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Brief Report

A Single-Center, Retrospective Comparison of Non-Pre-emptive with Pre-emptive Renal Transplantations

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ABSTRACT

Introduction. End-stage renal disease (ESRD) requires renal replacement therapy, either through pre-emptive transplantation (PET) or non-pre-emptive transplantation (non-PET). PET is associated with improved patient and allograft survival compared to non-PET; however, only 2.5% of patients in the United States undergo PET. The authors of this study report on mortality and allograft rejection rates in patients undergoing PET versus non-PET.

Methods. This single-center, retrospective study compared post-transplant complications between PET and non-PET in adults with ESRD. De-identified electronic health record data from 2017 to 2022 were analyzed. Odds ratios (ORs) for one-year post-transplant mortality and allograft rejection were calculated using unadjusted multivariate logistic regression (Model 1), adjusted for age and sex (Model 2), and further adjusted for comorbidities (Model 3).

Results. A total of 787 patients with ESRD underwent kidney transplantation: 14% underwent non-PET and 86% underwent PET. Compared to PET, the ORs for one-year post-transplant mortality with non-PET were:

- Model 1: OR 1.76 (95% CI, 0.64-4.85; p = 0.27)
- Model 2: OR 2.02 (95% CI, 0.71-5.71; p = 0.19)
- Model 3: OR 1.86 (95% CI, 0.64-5.39; p = 0.24)

For one-year allograft rejection, the ORs for non-PET versus PET were:

- Model 1: OR 1.63 (95% CI, 0.85-3.10; p = 0.13)
- Model 2: OR 1.61 (95% CI, 0.84-3.06; p = 0.15)
- Model 3: OR 1.60 (95% CI, 0.82-3.10; p = 0.16)

Conclusions. This single-center study found no statistically significant differences in one-year mortality or allograft rejection between patients undergoing PET and non-PET.

INTRODUCTION

In the United States, approximately 1 in 7 adults have chronic kidney disease (CKD), and about 800,000 individuals are living with end-stage renal disease (ESRD).[1] The most common causes of ESRD are diabetes and hypertension.[1] CKD and ESRD are debilitating conditions, leading often to serious complications such as cardiovascular disease and death.[2] CKD may progress to ESRD, at which point renal replacement therapy, either dialysis and/or kidney transplantation, is required.[1]

As of 2024, there were 5,392 individuals with ESRD in Kansas. Of these, 62% were receiving dialysis, while 38% had undergone kidney transplantation.[3] Nationally, kidney transplantation offers a projected survival benefit of 9.8 years compared to dialysis alone. However, this benefit is attenuated in older patients, those with comorbidities, and female patients.[4]

Pre-emptive transplantation (PET), a kidney transplant performed before the initiation of dialysis, is associated with better allograft survival, fewer cardiovascular complications, and improved quality of life compared to non-pre-emptive transplantation (non-PET). Despite these advantages, only 2.5% of patients with ESRD in the U.S. undergo PET.[5] This low rate is attributed to variability among transplant and nephrology centers, limited referrals from nephrologists or primary care physicians, and the complex nature of transplant evaluation.[5]

Although the benefits of PET are well-documented, the literature remains mixed regarding its impact on patient survival and allograft rejection.[6-8] Authors of this study compared one-year post-transplant mortality and allograft rejection rates between PET and non-PET in adult kidney transplant recipients.

METHODS

Study Design and Setting. This retrospective study included adult patients (aged 18 years or older) at The University of Kansas Health System (TUKHS), which performs 77% of the state's kidney transplants.[9,10] Data were obtained using the Healthcare Enterprise Repository for Ontological Narration (HERON), a de-identified data warehouse that supports clinical research.[11,12] The dataset met HIPAA de-identification criteria and was therefore exempt from Institutional Review Board (IRB) review. Data acquisition was approved by the HERON Data Request Oversight Committee.

Eligibility Criteria. Adult patients who received an initial PET or non-PET kidney transplant at TUKHS between January 2017 and January 2022 were included, based on the most recent complete dataset available from HERON. A total of 787 adult ESRD patients were identified after excluding cases with missing demographic data (e.g., age or sex). PET was defined as no dialysis for at least one year prior to transplantation. Kidney transplantation was identified using current procedural terminology (CPT) code 50360. Dialysis within one year prior to transplantation was identified using CPT codes 90935, 90937, 90945, 90947, 90966, and 90970.

Study Outcomes. The primary outcomes were one-year post-transplant mortality and one-year post-transplant rejection, comparing PET and non-PET recipients. Secondary outcomes included risk factors associated with these endpoints, including diabetes, hypertension, and cardiovascular disease (CVD).

Identification of Covariates. Patient-level variables were collected, including the presence of comorbid conditions such as diabetes, hypertension, and CVD. These comorbidities were identified using ICD-9 and ICD-10 diagnostic codes, detailed in Supplemental Table (available online at journals.ku.edu/kjm).

Statistical Analysis. Demographic data were summarized using counts and proportions for categorical variables and means with standard deviations for continuous variables. Associations between

transplant type (PET vs. non-PET) and outcomes were evaluated using multivariate logistic regression. Three models were constructed: unadjusted (Model 1); adjusted for age and sex (Model 2); and adjusted for age, sex, and comorbidities (diabetes, hypertension, and CVD; Model 3). Hosmer-Lemeshow goodness-of-fit tests for Models 2 and 3 indicated adequate model fit ($p > 0.05$). Results are reported as odds ratios (ORs) with 95% confidence intervals (CIs). Statistical significance was set at $p < 0.05$. Analyses were conducted using R software (version 3.6.0).

RESULTS

Demographic Characteristics. Patient demographic information is summarized in Table 1. Of the 787 individuals who underwent kidney transplantation, 462 (58.7%) were male, 534 (67.8%) were White, and 239 (30.4%) lived more than 100 miles from TUKHS. The overall mean age was 51.7 years. Among these, 109 patients (14%) received non-PET, while 678 (86%) received PET.

In the non-PET group, 69 (63.3%) were male, 71 (65.1%) were White, 17 (15.6%) lived more than 100 miles from TUKHS, and the mean age was 51.0 years. Among PET recipients, 393 (58.0%) were male, 463 (68.3%) were White, 222 (32.7%) lived more than 100 miles from TUKHS, and the mean age was 51.8 years.

Table 1 also shows that 13 patients (11.9%) in the non-PET group experienced kidney allograft rejection and 5 (4.6%) died within one-year post-transplant. In comparison, among PET recipients, 52 (7.7%) experienced rejection and 18 (2.7%) died.

Study Outcomes. Multivariate logistic regression was used to compare one-year post-transplant complications between PET and non-PET groups. No statistically significant differences in one-year mortality were observed between groups in any of the models:

- Model 1 (unadjusted): OR = 1.76; 95% CI, 0.64-4.85; p = 0.27
- Model 2 (adjusted for age and sex): OR = 2.02; 95% CI, 0.71-5.71; p = 0.19
- Model 3 (adjusted for age, sex, hypertension, diabetes, and CVD): OR = 1.86; 95% CI, 0.64-5.39; p = 0.24

Similarly, no statistically significant differences in one-year allograft rejection were found:

- Model 1 (unadjusted): OR = 1.63; 95% CI, 0.85-3.10; p = 0.13
- Model 2 (adjusted for age and sex): OR = 1.61; 95% CI, 0.84-3.06; p = 0.15
- Model 3 (adjusted for age, sex, hypertension, diabetes, and CVD): OR = 1.60; 95% CI, 0.82-3.10; p = 0.16

Although comorbidities, age, and sex did not significantly impact allograft rejection, non-PET showed a nonsignificant trend toward increased mortality. Full model results are presented in Table 2.

Table 1. Patient demographics categorized by non-PET and PET.

Measures	All Kidney Transplants n = 787	Non-Pre-emptive Transplantation n = 109	Pre-emptive Transplantation n = 678
Age, mean (yrs.)	51.7	51.0	51.8
Sex, n (%)			
Males	462 (58.7%)	69 (63.3%)	393 (58%)
Females	325 (41.3%)	40 (36.7%)	285 (42%)
Race, n (%)			
White	534 (67.8%)	71 (65.1%)	463 (68.3%)
Black	119 (15.1%)	21 (19.3%)	98 (14.5%)
Asian	26 (3.3%)	4 (3.7%)	22 (3.2%)
American Indian	4 (0.5%)	0	4 (0.6%)
Pacific Islander	3 (0.4%)	0	3 (0.4%)
Two Races	6 (0.8%)	1 (0.9%)	5 (0.7%)
Other	93 (11.8%)	12 (11%)	81 (11.9%)
Declined	2 (0.3%)	0	2 (0.3%)
Distance From TUKHS, n (%)			
>100 miles	239 (30.4%)	17 (15.6%)	222 (32.7%)
1-year Allograft Rejection, n (%)	65 (8.2%)	13 (11.9%)	52 (7.7%)
1-year Mortality, n (%)	23 (2.9%)	5 (4.6%)	18 (2.7%)

Note: PET, pre-emptive transplantation; non-PET, non-pre-emptive transplantation; TUKHS, The University of Kansas Health System.

Table 2. Multivariate logistic regression models with post-operative complications.

One-Year Post-Transplant Mortality						
	Model 1 (unadjusted)		Model 2†		Model 3‡	
	OR (95% CI)	p Value	OR (95% CI)	p Value	OR (95% CI)	p Value
Non-PET vs. PET	1.76 (0.64-4.85)	0.27	2.02 (0.71-5.71)	0.19	1.86 (0.64-5.39)	0.24
One-Year Post-Transplant Allograft Rejection						
Non-PET vs. PET	1.63 (0.85-3.10)	0.13	1.61 (0.84-3.06)	0.15	1.60 (0.82-3.10)	0.16

† adjusted for age & sex
‡ adjusted for age, sex, and comorbidities: CVD, hypertension, diabetes
Note: PET, pre-emptive transplantation; non-PET, non-pre-emptive transplantation; CVD, cardiovascular disease; OR, odds ratio.

DISCUSSION

Authors of this study compared one-year post-transplant mortality and allograft rejection between patients who underwent PET and those who received non-PET. We hypothesized that non-PET would be associated with higher rates of post-transplant mortality and allograft rejection. However, our findings showed no statistically significant differences between the two groups.

These results contribute to the existing literature by showcasing that patient mortality and kidney allograft rejection rates do not differ significantly between PET and non-PET recipients. A systematic review by Azegami and colleagues[13] also found no significant differences in

rates of biopsy-proven acute rejection between PET and non-PET groups. Most studies report PET rates between 9-44% and non-PET rates over 55%,[13] whereas our study showed a PET rate of 86% and non-PET rate of 14%. The predominance of PET in our sample may have contributed to the lack of significant findings.

Differences in transplant evaluation and dialysis initiation practices across centers also may influence these outcomes and deserve further investigation. For example, Cosio and colleagues[14] examined survival in deceased donor kidney transplant recipients and found that 7% of mortality occurred in patients who had not received dialysis preoperatively, while 67% occurred in those who had undergone dialysis. These conflicting findings suggest that prospective studies are needed to more definitively assess the comparative effectiveness of PET versus non-PET.

Limitations. Several limitations must be considered. The high rate of PET observed at TUKHS may reflect the structure of its integrated transplant and nephrology services, which streamline the evaluation process by coordinating care among specialists. This setup minimizes barriers to PET and may not be generalizable to centers lacking similar infrastructure.

Additionally, we could not access external medical records, so some patients classified as PET may have received dialysis at outside institutions. This could have led to misclassification, potentially underestimating the true non-PET rate. Information on donor type (living vs. deceased) also was unavailable and may have influenced post-transplant outcomes.

CONCLUSIONS

Although no statistically significant differences were found between PET and non-PET in terms of one-year mortality or allograft rejection, the clinical benefits of PET, including improved quality of life and fewer complications, remain well-supported. Efforts should focus on reducing barriers to PET access. In the meantime, treatment decisions should be guided by available resources and the expertise of the transplant team.

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