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Factors affecting the success of oocyte transfer in a clinical program for subfertile mares

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Abstract

Oocyte transfer is a potential method to produce offspring from valuable mares that cannot carry a pregnancy or produce embryos. From 2000 through 2004, 86 mares, 19.2 ± 0.4 yr of age (mean ± S.E.M.), were used as oocyte donors in a clinical program at Colorado State University. Oocytes were collected from 77% (548/710) of preovulatory follicles and during 96% (548/570) of cycles. Oocytes were collected 21.0 ± 0.1 h after administration of hCG to estrous donors and cultured 16.4 ± 0.2 h prior to transfer into recipients' oviducts. At 16 and 50 d after transfer, pregnancies were detected in 201 of 504 (40%) and 159 of 504 (32%) of recipients, respectively, with an embryo-loss rate of 21% (42/201). Pregnancy rates were similar ($P > 0.05$) for cyclic and noncyclic recipients and for recipients inseminated with cooled, fresh or frozen semen. One or more recipients were detected pregnant at 16 and 50 d, respectively, for 80% (69/86) and 71% (61/86) of donors. More donors <20 than ≥20 yr (mean ages ± S.E.M. of 15.5 ± 0.4 and 23.0 ± 0.3 yr, respectively) tended ($P = 0.1$) to have one or more pregnant recipients at 50 d (36/45, 80%; 28/45, 62%, respectively). Results of the program confirm that pregnancies can consistently be obtained from older, subfertile mares using oocyte transfer.

Keywords: Equine; Oocyte; Assisted reproduction; Oocyte transfer; Aging

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1. Introduction

Commercial oocyte transfer involves the collection of a donor mare's oocyte from the preovulatory follicle. The oocyte is transferred into the oviduct of an inseminated recipient. Fertilization and development of the embryo and fetus occur within the recipient. Because the donor is required only to develop a preovulatory follicle with a viable oocyte, many reproductive problems, e.g. ovulation failure, oviductal blockages, or uterine infections, are circumvented. Therefore, subfertile mares that cannot provide viable embryos are frequently good candidates for oocyte donors.

Although the first foal was born after an experimental oocyte transfer in the late 1980s [1], efficiency of the procedure was not sufficient for commercial use, with only one foal produced from 15 oocytes (1/15, 7%). In 1995, Carnevale and Ginther [2] reported experimental transfers with high embryo-development rates (11/12, 92%) after oocytes were collected from young donors and cultured in vitro prior to transfer into inseminated recipients' oviducts. Oocyte transfer was not used for clinical purposes until the late 1990s [3,4]. In 2001, Carnevale et al. [3] reported using oocyte transfer to obtain offspring from mares with various reproductive abnormalities, including persistent endometritis, ovulatory failure, and scarring of the cervix; for some mares, no definitive cause for subfertility was determined, but embryo-collection attempts were unsuccessful.

The present study is a retrospective analysis of the commercial oocyte transfer program at Colorado State University from 2000 through 2004. Objectives of the study were to review the success of oocyte transfer in a clinical setting and compare potential factors affecting pregnancy rates.

2. Materials and methods

2.1. Oocyte donors and reproductive monitoring

Oocyte collections and transfers occurred during the breeding seasons (February through September) from 2000 through 2004. Donor mares were of numerous, light-horse breeds that were housed at Colorado State University for variable intervals. Some donors were in the program for >1 yr; in these cases, data for the donors were included for each breeding season.

Transrectal ultrasonography was used to monitor ovarian activity in donors. During estrus, ovaries of most mares were scanned daily to determine the optimal day for induction of ovulation. Typical criteria for induction of ovulation included: (1) follicle ≥ 35 mm in diameter; (2) relaxed uterine and cerivical tone; (3) endometrial edema consistent with estrus; (4) estrous behavior. Because of the variety of mares in the program with atypical cycles, criteria were modified for individual mares. Availability and timing of semen delivery also contributed to the final decision of when to induce ovulation. To reliably induce follicle and oocyte maturation, a GnRH analog (deslorelin acetate; Ft. Dodge Animal Health, Ft. Dodge, IA, USA, or BET Pharm, LLC, Lexington, KY, USA) was administered approximately 4 h prior to administration of hCG (1500–2500 IU, i.v.; Chorulon®, Intervet Inc., Millsboro, DE, USA).