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The Viability Of Human Embryos After Transport In A Dry Shipper Between Assisted Conception Laboratories

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Abstract

Problems during transport have been described in the literature for human embryos despite specifically-designed dry shippers, including failure of the dry shipper and poorer outcomes using the transported material. The aim of the present study was to examine the performance after thawing of embryos imported to the Hollywood Fertility Centre in a dry-shipper (MVE SC 4/2V). A total of 926 embryos were imported for 154 women, and a total of 689 have been thawed to date. Thaws were performed using methods that matched the freezing protocols, and the outcomes were compared with a parallel group of women treated at the Hollywood Fertility Centre whose frozen embryos had remained in-house. The survival of thawed imported embryos was significantly reduced for zygotes (69.8% vs 84.6%) and blastocysts (51.7% vs 73.7%) but not early cleavage embryos (60.8% vs 65.7%). However, culture to Day 5/6 of either thawed zygotes or early cleavage embryos gave blastocyst utilization rates for imported embryos that were similar to or better than in-house embryos. The replacement of embryos at an appropriate stage of the cycle showed pregnancy rates that were similar for the imported embryos compared to the in-house embryos. It is concluded that transported human zygotes and blastocysts do not survive as well after thawing compared to equivalent embryos stored in-house. However, the ability of all surviving embryos to grow *in vitro* and implant is not compromised.

Introduction

The storage of human embryos in liquid nitrogen is now standard practice in most assisted conception laboratories, with the main challenge being with the optimization of the procedure [3]. These cryopreserved embryos appear to be quite stable over time once in storage [9]. However, embryos occasionally are required to be taken out of storage and moved to another assisted conception laboratory and, whilst specifically-designed dry shippers are often used successfully [1, 10] and are accepted as safe by the International Air Transport Association [6], problems have been described including failure of the dry shipper during transport [11] and poorer outcomes following treatment using the transported material [2].

The aim of the present study is to examine the performance after thawing of embryos imported to the Hollywood Fertility Centre in a dry shipper from assisted conception laboratories locally or from outside of the State. Consideration is given to the stage of embryo development at cryopreservation, and the parameters analysed include the survival, blastocyst utilization rate and subsequent clinical pregnancy rates. A comparison was made with embryos cryopreserved at the Hollywood Fertility Centre over the same period that were not transported but held continuously in-house.

Methods

Embryos were imported in accordance with West Australian State and Australian Federal legislation [5, 8], and with the written consent of the patients. A dry-shipper (MVE SC 4/2V), latterly monitored with a Cryoguard™ M-120 thermal exposure indicator, owned by the Hollywood Fertility Centre was used to transport all embryos from other assisted conception units within Perth (courier transport by road within a 2 hr period) and units outside of Western Australia (transport by air freight first class for up to 2 days). Embryos were frozen using versions of slow-freeze protocols described previously for pronucleate oocytes, early cleavage embryos and blastocysts [12]. Thaws were performed using methods that matched the original freezing protocols, as advised by the laboratory having undertaken the original freeze. The outcomes were compared with a parallel group of women whose embryos had been frozen at the Hollywood Fertility Centre and stored in-house.

Statistical analysis was performed using chi-squared [7] using Yates' correction if there was an expected frequency of 5 or less in one or more of the cells, and differences considered significant if p

Results

Table 1 shows that 81% (747/926) embryos were moved between assisted conception units in Perth, with the remainder coming from outside of the State. The survival of embryos according to the stage of cryopreservation is shown in Table 2 and compared to the survival rate of in-house embryos. The survival of thawed imported embryos was significantly reduced for zygotes (χ^2=22.13, p2=6.96, p2=2.77, p>0.09). The utilization rate of pronucleate and early cleavage embryos cultured to Day 5 or Day 6 is shown in Table 3. A similar proportion of imported early cleavage embryos formed usable blastocysts compared to their in-house counterparts (χ^2=0.01, p>0.9), whilst the surviving imported pronucleate oocytes apparently performed better than the in-house embryos (χ^2=29.62, p0.05, not significant).

Discussion

The movement of human embryos between assisted conception units is now commonplace [6] with good outcomes [1, 10], although some recent audits have revealed that problems can occur albeit with a low incidence [2, 11]. The present study has shown that human embryos surviving after transport do equally well or better than similar embryos frozen and stored without transport (Tables 3and 4). However, the survival of zygotes and blastocysts (but not early cleavage embryos) was reduced following transport (Table 2), and the reasons for this reduced survival are unclear. Factors common to all three stages of embryo development at freezing are unlikely to be responsible, such that (i) there was no evidence from the attached thermo-indicator or the condition of the shipper upon arrival that there was warming of the embryos during transit, (ii) airport screening X-irradiation does not appear to affect embryo survival or blastocyst formation rates [4], and (iii) storage time in liquid nitrogen does not appear to affect embryo viability [9]. The possibility of incompatibility between freezing and thawing solutions and protocols, with the early cleavage embryos being least affected, cannot be excluded. But the maximal effort made to match the commercially-available media used and the following of the provided protocols wherever possible means that this reduced survival may well have to be accepted by clinics and patients alike.

Conclusion(s)

It is concluded that transported human zygotes and blastocysts do not survive as well after thawing compared to embryos stored in-house. However, the ability of surviving embryos to grow *in vitro* and implant is not compromised. This information should be made available to laboratories and patients alike when making a decision about the transportation of embryos.

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