Use of Oocyte Transfer in a Commercial Breeding Program to Obtain Pregnancies from Mares with Reproductive Pathologies

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Oocyte transfer can be used to obtain pregnancies from mares in which embryo transfer is unsuccessful. Transfer of oocytes in a group of older mares with long histories of infertility resulted in pregnancies from 13% (6/46) of cycles, 23% (6/26) of oocyte transfers, and 38% (6/16) of cycling donors. Noncycling, hormone-treated mares were suitable oocyte recipients. With continued modifications, this technique would be a viable alternative to embryo transfer in specialized equine practices. Authors' Address: Colorado State University, Animal Reproduction and Biotechnology Laboratory, Fort Collins, CO 80523. © 1999 AAEP.

1. Introduction

Oocyte transfer involves collection of an oocyte from the follicle of a donor, and transfer of the oocyte into a recipient's oviduct. The recipient is inseminated, and fertilization and embryo development occurs within the recipient's reproductive tract. Oocyte transfer resulted in pregnancies in research mares. However, embryo development rates were significantly reduced when oocytes from old mares (>20 years) vs. young mares (<10 years) were transferred. Although the transfer of oocytes has been indicated for certain reproductive pathologies (i.e., severe endometritis or pyometra, cervical lesions, oviductal occlusion, ovulation failure), this procedure had not been attempted in a group of clinically subfertile mares. During the 1998 breeding season, the viability of oocyte transfer as a method to obtain pregnancies from mares with long histories of infertility and various reproductive pathologies was studied.

2. Materials and Methods

Mares (n = 18) were presented to Colorado State University (CSU) for various periods of time during the 1998 breeding season (May through September). The mares represented seven breeds and were between 16 and 30 years of age. All mares had long histories of reproductive failure in breeding and embryo transfer programs. One or more of the following pathologies were diagnosed per mare: persistent endometritis or pyometra (n = 6), intermittent or repeated ovulatory failure (luteinized or hemorrhagic follicles, n = 7), nonfunctional cervix (n = 3), and ovarian pathology (n = 1). In five mares >20 years of age, no definitive cause for reduced fertility was determined, however, previous repeated embryo transfer attempts were unsuccessful.
Ovarian activity was monitored by transrectal ultrasonography to determine follicular development. Ovaries were scanned at daily or hourly intervals as indicated. Injections of hCG (2500 IU, IV) and/or GnRH implants were used to initiate oocyte maturation. Oocyte collections were attempted 22.8 ± 0.8 and 30.0 ± 1.0 hours after hCG and/or GnRH, respectively. For seven aspirations, follicular changes consistent with ovulation were observed, and no treatment was used to induce follicular maturation. Oocytes were collected by transvaginal ultrasound-guided follicular aspirations using a curvilinear or linear ultrasound transducer and a double-lumen oocyte collection needle. Upon collection, the cumulus oocyte complex was evaluated for cumulus expansion (graded from compact to fully expanded). Oocytes with fully expanded cumulus and corona cells were transferred into a recipient in less than 1.5 hours (n = 5). Oocytes with moderately expanded cumulus were cultured (mean of 12.6 ± 1.5 hours) for the completion of maturation (n = 16), and one oocyte with a compact cumulus was matured for 25 hours in vitro. Oocytes were transferred into the following types of recipients: cycling (recipient’s oocyte aspirated, n = 21), noncycling (hormone treated, n = 4), or postovulation, estrogen-treated (n = 1). If two oocytes had been collected from a donor, the oocytes were transferred into the same recipient. For insemination of the recipient, fresh (n = 2), cooled (n = 22) or frozen (n = 2) semen was obtained from various stallions.

3. Results

Some mares did not cycle (n = 2) or cycled intermittently (n = 4). One to six oocyte collection attempts were made per mare. Follicle diameters ranged from 28 to 43 mm (mean of 36.3 ± 0.4 mm) prior to aspiration. Oocytes were collected during 39 of 46 cycles (85%) and from 39 of 56 follicles (70%). Twenty-six transfers were attempted. Six pregnancies resulted from 26 oocyte transfers (23%) and from 38% (6 of 16) of cycling mares. Pregnancies were obtained from donors with uterine and/or cervical pathology (2/6), with repeated ovulatory abnormalities (2/5), and with no definitive cause of subfertility (2/5). No pregnancies were obtained from noncycling mares (n = 2) or mares which cycled at prolonged intervals (n = 4). Problems encountered during the transfers included: atretic appearance to the oocyte cumulus complex (n = 5), immature oocyte (n = 1), inadequate semen (low motility and/or numbers, n = 4), and semen delayed during shipment (n = 1). For transfers in which oocyte and sperm appeared viable, pregnancies resulted after 38% (6/16) of transfers. Pregnancies were obtained in recipients which were cycling (3/21), noncycling (2/4) and postovulation (1/1).

4. Discussion

In the present study, oocyte transfer was used to obtain pregnancies from mares in which embryo transfer was unsuccessful and in which various reproductive pathologies were present. Oocyte collection rates were high, with oocytes recovered during 85% of cycles. Pregnancy rates obtained after oocyte transfer (23%) were comparable to published pregnancy rates after GIFT in women. With consecutive transfers, pregnancies were obtained from 38% of donors that had at least one estrous cycle. Problems encountered were primarily associated with oocyte and semen quality. Semen was shipped from various stallions and farms. Therefore, quality of the semen and sperm numbers were variable. Mares used for the study had diagnosed and undiagnosed causes of reproductive failure. The majority (13/18, 72%) of mares were greater than 20 years of age. Reduced fertility in old mares (>20 years) has been associated with reduced oocyte viability. The transfer of oocytes from old donors or from young donors into young recipients resulted in significantly different embryo development rates (old, 31% vs. young, 92%)

1 and morphological anomalies were observed by light and electron microscopy in the oocytes of old mares.

Most mares in the present study were >20 years of age. Therefore, viability of individual oocytes was probably reduced, requiring more cycles per pregnancy than in younger mares. In addition, donors could be divided into three general categories: uterine and cervical pathology, ovulatory failure and undiagnosed cause of reproductive failure. Aspiration of oocytes prevented exposure of the gametes to pathological conditions of the tubular genitalia. Some donors (7/18, 39%) had intermittent or repeated luteinized, unruptured follicles. Upon examination by ultrasonography, follicles were irregular in shape, usually with a rent within the wall. Walls of the follicles were thickened and echogenic, and echogenic debris was present within the lumen. Upon aspiration, the follicles typically had blood-tinged follicular fluid and the cumulus oocyte complex had changes associated with degeneration or atresia. However, when oocytes were collected from these mares prior to the appearance of numerous echogenic spots (probably blood and exfoliated cells) within the follicular fluid, the oocytes appeared viable and resulted in some pregnancies.

Oocytes were transferred into cycling and noncycling mares. Noncycling recipients were treated with estradiol before transfer and maintained on progesterone after transfer. Use of noncycling mares provided a convenient method for obtaining a recipient without requiring synchronization of donor and recipient cycles and removal of the recipient’s oocyte. Results of this program confirm that oocyte transfer can be a successful method for obtaining pregnancies from valuable mares in a commercial setting. Using this technique, pregnancies were established from mares with long histories of infertility and...
severe pathological conditions of the reproductive tract. Oocyte transfer is a viable and economical procedure for referral or for use in specialized clinical settings.

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References and Footnotes


*aAloka, Corometrics, CT.*

*bCook Veterinary Products, Bloomington, IN.*