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Original Article

Is Obesity an Obstacle to Being A kidney Donor? Experiences from A High-Volume Center

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ABSTRACT

Background: Donor obesity is considered a relative contraindication to kidney donation by most transplant centers because of concerns about short-term and long-term morbidity and mortality. In this study, the impact of kidney donor body mass index (BMI)on perioperative and postoperative morbidity was investigated.

Material and Methods: We included all individuals (n= 170) who donated their kidneys for living kidney transplants performed at our hospital between November 2017 and October 2018. We divided kidney donors into four groups according to their BMI; normal (< 25 kg/m^2), overweight (25 - 29.9 kg/m^2), class I obesity (30 - 34.99 kg/m^2), and class II obesity (> 35 kg/m^2). We compared preoperative and postoperative blood pressure, estimated glomerular filtration rate (eGFR), and proteinuria values. p< 0.05 was considered statistically significant in all analyzes.

Results: 32.9% of the donors had normal weight, 31.7% were overweight, 28.8% had class I obesity, and 9.4% had class II obesity. The mean postoperative hospital stay was 2.2(2-4) days, and there was no difference between donors with and without obesity (p > 0.05). The only parameter negatively correlated with low eGFR at 12 months postoperatively was donor age (p= 0.024 and r= 0.290). There was no correlation between eGFR and BMI (p=0.125 and r=0.065). No difference was observed in donors' blood pressure measurements after kidney donation. Postoperative proteinuria was positively correlated with BMI (p= 0.02, r= 0.296).

Conclusion: Donor candidates with obesity may be considered donors for patients with end-stage renal disease for whom there are no other suitable living kidney donors after a thorough perioperative evaluation.

Keywords: Living kidney donor, obesity, end-stage renal disease, renal transplant

INTRODUCTION

Kidney transplantation is the ideal renal replacement therapy for patients with end-stage renal disease (ESRD). It offers important advantages such as better quality of life and longer life expectancy compared with dialysis options (1). In particular, the long-term results of transplantation procedures with living donors have been quite successful. However, because there are not enough donors, many ESRD patients in our country and in the world rely on dialysis. Currently, more than twenty thousand ESRD patients in our country are on the deceased donor waiting list because they do not have a living donor (2).

Certain conditions such as active infections, severe cardiopulmonary problems, and malignancies identified in donor candidates during the screening process in which they are considered as donors definitely disqualify them from being donors (3). However, in some "gray areas," such as donor obesity, there can be significant differences in approach between countries and centers. Often, a body mass index (BMI) > 35 kg/m2 or > 40 kg/m2 precludes donor eligibility. Currently, the clinical practice guideline Kidney Disease: Improving Global Outcomes for the evaluation and care of living kidney donors (KDIGO) recommends consideration of BMI as part of the risk assessment of donor candidates. However,

no clear recommendation is made to reject candidates with high BMI (4). The main reason for concern about donors with high BMI in kidney transplantation is the risks of perioperative complications that can harm the donor even in the early (prolonged wound healing, infections, thromboembolism, etc.) or late (development of renal disease) stages (5-11). However, the prevalence of obesity is increasing worldwide, and donor obesity is one of the most important problems increasingly faced by many transplant centers (11-15). Therefore, every data regarding the short- and long-term morbidity and mortality of kidney donors with obesity are of great value.

In our high-volume center where 5-8% of annual kidney transplants are performed in Turkey, donor candidates of ESRD patients who do not have other suitable living donors with a BMI > 35 kg/m2 are also accepted. In this study, the effect of the BMI at the time of the operation on the morbidity of the kidney donors in the living kidney transplantation operations performed in our center was evaluated.

MATERIALS AND METHODS

Study Design and Participants

One hundred ninety-two kidney transplants performed at the Organ Transplant Center of Istanbul Yeni Yuzyil University Private Gaziosmapaşa Hospital between November 2017 and October 2018 were retrospectively reviewed. All living donors (n = 170) were included in our study. Diabetics with good glycemic control are accepted as kidney donors in our center if the recipient has no other suitable donor and has the following characteristics: patients over 50 years old, not more than 10 years old with diabetes and no signs of end-organ damage (proteinuria, left ventricular hypertrophy, coronary artery disease, diabetic neuropathy, and nephropathy, etc.).

Laboratory examinations and clinical measurements

Donor's age, sex, BMI, surgical technique (allograft harvesting), preoperative eGFR, protein excretion rate, systolic and diastolic blood pressure, and length of hospital stay were recorded. These parameters were also recorded 12 months postoperatively. Daily protein excretion was determined by the protein-creatinine ratio in spot urine. eGFR was calculated using the Chronic Kidney Disease Epidemiology Collaborative 2009 equation (CKD-EPI) via an online calculator website; http://www.mdrd.com/.

Definition and classification

The definition and classification of obesity were established according to the American Diabetes Association - Obesity and Weight Management for the Prevention and Treatment of Type 2 Diabetes: Standards of Medical Care in Diabetes-2022 (16). Accordingly, four groups were formed: Normal weight (BMI: 18.5-24.9), overweight (BMI: 25-29.9), class I obesity (BMI: 30-34.9), class II obesity (BMI > 35) (four subjects had BMI greater than 40 kg/m2, and we included them in the class II group because the sample size was too small to determine class III).

Ethical approval

This study was carried out in accordance with the Declaration of Helsinki. The consent form is not available since the study is retrospective. The study was approved by the ethics committee of scientific research of Istanbul Yeni Yuzyil University.

STATISTICAL ANALYSIS

Data were analyzed using SPSS (Statistical Package for the Social Sciences) version 23.0. The normality of continuous variables was tested using the Kolmogorov-Smirnov test. Descriptive data were expressed as mean + standard deviation (SD) and median (minimum-maximum). Groups were compared using the one-way ANOVA test for parametric variables, and the difference between groups was examined using the post hoc Tukey test. The Kruskal-Wallis test was used to compare nonparametric variables among the four groups. $P < 0.05$ was considered significant at the 95% confidence interval.

RESULTS

A total of 170 kidney donors were included in our study. The epidemiological and laboratory data are shown in Table 1. The number of male and female donors was equal. In 85.9% of the donors, the kidney grafts were harvested using laparoscopic techniques (**Table 1**). According to their BMI, 32.9% of the donors were of normal weight, 31.7% were overweight, 25.8% had class I obesity, and 9.4% had class II obesity. Four individuals had a BMI greater than 40 kg/m2, but because of the small sample size, they were included in the class II group. 22 donors were hypertensive, and the number of hypertensive donors was similar in all groups ($p > 0.05$). Postoperative hospital stay was similar in the donors with obesity and normal-weight (mean 2.2[1-4] days).

The mean eGFR reduction in donors at 12 months was 36.54±11.25 ml/min/1.73 m^2. Donor age was the only parameter negatively correlated with low eGFR ($p = 0.024$ and $r= 0.290$). No correlation was found between BMI and posttransplant 12 months eGFR ($p=0.125$ and $r=0.065$).

Systolic and diastolic blood pressure values correlated with BMI ($p=0.036$, $r=0.256$). However, the increase in blood pressure after kidney donation showed no significant change between the donors with obesity and normal-weight ($p > 0.05$).

Table 1. Epidemiological and laboratory characteristics of the donors

Parameters	Value
Age, years	85/85
Gender, male/female, n	85/85
Surgery technique •Laparoscopic, n •Open, n	 146 (% 85.9) 24 (% 14.1)
Preoperative eGFR	105.60 ± 12.42
Preoperative proteinuria, mg/day	30.7 (4.2-164)
Hypertension, n	22
Diabetes mellitus, n	2
Systolic blood pressure, mmHg	115 ± 11
Hospital stay, day	2.1 (1 - 4)
Discharge serum creatinine, mg/dL	1.08 ± 0.22
Postoperative 12. Months serum creatinine, mg/dL	1.13 ± 0.21

BMI; body mass index, eGFR; estimated glomerular filtration rate

The amount of protein excretion rate did not change at the end of the 12th month in donors with and without obesity (p>0.05) (**Table 2**). Posttransplant proteinuria decreased in donors (except the Class 1 obesity group), however, the reduction rate did not reach a statistically significant level (p>0.05). The rate of decrease in proteinuria was more pronounced in the obesity class II (p = 0.09). BMI was positively correlated with proteinuria in pre-and and postoperative periods (p = 0.03 and r= 0.312 and p = 0.02, r= 0.296, respectively).

DISCUSSION

Most transplant centers evaluate donors with obesity based on their local surgical experience and recipient and donor requirements. However, obesity, particularly more severe than class I (class II, class III, and super obesity), is generally considered a relative contraindication to donation. Although individuals with obesity are not ideal donors, they may be considered kidney donors in some cases. However, more data on long-term follow-up are needed. In this study, approximately 35.2% of the donors had a BMI over 30 kg/m2. Donors with obesity did not have longer hospital stays. One-year outcomes of high BMI donors were similar to normal weight donors in terms of eGFR, protein excretion rate, and blood pressure change.

Few studies address the health consequences of kidney donation in individuals with high BMI. However, the evidence available to date has not shown a significant difference between donors with and without obesity (17,18). Rea et al. demonstrated an increase in arteriolar hyalinosis and significant tubular vacuolization in biopsies from donors with obesity but found similar results for iothalamate GFR and albuminuria at 12-month follow-up (18). Previous studies have reported an initial GFR reduction of up to 20-35% after kidney donation and stable renal function over the years (19,20). Short-term recovery of renal function is worse in older donors and those with high BMI (19). Londen et al. reported that the decline in renal function after donation reaches 38 ml/min and that possible complications such as preeclampsia should be considered, especially in women with high BMI (21). Tavakol et al. and Thukral et al. reported similar results in their studies (22,23). In our study, the rate of change in eGFR and protein excretion levels after the donation was similar in individuals with and without obesity. The rate of decline in eGFR was approximately 35 ml/min/1.73 m2 in all donors after donation and was independent of BMI. The protein excretion rate was higher in donors with higher BMI and correlated with both preoperative and postoperative BMI. However, the protein excretion rate did not increase after donation. In contrast, a nonsignificant decrease was observed in donors with a BMI of > 35 kg/m^2. A slight (but statistically nonsignificant) weight loss in donors with a BMI > 35 kg/m2 may have led to a decrease in protein excretion rate; because all donors with a higher BMI were advised by our transplant team to lose weight before surgery and were informed about the increased risks.

Individuals with high BMI usually have higher blood pressure than normal-weight people. Therefore, some authors reported that their risk of blood pressure elevation is higher after kidney donation (23,24).

Ramcharan et al, in their study examining the long-term data (20-37 years) of 256 living kidney donors, found that 38% of the donors had elevated blood pressure and 50% of them started antihypertensive drug therapy. However, they reported that serum creatinine and protein excretion rates remained constant (25). A meta-analysis of more than 5000 donors concluded that, given the blood pressure changes in similar age groups, blood pressure increased by 5 mmHg in donors between 5 and 10 years after kidney donation. However, this meta-analysis was not considered to indicate the risk ratio for donors with higher BMI (26). However, the authors claimed that the remaining renal function of kidney donors did not deteriorate faster than would be expected due to the aging process (26). In our study, there was an increase in blood pressure values of approximately 2-3 mmHg in both donor groups. However, we could not detect the postoperative dietary behavior and weight changes of the donors, which is an important limitation of this study.

Although our study did not aim to demonstrate obesity-related postoperative complications, the hospital stay is no longer in donors with obesity than in normal-weight

Table 2. The comparison of the groups according to BMI

	[A]Normal weight, N= 56	[B]Overweight, N= 54	[C]Class I Obesity, N= 44	[D]Class II Obesity, N= 16	P value
Age, year	43.50 ±13.19	46.96±12.58	50.13±11.34	43.87±13.92	A vs B; p=0.16, A vs C; **p<0.05** A vs D; p=0.92 C vs D; p=0.08, B vs C; p=0.19 B vs D; p=0.40 (Post hoc Anova and Tukey's p values)
Preoperative BMI, kg/m^2	23.45±1.89	27.34±3.45	32.19±3.12	37.84±4.2	A vs B; **p<0.05**, A vs C; **p<0.001,** A vs D; **p<0.001,** B vs C; **p=0.02**, B vs D; **p=0.001** C vs D; **p=0.03 (**Post hoc Anova and Tukey's p values)
Postoperative BMI, kg/m^2	24.87±2.39	28.65±4.16	33.42±3.95	36.15±5.1	A vs B; **p<0.05**, A vs C; **p<0.001,** A vs D; **p<0.001,** B vs C; **p<0.001**, B vs D; **p=0.001** C vs D; **p=0.04 (**Post hoc Anova and Tukey's p values)
Surgery technique • Laparoscopic • Open	 46 10	 47 7	 38 6	 15 1	P > 0.05 (Anova)
Preoperative eGFR, ml/min	105.58±11.72	105.10±13.64	105.43±13.07	107.25±9.19	A vs B; p=0.84, A vs C; p=0.95 A vs D; p=0.60 B vs C; p=0.90 B vs D; p=0.55, C vs D; p=0.61 (Post hoc Anova and Tukey's p values)
Postoperative 12 months eGFR, ml/min	71.39±13.59	67.16±13.69	67.79±l5.00	70.11±l4.12	A vs B; p=0.10, A vs C; p=0.21 A vs D; p=0.96 B vs C; p=0.82, B vs D; p=0.33, C vs D; p=0.45 (Post hoc Anova and Tukey's p values)
Systolic blood pressure, mmHg (Mean measurements during preoperative hospitalization)	112(80-140)	114(90-160)	117(100-160)	119(100-140)	A vs B; p=0.34, A vs C; **p<0.05** A vs D; **p<0.05** B vs C; p=0.10 B vs D; p=0.06, C vs D; p=0.48 (Post hoc Anova and Tukey's p values)
Systolic blood pressure, mmHg (Mean measurements postoperative 12-month outpatient polyclinic visits)	115(90-140)	116(90-160)	119(110-170)	122(110-160)	P>0.05 (Anova)
Diastolic TA, mmHg (Mean measurements during preoperative hospitalization)	70.89±6.68	73.70±7.59	73.86±5.79	76.25±+9.57	A vs B; **p<0.05**, A vs C; **p<0.05**, A vs D; **p<0.05**, B vs C; p=0.90 B vs D; p=0.27 C vs D; p=0.24 (Post hoc Anova and Tukey's p values)
Diastolic TA, mmHg (Mean measurements postoperative 12-month outpatient polyclinic visits)	73.05±7.72	77.28±8.32	78.12±6.43	80.55±9.78	P>0.05 (Anova)
Preoperative proteinuria, mg/day (Mean measurements during preoperative hospitalization)	12.4 (4.2-80.6)	27.6 (19.2-49.3)	32.2 (9.7-164)	46.3 (8.3-124.3)	A vs B; **p<0.001,** A vs C; **p<0.001**, A vs D; **p<0.001**, B vs C; p=0.06, B vs D; **p=0.03,** C vs D; p=0.07 (Post hoc Anova and Tukey's p values)
Postoperative proteinuria, mg/day (Mean measurements postoperative 12-month outpatient polyclinic visits)	10.3 (3.8-76.2)	22.56 (11.05-51.45)	33.3 (10.1-140.4)	42.4 (16.3-133.5)	A vs B; **p<0.05,** A vs C; **p<0.001**, , A vs D; **p<0.001**, B vs C; **p=0.04**, B vs D; **p=0.02,** C vs D; p=0.10 (Post hoc Anova and Tukey's p values)
Hospital stay following surgery, day	2.1(1-3)	2.2(2-3)	2.1(2-3)	2.3(2-4)	A vs B; p=0.27, A vs C; p=0.51 A vs D; p=0.30, B vs C; p=0.65 B vs D; p=0.77, C vs D; p=0.57 (Post hoc Anova and Tukey's p values)

donors. Therefore, it can be indirectly assumed that the complication rate in the early perioperative period did not increase in donors with obesity in our cohort. Moreover, previous studies have shown that laparoscopic kidney donation is safe (27,28). However, prolonged intraoperative time, which is one of the major problems faced by the surgical team, might be an expected problem in donors with obesity.

Limitations of the study include the lack of metabolic assessment of donors, the lack of data on medication use (antihypertensives, etc.), the assessment of blood pressure with only one measurement in the office, and the relatively short follow-up period.

CONCLUSION

We consider that individuals with obesity, in conjunction with a good perioperative evaluation process, may be considered donors for ESRD patients for whom there are no other suitable living donors.

DECLARATIONS

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