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Higher recipient body mass index is associated with post-transplant delayed kidney graft function

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To examine whether a higher body mass index (BMI) in kidney recipients is associated with delayed graft function (DGF), we analyzed data from 11,836 hemodialysis patients in the Scientific Registry of Transplant Recipients who underwent kidney transplantation. The patient cohort included women, blacks, and diabetics; the average age was 49 years; and the mean BMI was 26.8 kg/m^2. After adjusting for relevant covariates, multivariate logistic regression analyses found that one standard deviation increase in pretransplant BMI was associated with a higher risk of DGF (odds ratio (OR) 1.35). Compared with patients with a pretransplant BMI of 22–24.99 kg/m^2, overweight patients (BMI 25–29.99 kg/m^2), mild obesity patients (BMI 30–34.99 kg/m^2), and moderate-to-severe obesity patients (BMI 35 kg/m^2 and over) had a significantly higher risk of DGF, with ORs of 1.30, 1.42, and 2.18, respectively. Similar associations were found in all subgroups of patients. Hence, pretransplant overweight or obesity is associated with an incrementally higher risk of DGF.

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Delayed graft function (DGF) is a well-known complication affecting kidney allograft outcomes in the immediate post-transplantation period and is defined as the need for at least one session of dialysis treatment in the first week after receiving a kidney transplant;[1] DGF is attributed to ischemia reperfusion and immunological injury of the graft.[2] The prevalence of DGF varies from 4 to 10% in living donor[2] and 5–50% in deceased donor kidney transplants.[3–7] The occurrence of DGF may significantly complicate the immediate post-transplant management by increasing morbidity and mortality,[8,9] prolonging patient hospitalization,[10] and inflating health care costs.[10–12]

Overweight (body mass index (BMI) 25-$<$30 kg/m^2) and obesity (BMI $>$ 30 kg/m^2) at the time of kidney transplantation are common among North American dialysis patients.[13] Pretransplant obesity may have differential effects on short- versus long-term post-transplant outcomes. Some studies report poorer long-term post-kidney transplant outcomes in obese dialysis patients[14–17] mainly due to cardiovascular complications,[18] whereas other studies have found no association between pretransplant BMI and long-term post-transplant outcomes,[19–22] including our recent study in10,090 kidney transplant recipients.[23] In contrast, pretransplant obesity is usually associated with such untoward short-term complications, such as surgical wound infections or dehiscence.[24] More recent studies report that obese renal transplant recipients have higher risk of developing diabetes mellitus or diverse postoperative complications.[19,22,24–26] However, it is not known whether overweight or obesity has a negative impact on other short-term complications, in particular DGF. To the best of our knowledge, only a small case–control study ($n = 80$) by Espejo *et al.*[27] showed that obese patients have higher risk of DGF after kidney transplantation, whereas Yamamoto *et al.*[28] ($n = 28$) found no meaningful association between obesity and DGF. Obesity is associated with higher sympathetic activity,[29,30] which along with imminent administration of calcineurin inhibitors may lead to renal vasoconstriction and decreased kidney

perfusion, resulting in DGF. Moreover, obesity is associated with longer operative time and longer ischemic time,[31] which is associated with elevated risk of DGF.[32,33] Given these biologically plausible hypotheses and the foregoing inconsistent data, we sought to examine whether recipients' high BMI has a bearing on early post-transplant graft function in a large and contemporary, incident cohort of kidney transplant recipients throughout the United States. We hypothesized that higher pretransplant BMI during the months immediately before kidney transplantation is associated with higher prevalence of DGF in post-transplant patient.

RESULTS

The original 5-year (July 2001–June 2006) national database of all DaVita dialysis patients included 164,789 adult subjects. This database was linked via unique identifiers to the national Scientific Registry of Transplant Recipients (SRTR) registry that included all transplant waitlisted people and kidney transplant recipients until June 2007 (Figure 1). Out of 37,766 DaVita dialysis patients who were identified in the SRTR database, 17,629 had undergone one or more kidney transplantations during their life time, including 14,508 patients who had undergone their first kidney transplantation between July 2001 and July 2007. After excluding those without electronically recorded data ($n=1$), peritoneal dialysis patients ($n=2092$), subjects who lacked data from baseline quarter, or those with outlier values for age (>99 or <16 years; $n=579$), there were 11,836 hemodialysis patients who met all inclusion and exclusion criteria and who subsequently underwent their first kidney transplantation during the observation period.

Table 1 compares the demographic, clinical, transplant-related, and pretransplant laboratory characteristics of the patients with ($n=2628$) and without ($n=9208$) DGF. Patients with DGF were 2 years older and more likely to be diabetic or African American or to have Medicare as their primary insurance. Patients with DGF had lower serum albumin and hemoglobin levels and were more likely to receive kidneys from deceased donors with longer cold ischemic time. Additionally, patients with DGF had a higher pretransplant BMI by 1.2 kg/m^2 than those without DGF (Table 1).

Table 2 shows the results of multivariate logistic regression analyses. Pretransplant BMI was an important predictor of DGF in univariate analysis. One s.d. (s.d. = 6.0 kg/m^2) increase of pretransplant BMI was associated with 30% higher risk of DGF (odds ratio (OR) = 1.30; 95% confidence interval (CI): 1.24–1.36). The association between pretransplant BMI and the risk of DGF in the entire cohort are shown in Figure 2 and Supplementary Figure S1 in the Appendix online. After adjusting for case mix and malnutrition–inflammation complex syndrome variables, pretransplant BMI remained an independent and significant predictor of DGF (Table 2). This association remained significant after adjusting for transplant-related variables: 1 s.d. increase of pretransplant BMI was associated with a 35% higher risk of DGF (OR = 1.35; 95% CI: 1.27–1.45). Compared with patients with pretransplant with BMI in high normal range (22–24.99 kg/m^2), the patient groups with overweight (25–29.99 kg/m^2), mild obesity (30–34.99 kg/m^2), and moderate-to-severe obesity (≥ 35 kg/m^2) had 30, 42, and 118%, respectively, higher risk of DGF in the fully adjusted model

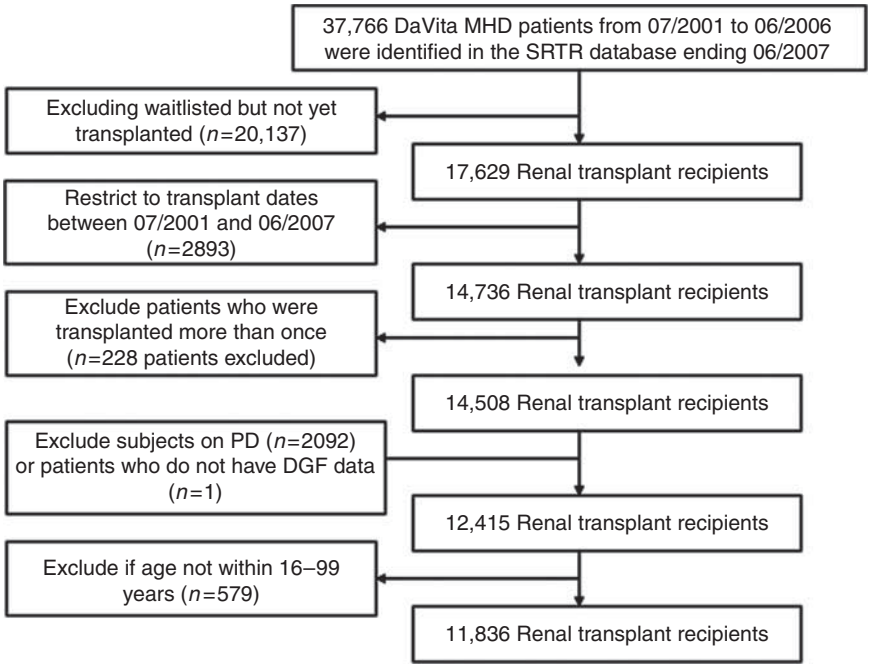

Figure 1 | Flow chart of the patient selection (see text). DGF, delayed graft function; MHD, maintenance hemodialysis; PD, peritoneal dialysis; SRTR, Scientific Registry of Transplant Recipients.