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Morbid obesity and functional status as predictors of surgical complication after renal transplantation

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ABSTRACT

Background: This study evaluated the impact of body mass index (BMI) and patient functional status on the risk for surgical complications after kidney transplant.

Methods: This retrospective cohort study of adult kidney transplant recipients grouped patients by baseline Karnofsky status (low function $\leq 70\%$) and further stratified by morbid obesity (BMI ≥ 35 kg/m²) to assess surgical complication risk.

Results: 736 patients were included with surgical complications occurring in 25%. Logistic regression analysis with interaction terms demonstrated that morbid obesity and low functional status conditionally impact risk with an OR of 2.8 [95% CI (1.1–7.3)]. Within the functional status cohort, BMI ≥ 35 kg/m² was associated with increased risk of surgical complication, superficial wound infection, and DGF. Independent predictors for surgical complications included diabetes and morbid obesity with low functional status. There was no significant difference in graft loss or death across the cohorts.

Conclusions: While neither morbid obesity nor poor functional status alone predicts increased complications, the combined presence is associated with significant increase in risk for surgical complications after renal transplantation.

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1. Introduction

Surgical complications after kidney transplantation are not as common as after other abdominal organ transplant surgeries. However, renal artery or vein thrombosis, wound infections, and urine leak, may occur.¹ These complications result in increased patient morbidity and mortality and have the potential to increase healthcare costs via increased length of stay or need for reoperation or readmission. Additional general surgical complications that may occur after kidney transplant include deep venous thrombosis, urinary tract infection, and pneumonia.

Mirroring the increasing incidence of obesity in the general population, there has been an increase in the percentage of obese

end stage renal disease (ESRD) patients being referred for kidney transplantation.^{2–4} Data is inconclusive, but obesity is theorized to have pro-thrombotic and pro-inflammatory effects and may increase the risk for post-operative complications in non-bariatric surgery.⁵ Specifically, in the setting of kidney transplant, an association has been reported between obesity and the risk for surgical complications, including surgical site infection and lymphatic complications.^{6–10} Robotic kidney transplantation might be an option for reducing risk of surgical complications in the morbidly obese patient population but is not widely utilized at all centers.¹¹ With each transplant center attempting to balance the benefit of kidney transplantation with the potential for adverse outcomes, obesity remains a controversial criterion for evaluation of kidney transplant candidates.¹²

Additionally, studies have begun to assess what, if any, impact the functional status or frailty of a patient may have on outcomes after kidney transplant.^{13–17} These studies have demonstrated

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associations between frailty or functional status and post-transplant outcomes such as delayed graft function (DGF) or mortality. Frailty has also been associated with post-operative surgical complications in older adults undergoing elective surgeries.¹⁸

This study sought to evaluate the impact of body mass index (BMI) and patient functional status on the risk for surgical complications after kidney transplant.

2. Materials and methods

2.1. Study design

This was a retrospective single center cohort study of adult kidney transplant recipients to assess the impact of functional status and obesity on surgical complications after kidney transplant. Patients were allocated to study cohorts by Karnofsky performance status at baseline (low or high functional status) and presence or absence of morbid obesity (BMI ≥ 35 kg/m²).^{19,20} The study was approved by the local institutional review board and informed consent was waived (IRB Pro00047616).

2.2. Patients

This study included adult patients who underwent kidney transplantation at a 750-bed, tertiary care, academic medical center between January 1, 2010 and December 31, 2014, with follow up through June 30, 2015. Patients ≥ 18 years of age who received a solitary kidney transplant at our institution were included in the study. Patients who received a multi-organ transplant, those who were converted to an mTOR inhibitor within 30 days of transplant, pediatric en bloc, and those without documented Karnofsky status at admission for transplant were excluded. Conversion to mTOR inhibitor was an exclusion criteria due to the association of these agents with poor wound healing.

2.3. Definitions

Morbid obesity was defined as a BMI ≥ 35 kg/m² at the time of transplant.¹⁹ This BMI was selected as the cutoff for comparison to allow for identification of the highest risk patients. Due to the retrospective nature of the study and need to use available information, functional status was defined according to the Karnofsky criteria for performance status (Table 1).²⁰ For this study, patients were defined as having low functional status at $\leq 70\%$ because this is the performance level at which a patient is unable to carry on normal activity or conduct active work.²⁰ For the purpose of the study, surgical complications included re-operation, wound infection, urine leak, lymphocele, renal artery or vein thrombosis, hematuria, venous thromboembolism, urinary tract infection, and pneumonia. Wound infections were defined according to the criteria of Humar and Matas, with deep infections requiring percutaneous or surgical drainage plus antibiotics and superficial infections being treated by opening and allowing to heal, usually without antibiotics.¹ Wound infections were included if they occurred within 30 days of transplant.⁹ Other complications, defined according to the criteria of Humar and Matas, included urine leak (requiring drain, change of stent, or re-stenting), lymphocele (requiring drainage or surgical repair), renal artery or vein thrombosis (identified via Doppler), and hematuria (requiring cauterization of bleed).¹ Deep vein thrombosis or pulmonary embolism was considered a surgical complication if it occurred within 6 months of transplant; was confirmed by Doppler, computerized tomography (CT) scan, or ventilation-perfusion (VQ) scan; and was treated with anticoagulation. Urinary tract infections requiring intravenous antibiotics and pneumonia requiring antibiotics were

Table 1
Karnofsky performance status.

Percent	Description	
100	Able to carry on normal activity, no special need is required	Normal; no complaints; no evidence of disease
90		Able to carry on normal activity; minor signs or symptoms of disease
80		Normal activity with effort; some signs or symptoms of disease
70	Unable to work; able to live at home and care for most personal needs; a varying amount of assistance is needed	Cares for self; unable to carry on normal activity or do active work
60		Requires occasional assistance and frequent medical care
50		Requires considerable assistance and frequent medical care
40	Unable to care for self; requires equivalent of institutional or hospital care; disease may be progressing rapidly	Disabled; requires special care and assistance
30		Severely disabled; hospitalization is indicated, though death is not imminent
20		Very sick; hospitalization is necessary; active supportive treatment is necessary
10		Moribund; fatal processes are progressing rapidly
0		Dead

Adapted from Karnofsky et al.²⁰

considered surgical complications if they occurred within 30 days of transplant. DGF was defined as a requirement for hemodialysis within 7 days after transplant.

2.4. Immunosuppression protocol

Patients were induced with an interleukin-2 receptor antagonist (IL-2RA) unless they met criteria for rabbit antithymocyte globulin (RATG) 1.5 mg/kg X 3–5 doses. Prior to 2012, these criteria were calculated panel reactive antibody (cPRA) $> 20\%$, cold ischemic time (CIT) > 24 h, or repeat transplant. Thereafter, the criteria for RATG induction adjusted to: cPRA $> 80\%$, positive flow cytometry cross-match, donor < 8 years of age, or high risk for DGF at the discretion of the attending surgeon. Maintenance immunosuppression included tacrolimus dosed to maintain target 12-h trough concentrations of 8–12 ng/mL for weeks 1–6 post-transplant, 6–10 ng/mL for weeks 7–52, and greater than 5 ng/mL or as clinically indicated thereafter. Mycophenolate mofetil was initiated at 1000 mg twice daily and corticosteroids were started on post-operative day 0 as intravenous methylprednisolone 500 mg, followed by 250 mg on day 1, 125 mg on day 2, then 50 mg on day 3. Patients were discharged on 20 mg of oral prednisone and further tapered to 5 mg by 6 weeks post-transplant. Steroids were not routinely withdrawn.

2.5. Objectives

The primary objective of this study was to assess the association between morbid obesity and functional status and a composite of surgical complications. Secondary outcomes included the incidence of individual surgical complications, independent risk factors for surgical complications, DGF, graft loss, and death.

2.6. Statistical analysis

For the univariate analysis, baseline demographics and outcomes were compared between the groups using the Mann Whitney-U test for continuous variables, while categorical variables

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