Effect of Obesity on Clinical Outcomes of Kidney Transplant Patients

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ABSTRACT

Purpose. Correlating with the obesity epidemic, the number of obese transplant candidates is increasing. This study was designed to evaluate the effect of obesity on the survival of our kidney transplant recipients.

Methods. Among 1033 kidney transplants performed during the last 7.5 years in our center, 750 adult recipients were transplanted from living donors and were evaluated, and 561 of them were included in the study. Demographic and clinical data were collected. Body mass index (BMI) values at the time of transplant and post-transplant during the first year, the presence of delayed graft function, hospitalization duration, number of readmissions within the first year post-transplant, presence of post-transplant diabetes mellitus (PTDM) and cardiovascular disease, and graft and patient survival rates at 1, 3, and 5 years were investigated.

Results. Obesity (BMI >30) was observed in 148 (19.7%) at the time of the transplant (initial obesity) and in 174 (23.2%) recipients at post-transplant first year. Initial obesity was not only found to be correlated with delayed wound healing ($P = .03$), increased hospitalization duration ($P = .03$), number of readmissions within the first year ($P = .04$), presence of PTDM ($P = .02$), and cardiovascular disease ($P = .03$) but also with lower graft survival rate ($P = .04$) at the first year. On the other hand, obesity at post-transplant the first year was associated with lower 3- and 5-year grafts ($P = .04$ and $P = .03$, respectively) and 5-year patient ($P = .03$) survival rates.

Conclusion. Obesity should not be considered as a contraindication for kidney transplantation; however, to achieve better results, certain precautions should be taken pre- and postoperatively.

OBESITY is defined as having a body mass index (BMI = weight in kg/m^2 height) of ≥30 and is an established risk factor for the decline in kidney function in both healthy individuals and individuals with a history of kidney transplantation [1].

The deleterious effects of obesity on the kidney are associated with cardiovascular risk factors such as diabetes mellitus, hypertension, dyslipidemia, and insulin resistance. In addition, the accumulation of visceral fat can increase inflammatory mediators produced by adipocytes, such as tumor necrosis factor alpha and interleukin-6 contributing to glomerular and interstitial fibrosis. Moreover, obesity is associated with an increased single-nephron glomerular filtration rate, which may lead to glomerulosclerosis and subsequent loss of renal function over time. The higher blood pressures caused by activation of the sympathetic nervous system and renin–angiotensin system may also accelerate loss of kidney function in obese individuals [2,3].

Obesity-related risks in kidney transplant recipients can be categorized as skin and soft tissue complications (such as wound infections), anastomotic and perinephric complications (such as lymphocele, hematoma, and vascular), complications of intrinsic allograft function (such as delayed graft function, immunologic rejection, and graft survival), and systemic complications (such as sepsis, hospital

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readmissions, post-transplant diabetes mellitus, and patient survival) [3,4].

This study was designed to evaluate the effect of obesity on the survival of our kidney transplant recipients.

PATIENTS AND METHODS

Selection and Description of Participants

Among 1033 kidney transplants performed during the last 7.5 years in our center, 750 adult recipients were transplanted from living donors and were included in the study. Demographic and clinical data were collected. BMI values at the time of transplant and post-transplant at the first year, presence of wound complications and delayed graft function, hospitalization duration, number of readmissions within the first year post-transplant, occurrence of post-transplant diabetes mellitus (PTDM) and cardiovascular disease, and graft and patient survival rates at 1, 3, and 5 years were investigated.

Data Collection and Statistical Analysis

The demographical and clinical data were obtained from charts and records. The results were analyzed by using SPSS, version 22 (IBM, Armonk, NY, United States). Values displaying a normal distribution are expressed as mean ± standard deviation. Differences between numeric variables were tested with the independent samples from the Student *t* test or Mann-Whitney U test, whichever was appropriate. Ratios for categorical variables were compared by using χ^2 tests and Fisher tests.

BMI values were categorized as > 30 kg/m^2 and <30 kg/m^2. We assessed the relation between BMI and the primary endpoint using proportional hazards regression. We constructed Kaplan-Meier curves for the primary endpoints. Patient and graft survival analyses were performed, conditional on being alive with a functioning graft one year after kidney transplantation. A value was considered statistically significant at $P < .05$.

RESULTS

Due to missing variables during the follow-up, a total of 561 patients were included in the study.

Obesity (BMI > 30 kg/m^2) was observed in 148 (19.7%) at the time of transplant (initial obesity) and in 174 (23.2%) recipients at the end of the post-transplant first year. Among 148 patients with initial obesity, 134 of them remained obese. On the other hand, 40 patients whose initial BMI levels were less than 30 became obese at the end of the first year.

Data regarding kidney transplant recipients' demographic and baseline clinical characteristics such as age (years), sex (male, female), diagnosis of diabetes mellitus, hypertension, and coronary artery disease are presented in Table 1.

No differences in terms of sex or the prevalence of diagnosed diabetes mellitus, hypertension, or coronary artery disease were observed between the group of patients with initial obesity and normal BMI. However, the patients with initial obesity were older ($P = .03$).

Initial obesity was not only found to be correlated with delayed wound healing ($P = .03$), increased hospitalization duration ($P = .03$), number of readmissions within the first year ($P = .04$), presence of PTDM ($P = .02$), and cardiovascular disease ($P = .03$) but also with lower graft survival rate ($P = .04$) at the post-transplant first year (Table 2).

On the other hand, obesity at the post-transplant first year were associated with lower 3- and 5-year grafts ($P = .04$ and $P = .03$, respectively) and 5-year patient ($P = .03$) survival rates.

Table 1. Demographic and Clinical Features of Kidney Transplant Patients

Patients	BMI > 30 kg/m^2 (n = 148)	BMI < 30 kg/m^2 (n = 373)
Age (years)*	47.1 ± 10.2	36.6 ± 11.2
Sex (male/female)	75/73	196/177
Diabetes mellitus	41 (27%)	97 (26%)
Hypertension	83 (56%)	179 (48%)
Coronary artery disease	48 (32%)	108 (29%)

Abbreviation: BMI, body mass index.
*$P = .02$.

DISCUSSION

Kidney transplantation is the best treatment for end stage renal disease, and patient survival after transplantation is superior to survival on dialysis. Recent data from the United State Renal Data System showed the sex and race-adjusted mortality rate for patients on dialysis to be 6.7 to 8 times higher than that for the general population, whereas mortality for transplanted patients with functioning grafts was 1.3 to 1.6 times higher than that of the general population [1,5,6].

Correlating with the obesity epidemic, the numbers of both obese transplant candidates and patients are increasing. Our study shows that initial obesity is a risk factor for delayed wound healing, increased hospitalization duration, and number of readmissions within the first year. This situation also leads a higher prevalence of PTDM, cardiovascular disease, and graft loss at the post-transplant first year. Regarding the long-term effects of post-transplant obesity, one should pay attention to decreased graft and patient survival rates.

Table 2. Clinical Features of Patients During the Post-transplant First Year

Patients	BMI > 30 kg/m^2 (n = 148)	BMI < 30 kg/m^2 (n = 373)	*P*
Wound healing complications (%)	9	4.7	.03
Delayed graft function (%)	2.3	1.5	NS
Hospitalization duration (days)	13.4	7.2	.03
First year readmission (%)	37	24	.04
Post-transplant diabetes mellitus (%)	34	18	.02
Cardiovascular disease (%)	32	18	.03
1-year patient survival (%)	97	99	NS
1-year graft survival (%)	95	98	.04

Abbreviations: BMI, body mass index; NS, nonsignificant.

It will be useful to keep in mind that obese patients are more likely to have or develop diabetes and hypertension, steps in the causal pathway linking increased BMI to graft failure or death. Therefore, the World Health Organization suggests that to prevent underestimation of the risk associated with high BMI, factors closely related, such as hypertension, hypercholesterolemia, and hyperglycemia, should not be considered confusing [1,7–9].

CONCLUSION

Obesity should not be considered as a contraindication for kidney transplantation; however, to achieve better results, certain precautions should be taken pre- and postoperatively.

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