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ORIGINAL ARTICLE

The effect of obesity on reproductive outcomes in ICSI/ET cycles

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ABSTRACT

Objective: Obesity is an important public health problem among women at reproductive age. The relationship between obesity and reproductive functions is well known mainly in the negative way. This study aims to explore the effects of obesity on intracytoplasmic sperm injection (ICSI) and embryo transfer (ET) cycles and pregnancy outcomes.

Material and Methods: This study was yielded retrospectively at a tertiary Reproductive Medicine and Infertility Center. Patients aged between 25 and 45 years, who underwent ICSI and ET procedure for infertility between 2015 and 2017 were included recruited in this study. Patients were stratified into three groups, as: (i) body mass index (BMI) <25 kg/m^2 (normal weight); (ii) BMI between 25 and 30 kg/m^2 (overweight), and (iii) BMI >30 kg/m^2 (obese). The success was defined as positive serum ß-hCG levels 10–12 days after the ET.

Results: A total of 196 women were included in the study. A negative association was found between conception, live birth rate, and BMI (normal weight versus obese patients) (p=0.036). A mean of 2.25 oocytes more were collected in patients with normal BMI compared with obese women (p=0.014).

Conclusion: This study revealed that obesity negatively affects conception and live birth rates in patients undergoing ICSI-ET procedures.

Keywords: Assisted reproductive techniques, body mass index, embryo, infertility, obesity.

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INTRODUCTION

Obesity is an important public health problem that is particularly common among women at reproductive age. In 2016, the World Health Organization estimated 1.9 billion adults (age among women at repro-ductive age, birth rate, and BMI (normal weight versus obese patients) (ese (BMI >30 kg/m^2).[1] Obesity and overweight involve an abnormal and excessive fat accumulation that negatively affects the health of the body.[2] In addition to internal diseases, clinically, it makes adversely affects reproductive functions.

The relationship between obesity and reproductive functions is well known. Menstrual dysfunction, ano-vulation and reproductive problems are more common in obese women.[3]

Assisted reproductive techniques have widely used in obese women. However, they have poor reproduc-tive outcomes such as low pregnancy rate, live birth rate, and increase the risk of miscarriage in assisted conception cycles. These poor reproductive outcomes may be associated with response to ovulation in-duction, in vitro fertilization/intracytoplasmic sperm injection (IVF/ICSI), and ovum donation cycles. Furthermore, it has been reported that fertility status in obese women is lower than women with normal BMI, and the gonadotropin dose used in IVF cycles is higher in these women and the number of oocytes obtained is lower.[4] Although some studies have reported no adverse effect of raised BMI on IVF out-come,[5–10] others have linked raised BMI with a negative impact on outcome.[11–16]

The aim of the study is to explore the effects of obesity on ICSI and ET cycles and to examine how these methods affect pregnancy outcomes in female patients with obesity.

MATERIAL AND METHODS

This study was yielded at a tertiary reproductive medicine and ınfertility center. Data were retrospectively collected from the electronic database of the hospital for the patients who underwent ICSI procedures between 2015 and 2017. Patients aged between 25 and 45 years, who underwent ICSI and ET procedure for infertility between 2015 and 2017, were included recruited in this study. The criteria for ICSI proce-dure were defined as; (i) severe male factor including azoospermia, teratozoospermia, the need for micro-surgical testicular sperm extraction; (ii) following pregnancy failure after 2 trial of IVF; (iii) the existence of antisperm antibody; (iv) the need for Preimplantation genetic diagnosis; and (v) idiopathic infertility. Patients with BMI below 18 and above 35 kg/m^2, frozen embryo transfer (ET), and whose oocytes could not have collected were excluded from the study. The primary outcome was to assess the effect of BMI on the ICSI outcome. Patients were stratified into three groups, as: (i) BMI <25 kg/m^2; (ii) BMI between 25 and 30 kg/m^2 and (iii) BMI> 30 kg/m^2. Normal weight was defined as BMI between 18.5 and 24.9 kg/m^2 and overweight was defined as BMI between 25 and 29.9 kg/m^2, obese was defined as BMI between >30 kg/m^2. The success was defined as positive serum ß-hCG levels 10–12 days after the ET.

Age, BMI, the number of oocytes, the number of the fertilized embryo, the indication of ICSI procedure, and the number of the transferred embryos were included in the logistic regression analysis. One ET rule was adopted in the first two trials for those aged below 35 years. Transfer of two embryos was perfor-med in the third or following trials and in those aged over 35 years.

The Institutional Ethical Committee of Biruni University approved the study (No: 2018/12-4). The preli-minary results of this study have been previously presented in the 2nd International European Conference on Interdisciplinary Scientific Researches Congress, Ankara, Türkiye, July 2020. The data were analyzed using the Statistical Package for the Social Sciences (SPSS) program (Version 22.0; IBM Corporation, Armonk, NY). Demographic variables are given with mean and standard deviation for the relevant items. Categorical and parametric data were analysed through the Chi-square test and Student T-test, respecti-vely. The ANOVA test was used to measure more than two groups with post hoc LSD test. P<0.05 was considered to be statistically significant for all statistical tests.

RESULTS

A total of 196 women were included in the study. No patients were excluded from the study. The mean age of all patients was 33.79±5.15 years and ranged between 25 and 45 years. The demographic, proce-dural variables, and the distribution rate of these indications within BMI group are presented in Table 1. The outcome variables within BMI groups are given in Table 2. The conception and live birth rate was 45.9% (n=90), 31.1% (n=61), respectively. A negative association was found between conception rate, live birth rate, and BMI (normal weight; BMI <25 kg/m^2 vs. obese weight; BMI >30 kg/m^2) (p=0.036, χ^2=4.643). The mean BMI values were found as 25.71±5.34 kg/m^2 in patients who got conceived and 26.53±5.15 kg/m^2 in patients with failure (p=0.275, Independent Samples Test). The patients with low ovarian reserve were unlikely to get pregnant, whereas the patients without a known indication (idiopat-hic) were likely for conception (p=0.001, χ^2=18.569). More oocyte (Mean differece: 2.25 oocytes) was collected in patients with normal BMI when compared to obese women (95% CI=0.66–3.85, p=0.014, ANOVA, post hoc Bonferroni test). The number of transferred embryo (1 vs. 2) did not affect the con-ception rate (p=0.679, χ^2=0.171).

DISCUSSION

The findings of this study showed that obesity negatively affected conception and live birth rate. Obesity was found to be associated with less number of the collected oocytes, although the increase in the num-ber of transferred embryo did not increase the conception rate.

The negative effect of obesity on the ART outcomes is controversial. It was previously reported that obe-sity increases the rate of being infertile by 82.7%.[12] In particular, having a BMI over 27 kg/m^2 is asso-ciated with an increased infertility risk.[17] Bellver et al.[18] observed poorer implantation, pregnancy, and live birth rates in obese women undergoing IVF-ICSI cycles. On the other hand, Banker et al.[19] re-cently argued against the role of BMI on pregnancy. They showed the limited effect of BMI on the ongo-ing pregnancy rate and the quality of collected oocytes. Fedorcsak et al.[20] found similar rates of preg-nancy and implantation and embryo quality between women with different BMI. In the present study, the number of the collected oocytes and the conception rates was found less in obese women when compa-red to women with normal BMI.

Table 1: The demographic variables and the distribution rate of the intracytoplasmic sperm injection and embryo transfer within BMI groups

	BMI						
	<25 kg/m²		25–30 kg/m²		>30 kg/m²		p
	n	%	n	%	n	%	
Age	33.2±4.5		34.8±5.5		34.0±5.7		0.231[a]
PCOS	1	0.01	3	0.07	2	0.03	0.87
Low ovarian reserve	22	0.23	12	0.31	21	0.33	0.32
Tubal factor	8	0.08	2	0.05	2	0.03	0.42
Male factor	28	0.29	8	0.21	21	0.33	0.41
Idiapathic	36	0.37	13	0.34	17	0.26	0.36
Total	95		38		63		

a: ANOVA (analysis of variance) test; Pearson Chi-square test; Fisher exact test; PCOS: Polyoystic ovary syndrome; ICSI: Intracytoplasmic sperm injection; ET: Embryo transfer; BMI: Body mass index.

Table 2: The outcome variables within BMI groups

	BMI			p (χ^2)
	<25 kg/m² (n=95)	25–30 kg/m² (n=38)	>30 kg/m² (n=63)	
No of oocytes retrieved	9.2±5.0*	7.4±4.6	7.0±5.1*	0.014[a]
No of embryo fertilized	5.3±3.1*	4.4±2.9	3.6±2.2*	0.001[a]
Transferred embryo	1.25±0.4	1.18±0.3	1.20±0.4	0.640[a]
Live birth	40 (78.4%)*	10 (62.5%)	11 (47.8%)*	0.026[b]
Positive ß-hCG	51 (53.7%)*	16 (42%)	23 (36.5%)*	0.036[b] (4.776)

Values are given as mean±standard deviation or number (percentage). a: ANOVA test, Values are given as mean±standard deviation or number (percentage). BMI: Body mass index. a: ANOVA test, Pearson Chi-square Test (*the mean difference is significant between the indica-ted variables)[b].

The increased adipose tissue in obesity results in increased production of leptin, free fatty acids, and so-me cytokines that impair the oocyte maturation and endometrial epithelium receptivity.[21] It is known that obesity may negatively impact the quality of oocytes by through lipotoxicity, mitochondrial dysfunction, and apoptosis responses.[22] Increased BMI also negatively affects the blastocyst formation rate in pati-ents undergoing IVF which is correlated with the embryo quality.[23] Obesity has also negative effects on tissues other than the ovary. In oocyte donors, the BMI of recipients has been shown to affect the ongo-ing pregnancy rates although rates of implantation, pregnancy, and miscarriage rates were found as simi-lar.[9]

Fedorcsak et al.[12] found a negative correlation between the BMI and the collected oocyte number in women who underwent the ICSI procedure. Similarly, a median of two oocytes was less collected in the present study from women with BMI over 30 kg/m², when compared to normal-weight women. Esinler et al.[4] observed significantly lower cumulus–oocyte complexes, metaphase II oocytes and two-pronucleated oocytes in obese women when compared to women with normal weight in ICSI cycles. However, conception rate, number of transferred embryos, clinical pregnancy, and implantation rates did not significantly differ based on the BMI of women. Major differences between the current and other studies may be due to the inclusion criteria and indications for having ICSI.

The main limitations of the present study include absence of data on embryo quality and the male partner may also have caused bias. Future studies should focus on large, longitudinal studies, and the impact of Wright control strategies on reproductive outcomes.

CONCLUSION

Our data revealed that obesity had a negative impact on conception and live birth rates in patients who underwent ICSI procedures. As a consequence, the pregnancy rates of the group with BMI >30 (36.5%) in the ICSI-ET cycle were found to be lower than the group with BMI <25 (53.7%).

Statement

Ethics Committee Approval: The Biruni University Non-Interventional Clinical Research Ethics Committee granted approval for this study (date: 29.01.2018, number: 2018/12-4).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – MK, SE; Design – MK; Supervision – MK; Materials – MK, SE; Data Collection and/or Processing – MK; Analysis and/or Interpretation – TÖ; Literature Search – SE, TÖ; Writing – SE, TÖ; Critical Reviews – SE, TÖ.

Conflict of Interest: The authors have no conflict of interest to declare.

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