Current overview of pregnancy complications and live-birth outcome of assisted reproductive technology in mainland China

Xiaokui Yang, M.D., Ying Li, B.D., Changdong Li, M.D., and Weiyuan Zhang, M.D.

Department of Human Reproductive Medicine, Beijing Obstetrics and Gynecology Hospital, Capital Medical University, Beijing, People's Republic of China

Objective: To survey the proportion of births born after assisted reproductive technology (ART) and compare the obstetric and prenatal complications between ART and spontaneous pregnancy in women in mainland China.
Design: Retrospective analysis.
Setting: Thirty-nine hospitals.
Patient(s): A total of 112,403 deliveries from 14 provinces and 39 different hospitals composed our retrospective study.
Intervention(s): A multiprovince, hospital-based survey was performed.
Main Outcome Measure(s): The prevalence of obstetric complications, mode of delivery, and prenatal outcomes were compared between ART and spontaneous pregnancy. For each group, data included singleton and twin deliveries.
Result(s): The proportion of infants born as a result of ART in mainland China was about 1.013% in 2011. The incidence of hypertensive disorder in pregnancy (11.0%, odds ratio [OR], 1.27, 95% confidence interval [CI] 1.04–1.60), premature delivery (27.0%, OR, 4.53, 95% CI 3.91–5.25), gestational diabetes mellitus (15.1%, OR 3.05, 95% CI 2.57–3.60), and placenta previa (4.5%, OR 2.18, 95% CI 1.62–2.94) were markedly increased in women who conceived using ART. The cesarean section rate in the ART pregnancy group was 85.3%, which is significantly higher than spontaneous pregnancies (54.0%). Compared with spontaneous pregnancy, ART pregnancy had a significantly increased incidence of low birth weight babies (29.7%) and birth gestational age of less than 37 weeks (30.0%). Infants conceived by ART have increased low 5-minute Apgar and mortality.
Conclusion(s): This population-based survey demonstrates that the proportion of births from ART in mainland China was about 1.013% in 2011. Multiple gestation is significantly increased in ART pregnancies, relative to spontaneous pregnancies. The increasing incidence and risk of maternal complications in ART pregnancies (e.g., premature delivery, placenta previa, gestational diabetes mellitus) are found in singleton and twin gestations in ART. A higher cesarean section rate, low birth weight infants, and higher infant mortality rate were also observed in ART pregnancies. Our survey provides a comprehensive overview of the prevalence of ART and ART-associated complications in mainland China, and provides insight into attitudes toward ART among the mainland Chinese population. (Fertil Steril® 2014;101:385–91. ©2014 by American Society for Reproductive Medicine.)
Key Words: Assisted reproductive technology, live birth, obstetric complications, perinatal outcome, mainland Chinese population

Discuss: You can discuss this article with its authors and with other ASRM members at http://fertstertforum.com/yangx-pregnancy-complications-live-birth-art-mainland-china/

Use your smartphone to scan this QR code and connect to the discussion forum for this article now.*

* Download a free QR code scanner by searching for "QR scanner" in your smartphone's app store or app marketplace.

Received July 8, 2013; revised October 5, 2013; accepted October 9, 2013; published online November 20, 2013.
X.Y. has nothing to disclose. Y.L. has nothing to disclose. C.L. has nothing to disclose. W.Z. has nothing to disclose.
Supported by "Health industry special funds for Public Benefit Research Foundation" from the Ministry of Health, People's Republic of China (grant 201002013). W.Z. and X.Y. are the recipients of "the Health Excellent Talent Foundation of Beijing" from Beijing Health Bureau (grants 2009-2-11 and 2011-3-071).
Reprint requests: Weiyuan Zhang, M.D., Beijing Obstetrics and Gynecology Hospital, Capital Medical University, Beijing, 100026, People's Republic of China (E-mail: zhangwy9921@hotmail.com).

Fertility and Sterility® Vol. 101, No. 2, February 2014 0015-0282/$36.00

http://dx.doi.org/10.1016/j.fertnstert.2013.10.017

Since the first successful IVF-ET in the United Kingdom in 1978 (1) and first live birth of IVF-ET in mainland China in 1988, an increasing number of infertile couples have babies through modern reproductive therapy. During the past 30 years, assisted reproductive technology (ART) has developed rapidly. Assisted reproductive technology, which includes IVF, intracytoplasmic sperm

injection (ICSI), embryo cryopreservation, frozen thawed ET, and preimplantation genetic diagnosis, are increasingly being used to treat infertile couples with both female and male infertility factors. In vitro fertilization, ICSI, and frozen thawed ET are widely applied in clinical work and the safety of these techniques is of important clinical value. In developed countries, the proportion of infants born after ART is up to 4% of births (2–5). However, the proportion of infants born after ART and the obstetric and prenatal complications between ART and spontaneous pregnancy in mainland China remain unclear.

Assisted reproductive technology procedures involve manipulation of eggs, sperm, and embryos in the laboratory, for the purpose of establishing a pregnancy. The IVF-ET consists of several steps, including controlled ovarian hyperstimulation (COH), oocyte retrieval, fertilization of sperm and eggs through spontaneous interaction, embryo culture for 2–5 days, and intrauterine ET (6, 7). Intracytoplasmic sperm injection involves the isolation of one particular spermatozoon, followed by the insertion of a single selected sperm directly into the cytoplasm of oocyte with a micropipette, bypassing all the preliminary steps of sperm binding. This procedure overcomes many barriers to fertilization, including severe low sperm counts and/or motility, high number of morphologically abnormal sperm, failed fertilization from conventional IVF, and the sperm that was surgically retrieved or frozen (8).

Recently, although the number of single ETs was increased (2), two to three embryos transferred remains the average in ART procedures in mainland China. It is associated with a substantially increased risk of multiple gestation and multiple births. Some studies have shown that use of IVF is associated with increased maternal adverse effects, such as preeclampsia, gestational hypertension, placental abruption, placenta previa, and the risk of cesarean delivery (9, 10). However, the current status of maternal obstetric complications as a result of ART in mainland China remains unclear.

It has been shown that children conceived through ART may be susceptible to more health risks than spontaneously conceived children (8, 11–13). These include not only the artificial induction of ovulation, exposure of oocytes, sperm, and embryos outside of the body environment, freezing and manipulation of oocytes and embryos, but also the risk of infertility. The protocols for COH, which results in more oocytes retrieved in one cycle, are used to increase the efficiency of the IVF cycle, and it is different from the woman's natural menstrual cycle. The transfer of multiple embryos increases the risk that at least one embryo will implant, but also results in a higher risk of multiples, which is accompanied by a higher risk of maternal and neonatal morbidity and mortality. In the present study, ART includes fertility treatments in which eggs and sperm were handled in the laboratory (i.e., IVF, ICSI, and related procedures) and excludes treatments in which only sperm are handled in the laboratory (i.e., IUI).

To survey the current status of the infants born after ART and compare the obstetric complications between women who underwent ART and those who conceived spontaneously, we surveyed the generation of ART and spontaneously conceived births, delivered between January 1, 2011 and December 31, 2011 in mainland China. Our study was designed to provide a population-based survey and present an up-to-date overview of the maternal obstetric complications and prenatal outcomes between ART and spontaneous pregnancies.

MATERIALS AND METHODS

Data Collection

This is a multiprovince, hospital-based survey. To reflect the population of China, we chose hospitals located in seven territories of mainland China based on a stratified random sampling (except Hong Kong and Macau): Northeast China, Northwest China, North China, South China, East China, West China, and Central China. The study population included women who delivered babies in 39 hospitals in 14 provinces in China, from January to December 2011. In mainland China, a level 3A hospital is the highest level of care and a level 2A gives middle level of care. For the current analysis, we selected 112,403 birth deliveries during 2011, and 1,139 of them were ART conceived. Maternal age, education level, smoking and alcohol consumption during the present pregnancy, gravidity and parity, mode of delivery, timing of cesarean section, and birth gestational age were compared between women who conceived spontaneously and ART pregnancies.

Data were obtained from medical records, which included maternal characteristics, gestational care, intrapartum care, delivery care, postpartum care, newborn baby care, and laboratory tests. The complications of gestation, mode of delivery, and maternal and perinatal outcomes were included in the present study. Trained staff reviewed medical records of all women and their babies before discharge from the hospital, and another staff supervised data collection for data entry. All data were inputed into a computer for statistical analysis. The ART procedures in this study included oocytes, sperm, and embryos that were handled in laboratory such as IVF/ICSI-ET and frozen thawed ET. Infertility medications and treatments in which only sperm were handled in the laboratory (i.e., IUI) were excluded.

Statistical Analysis

The prevalence of obstetric complications was compared between women who conceived by ART and those who conceived spontaneously. For each group, data included singleton and twin deliveries. Neonatal outcomes for the ART and spontaneously conceived groups were analyzed to include multiple births.

The SAS statistical software (version 9.1) was used for data analysis. Quantitative data were presented as mean and SD (mean ± SD). Fisher's exact and χ^2 tests were performed to test for differences in the proportions of categorical variables between two or more groups. Logistic regression analysis was carried out to identify possible predictors of pregnancy complications and the association of ART and spontaneous pregnancy with major birth defects. Potential