Pregnancy outcomes decline with increasing recipient body mass index: an analysis of 22,317 fresh donor/recipient cycles from the 2008–2010 Society for Assisted Reproductive Technology Clinic Outcome Reporting System registry

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Objective: To examine the effect of recipient body mass index (BMI) on IVF outcomes in fresh donor oocyte cycles.
Design: Retrospective cohort study.
Setting: Not applicable.
Patient(s): A total of 22,317 donor oocyte cycles from the 2008–2010 Society for Assisted Reproductive Technology Clinic Outcome Reporting System registry were stratified into cohorts based on World Health Organization BMI guidelines. Cycles reporting normal recipient BMI (18.5–24.9) were used as the reference group.
Intervention(s): None.
Main Outcome Measure(s): Implantation rate, clinical pregnancy rate (PR), pregnancy loss rate, live birth rate.
Result(s): Success rates and adjusted odds ratios with 95% confidence intervals for all pregnancy outcomes were most favorable in cohorts of recipients with low and normal BMI, but progressively worsened as BMI increased.
Conclusion(s): Success rates in recipient cycles are highest in those with low and normal BMI. Furthermore, there is a progressive and statistically significant worsening of outcomes in groups with higher BMI with respect to clinical pregnancy and live birth rate. (Fertil Steril® 2016;105: 364–8. ©2016 by American Society for Reproductive Medicine.)
Key Words: Obesity, donor, recipient, BMI, success rates, IVF

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Obesity is a health issue that is increasing in severity and afflicts many women of reproductive age (1, 2). The deleterious effects of maternal obesity during pregnancy and childhood development are well established (3–5). As obesity in the general population increases, so do the number of obese women presenting to clinics for assisted reproduction. Recent studies, including our own research in autologous cycles, have demonstrated an adverse effect of body mass index (BMI) on IVF outcomes (6–12). Although the negative effect of BMI on IVF seems clear, the mechanism of this detrimental effect is far less clear.

Theories regarding the effect of BMI on IVF outcomes consists of two main categories—effects on the oocyte/oocyte environment and effects on the endometrium/endometrial environment. Several recent studies have suggested that obese patients have decreased oocyte quality (10, 13). Additional studies have noted differences in the follicular fluid (FF) between obese and nonobese patients (14–18). Other studies have demonstrated different metabolic parameters in the oocytes and embryos of obese and nonobese patients (19).

Although some researchers have pointed to decreased quality of oocytes in obese patients, a recent study did not find increased rates of aneuploidy with increasing BMI (20), suggesting that poor oocyte "quality" in obese patients may be due to factors more complex than an abnormal number of chromosomes. Other studies have demonstrated an increase in euploid miscarriage in obese women (10), suggesting that endometrial factors likely play a role in the poorer assisted reproductive technology (ART) outcomes in obese women.

Although not perfect, oocyte donation has been recognized as one of the best models to attempt to isolate the effects of the endometrium in IVF cycles (21). In the present study, we investigate the effects of recipient obesity on the endometrium through an analysis of 22,317 donor/recipient cycles from the Society for Assisted Reproductive Technology Clinic Outcome Reporting System (SART) from 2008 to 2010. This is not the first time this model has been used to attempt to answer this question, but it does represent the largest and most recent cohort to date in an attempt to demonstrate statistical significance of results. Bellver et al. (21, 22) has previously published two studies using this donor/recipient model. Their first study (22) analyzed 2,656 first ovum donation cycles, and their second (21) added to the initial database and included 9,587 cycles. Although trends toward worsening outcomes with increasing BMI were seen, statistical significance could not be shown. Luke et al. (11) included an analysis of recipient BMI in women >35 years in their review of SART data from 2007, but did not demonstrate a significant difference in outcome. In addition, a systematic review and meta-analysis by Jungheim et al. published in 2013 that pooled 4,758 donor-oocyte cycles also demonstrated no effect.

With 22,317 cycles analyzed, this study represents a sample size more than two times that of the next largest study on this subject, and it was our hypothesis that this large sample size would demonstrate statistical significance where only trends could be shown previously. The objective of this study was to examine the effect of recipient BMI on IVF outcomes including implantation, clinical pregnancy, pregnancy loss, and live birth rate in fresh donor oocyte cycles.

MATERIALS AND METHODS

This study was approved by the Institutional Review Board at Duke University. A retrospective cohort study was performed using 22,317 donor/recipient IVF cycles using data from the Society for Assisted Reproductive Technology Clinic Outcome Reporting System (SART CORS) database from 2008 to 2010. SART CORS (or SART) is a self-reported database in the United States that represents approximately 97% of the clinical activity of US IVF clinics (23). SART began collecting BMI data (height and weight) in 2007.

All fresh cycles from this time period for which physiologically reasonable data had been entered for height and weight were included. Patients with height <48 inches and weight <70 pounds were excluded. These cycles were then stratified into cohorts based on female BMI using the following World Health Organization BMI guidelines: underweight (16.0–18.4), normal (18.5–24.9), overweight (25.0–29.9), obese (class I, 30.0–34.9; class II, 35.0–39.5; class III, 40.0–45.9 and 46.0–49.9), and superobese (>50.0) (24). Cycles in patients with a normal BMI (18.5–24.9) were used as the reference group. Because there were very few recipients in the highest BMI categories we also combined the BMI groups >40 into one large group when analyzing outcomes.

Outcomes for this study included clinical pregnancy, pregnancy loss, and live birth rate, which where all included as binary variables. Implantation rate, calculated as the ratio of fetal heart beats to the number of embryos transferred, was observed as a continuous variable. Clinical pregnancy was defined as an intrauterine gestational sac visible by transvaginal ultrasound coincident with a positive serum β-hCG concentration. Pregnancy loss was defined as a clinical pregnancy ending before 24 completed weeks of gestation. Live birth was defined as delivery of a live-born infant at $\geq$24 weeks gestational age. All outcomes except for pregnancy loss were calculated on a per transfer basis, which was calculated per clinical pregnancy. Adjusted odds ratios (OR) were obtained after fitting regression models and adjusting for age, smoking status, number of oocytes retrieved, number of embryos transferred, and percent blastocyst transfer were considered significant when 95% confidence intervals (CI) did not cross the null value (OR = 1). Logistic regression was used for binary outcomes, whereas linear regression was used for continuous outcomes. An analysis of variance (ANOVA) was carried out to assess significant variance across the BMI categories, as well as between the individual BMI categories and the reference values for all outcome results. These were considered significant if the P value was <.05. All statistical analyses were done in the statistical environment R (R Core Team).

RESULTS

The number of recipients in each World Health Organization BMI category varied greatly (Table 1) with just more than half of the patients being in the normal BMI reference group. The sample size decreased with each increase in weight category,