Historically, cryopreservation of sperm has existed for several decades. The earliest reports of pregnancies (Trounson et al., 1983) and births (Zeilmaker et al., 1984) from the cryopreservation of embryos occurred in the early 1980s. Presently, the freezing and storage of embryos following in vitro fertilization (IVF) is standard practice at most fertility clinics. In 2003, the CDC Assisted Reproductive Technology success rates report stated that 4,246 live births occurred out of 17,517 non-donor frozen embryo cycles. . Because the egg is a relatively voluminous cell with abundant cytoplasm, crystallization at the time of freezing may result in damage to the organelles. Secondly, a mature metaphase II oocyte contains a fragile spindle apparatus involved in cleavage. The purpose of this research study is to evaluate a method of freezing and thawing oocytes. This evaluation will be made by comparing the survival rates and rates of fertilization, cleavage and embryo quality of fresh oocytes and frozen-thawed oocytes which will be inseminated during the IVF (in vitro fertilization) treatment cycle. In addition, the same comparisons will be made between frozen oocytes from infertile women and those of egg donors. You are being asked to be in this study because you are currently undergoing in vitro fertilization

Keywords: Oocyte, Freezing, Cryoprotectant

1. Introduction

Cryobiology is the study of the effects of low temperatures on living organisms. People long believed that very low temperatures would only exert negative effects on cells and tissues. They could not possibly imagine the advancements in cryobiology to be achieved and possibilities of the future in this area. In the future, it may be possible to cryopreserve human cells, whole human organs, such as kidneys, hearts and livers for subsequent transplantation, preserve corneas and other delicate tissues with minimal damage long enough to allow them to be shared all over the world and protect fragile and rare plants from extinction through ice-free preservation. Before going further let us try to define the term freezing that is also known as cryopreservation. Cryopreservation may be defined as “arresting all biological processes and placing biological material such as cells, eggs also known as oocytes, embryos, spermatozoa or tissues etc. into a suspended state of animation at ultra low temperatures”.

1.1 The concept of oocyte Freezing

Oocyte freezing has the potential to be an important adjunct to assisted reproductive technologies (ART) in

humans and domestic animals. However, the ease and success of cryopreservation programmes for sperm and embryos contrast markedly with the problems associated with freezing mammalian oocytes. The results of numerous studies suggest that the survival of oocytes after cryopreservation can be affected by their stage of maturation, quality or by biophysical factors resulting from the cryopreservation procedure used. For example, the maturity, quality and size of the oocyte are particularly important characteristics affecting the outcome of cryopreservation. However, oocyte freezing has been slow to be adopted clinically as the number of oocytes which survive the freeze-thaw process is extremely variable and less than 1% of fertilized cryopreserved oocytes have developed to term.

1.2 Basics of oocyte Freezing

Developing protocols that optimize the survival, fertilization and developmental rates of oocytes following exposure to the extreme chemical and physical stresses associated with cryopreservation has proved to be a major challenge. Cryopreservation of biological specimens causes complex changes in structure and cellular composition, and no single approach has yet proved to be universally effective. In addition, there are significant