Assisted reproductive technologies (ART) in Canada: 2006 results from the Canadian ART Register

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Objective: To present a report on assisted reproductive technologies (ART) cycles performed in 2006 in Canada and show trends in outcomes over time. This is the sixth annual report from the Canadian ART Register (CARTR).
Design: Prospective cohort study.
Setting: Twenty-five of 25 ART centers in Canada.
Patient(s): Couples undergoing ART treatment in Canada during 2006.
Intervention(s): ART treatments, including in vitro fertilization (IVF), intracytoplasmic sperm injection (ICSI), and frozen embryo transfer (FET).
Main Outcome Measure(s): Clinical pregnancy, live birth, and multiple birth rates.
Result(s): A total of 12,052 ART cycles was reported to CARTR. In 8278 IVF/ICSI cycles using the woman's own oocytes, the clinical pregnancy rate per cycle started was 33.7% (38.6% per ET), and the live birth rate was 27.1%; the multiple birth rate per delivery was 30.3%, with a high-order multiple birth rate of 1.5%. In 64% of cycles, ICSI was performed. One or two embryos were transferred in 67% of cycles. In 350 IVF/ICSI cycles using donor oocytes, the clinical pregnancy rate was 42.3%, and the live birth rate was 33.6%; the multiple birth rate was 37.3%, with no triplet birth. In 2838 FET cycles using the woman's own oocytes, the clinical pregnancy rate was 24.3%, and the live birth rate was 18.6%; the multiple birth rate was 22.5%, with a triplet birth rate of 0.6%. Birth outcomes were unknown for 3.6% of ongoing pregnancies.
Conclusion(s): For 2006, CARTR achieved 100% voluntary participation from Canadian ART centers for the fourth consecutive year. Clinical pregnancy and live birth rates continued to increase in 2006 compared with previous years, but multiple birth rates decreased only slightly. (Fertil Steril® 2010;93:2189–201. ©2010 by American Society for Reproductive Medicine.)

Key Words: Assisted reproductive technologies, frozen embryo transfer, intracytoplasmic sperm injection, in vitro fertilization, multiple births, oocyte donation, pregnancy rates

The Canadian Assisted Reproductive Technologies Register (CARTR) was first established in 1999 for the collection of treatment cycle data from Canadian fertility centers that were using assisted reproductive technologies (ART), including in vitro fertilization (IVF), intracytoplasmic sperm injection (ICSI), and frozen embryo transfer (FET). The IVF Directors Group of the Canadian Fertility and Andrology Society (CFAS) directs the CARTR program, which is financially supported by participating ART centers. Participation of ART centers in CARTR is voluntary.

The first report from the Canadian ART Register, describing results from ART cycles performed in 2001, was published in 2005 (1). Subsequent reports described CARTR results from 2002 (2), 2003 (3), 2004 (4), and 2005 (5). This is the sixth published annual report of Canadian ART outcomes.

The purpose of this paper is to report on ART cycles performed in Canadian centers in the 2006 calendar year and submitted to CARTR. Trends in outcomes over 3 years will also be examined.

MATERIALS AND METHODS

Data Collection

For CARTR, 2006 marked a year of transition in data collection. A revised set of outcome variables was developed, in collaboration with an advisory committee consisting of physicians and embryologists from several ART centers. Changes included collecting some information in a different format (e.g., obstetric history, infertility diagnosis, ovarian stimulation protocols, and birth outcomes) and collecting new information (e.g., total dose of follicle-stimulating hormone, number of oocytes inseminated or injected, number of oocytes fertilized, number of cleaved embryos, number of frozen embryos that survived thawing, and method of assisted hatching). The list of new variables was distributed

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to the centers in December 2006. Because many centers had already entered their 2006 data using the old variable set, centers were given the option to submit their data using either variable set.

In December 2007, the new CARTR data entry computer program, called CARTR Treatment Outcome Reporting System (CARTR-TORS; CompuArt Technology, Richmond Hill, Ontario, Canada), was distributed to all Canadian ART centers. The CARTR-TORS software replaced the Society for Assisted Reproductive Technology (SART) Clinical Outcome Reporting System (CORS), version 2 (Redshift Technologies Inc., New York, NY), which CARTR had been using since 1999. The SART-CORS data could be imported into CARTR-TORS and were automatically converted to the new variable format. Updates to old data (such as birth outcomes) could be made in CARTR-TORS; however, retrospectively filling in missing data for the new variables (mainly embryology data) was not required. The export file for the 2006 final submission to CARTR was created in CARTR-TORS.

Nine centers submitted 2006 data via CARTR-TORS, eight centers submitted data using the old variable set directly from their own clinic database, and eight centers submitted data from their own database using the new variable set. After data from centers using the old variable set were converted into the new variable format, they were combined with data from the other centers. Data for the new variables (that had no corresponding variable in the old system) were missing for most centers using CARTR-TORS and those submitting in the old variable format, representing about two thirds of cycles.

Staff at each center entered information about patient demographics, diagnosis, and obstetric history; details of treatment; complications; and pregnancy and birth outcomes for each ART treatment cycle initiated. The completed anonymous case records were sent electronically from each ART center to the CARTR coordinating center, where they were manually checked for accuracy and completeness. Corrections or clarifications were requested from the centers as necessary. No on-site data validation from source documents was performed. The records from each center were then aggregated for data analysis using the computer program Statistical Package for the Social Sciences (SPSS), version 15 (SPSS Inc., Chicago, IL). The ART cycles started between January 1 and December 31, 2006, were submitted to CARTR in batch mode twice: once in mid-2007 when the pregnancy outcomes were known, for an internal interim report, and again in mid-2008, when all the birth outcomes were known, for this published report.

It was not necessary to obtain institutional review board approval for this study because data collection is one of the requirements for accreditation of centers providing ART services as organized by the CFAS in conjunction with Accreditation Canada (formerly the Canadian Council on Health Services Accreditation). Although participation in accreditation is voluntary, most of the ART centers in Canada have agreed to the process and are obliged to inform patients that such data will be collected in a manner that is anonymous.

Definitions of Outcomes

The definitions established by the International Committee Monitoring Assisted Reproductive Technologies (ICMART) are followed by CARTR (6). A treatment cycle is considered to have "started" when a woman undergoing ovarian stimulation receives the first dose of gonadotropins or, in a nonstimulated cycle (e.g., for FET), when a decision is made to attempt ART treatment in that cycle. A canceled cycle is one that is stopped before the oocyte retrieval procedure or thawing of embryos.

Clinical pregnancy includes intrauterine gestation (presence of a gestational sac on ultrasonography), ectopic pregnancy, and miscarriage diagnosed by histology. Cycles with only a positive pregnancy test (biochemical pregnancy) are not considered to have a clinical pregnancy. Implantation rate is the number of gestational sacs observed on ultrasonography divided by the number of embryos transferred.

Pregnancy loss includes miscarriage and therapeutic abortion of a clinical intrauterine pregnancy occurring at $\leq$20 weeks' gestation. Any pregnancy termination, either spontaneous or therapeutic, occurring after 20 weeks' gestation with no liveborn infant is considered a stillbirth. A delivery is the birth of one or more infants, either living or not, after 20 weeks' gestation. A live birth is a delivery that results in at least one living infant (but, if a multiple birth, may include one or more stillborn infants). A neonatal death is the death of a liveborn infant in the first 28 days of life. A multiple birth is the delivery of more than one infant, either liveborn or stillborn, including deliveries with all infants stillborn. High-order multiple births (triplets or more) are reported separately. A preterm birth is a delivery at $<$37 weeks of gestation, and a very preterm birth is a delivery at $<$34 weeks.

Statistical Analysis

The statistics used in this report are mainly descriptive: rates, proportions, means, and medians. The chi-square test was used occasionally to compare proportions. The chi-square test with trend was used to evaluate the change over time in pregnancy, live birth, and multiple birth rates.

Unless otherwise noted, the clinical pregnancy rate is reported per cycle started. Cycle cancellation, ectopic pregnancy, and other complications are reported per cycle started. The miscarriage or pregnancy loss rate is reported per intrauterine pregnancy. The live birth rate is reported per cycle started, excluding from both the numerator and the denominator cycles in which the outcome of the clinical pregnancy has not been reported. Because of these missing data, the live birth rates reported may underestimate the