Costs in the Year Following Deceased Donor Kidney Transplantation: Relationships with Renal Function and Graft Failure

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Background

Healthcare costs following kidney transplantation are hypothesized to be inversely associated with renal function. However, the magnitude of these relationships are not fully quantified for deceased donor kidney transplant recipients over the first year post-transplant.

Objectives

Describe relationships between total medical costs in the first year following deceased donor kidney transplant with overall renal function as measured by: 1) estimated glomerular filtration rate (eGFR) at different time points, and; 2) early graft failure.

Methods

The United States Renal Data System was used to identify adults receiving single-organ deceased donor kidney transplants 2012-2015. Recipients without Medicare as primary payer were excluded. Costs derived from Parts A and B claims including inpatient, emergency, outpatient, and skilled nursing facility costs. eGFRs were available at discharge, 6-months, and 12 months. Thus, eGFR:Cost relationships are described for several month-based time periods post-discharge: 0-3, 3-6, 6-12, and 3-12. For recipients with graft failure a time-history of medical costs was constructed with failure as the index date. Descriptive analyses were conducted. Monthly costs of those with graft failure in the first year post-transplant were compared to those without failure.

Table 1: Cohort Attrition

	Criteria (applied sequentially)	N	%
Step 1	Patients who had only 1 kidney transplant from 2012 – 2015	67,360	100.0%
Step 2	Patients aged 18 and older at time of transplant	64,487	95.7%
Step 3	Excluding patients with multi-organ transplants	62,372	92.6%
Step 4	Patients with no kidney transplants prior to 2012	54,674	81.2%
Step 5	Patients with deceased donors only	35,623	52.9%
Step 6	Patients with Medicare as primary payer during the transplant	24,501	36.4%
Step 7	Patients with at least one serum creatinine level post-transplant (near discharge, at 6 month, or 12 month)	24,485	36.3%
Step 8	Exclude patients with missing discharge date	24,446	36.3%
Step 9	Exclude patients who had graft failure or died during transplant admission	24,121	35.8%
Step 10	Exclude patients with extreme BMI values (BMI>100 or BMI<6)	24,114	35.8%
Step 11	Exclude patients whose initial hospitalization LOS > 45 days	24,021	35.7%

Results

- The resulting cohort of deceased donor transplant recipients represents a total of 24,021 patients who experience a 2.4% graft failure rate in the first year post-transplant **(Table 2)**. Those with graft failure have lower eGFR values at each of the 3 time points post-transplant and are more likely to be younger, assigned Black race identity, and have higher BMI.

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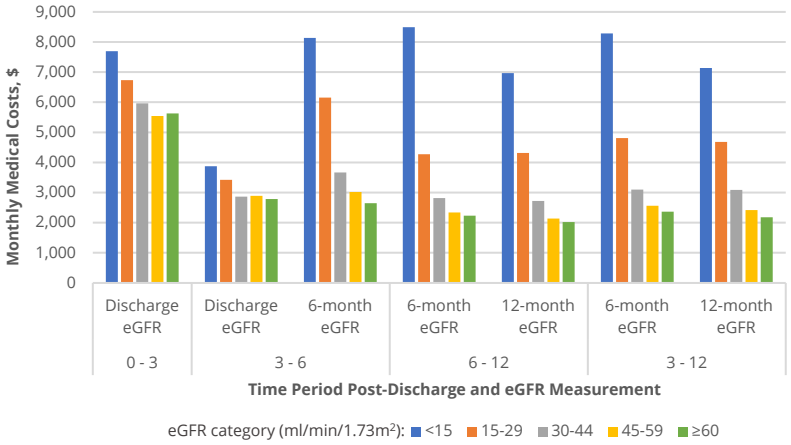
Table 2: Patient Characteristics in First 12 months Post-Transplant

Measure	With Graft Failure		Without Graft Failure	
eGFR* near discharge				
N	586		23,426	
Mean (SD)	19.9	20.4	30.9	25.2
eGFR* 6 months post-transplant				
N (% of cohort at discharge)	195	33.3%	22,977	98.0%
Mean (SD)	31.9	21.2	60.6	21.4
eGFR* 12 months post-transplant				
N (% of cohort at discharge)	19	3.2%	22,508	96.0%
Mean (SD)	15.1	8.42	61.3	21.9
Mean Age (SD)	54.0	13.1	55.2	13.5
Male Gender, N (%)	359	61.3%	14,346	61.2%
Black Race, N (%)	239	40.8%	8,496	36.3%
Mean Body Mass Index, kg/m² (SD)	29.3	5.75	28.5	5.44

**ml/min/1.73m² per CKD-EPI equation*

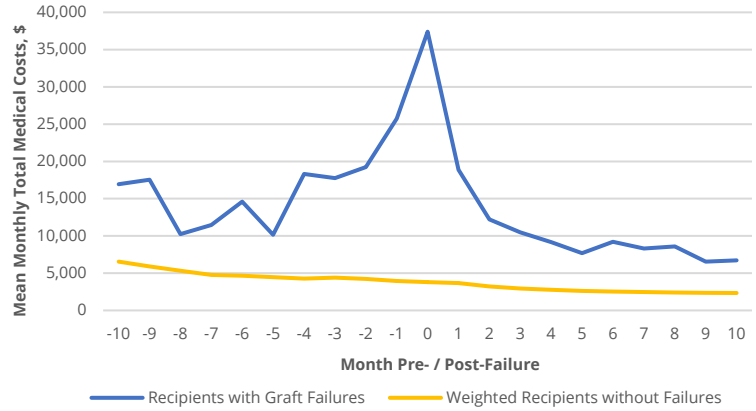
- For those without graft failure in the first year following transplant, total medical costs exhibit strong trends with eGFR in the post-discharge period. In the 3-6 months post-discharge period, recipients with 6-month eGFRs of 30-59 mL/min/1.73m² have total costs 48% lower than those with <30 mL/min/1.73m². The relationship between eGFR at discharge and monthly costs appears to be less strong than eGFR measured at other time periods. Both 6- and 12-month eGFRs correlate well with costs from 3 to 12 months post-discharge **(Figure 1)**.

Figure 1: Mean Monthly Medical Costs for Patients Without Graft Failure by Time Period Post-Transplant and eGFR



- For recipients with graft failure monthly costs begin to rise 3-4 months prior to failure, with a spike of over $38,000 during the month of failure. Costs appear to stabilize 3-4 months post-failure suggesting a failure process that is several months long. **(Figure 2)**.
- Compared to the monthly costs of patients without graft failure weighted for the month post-transplant, costs for those experiencing graft failure are higher at each month observed. Centering on the median month of failure, 6 months post-transplant, the incremental costs of graft failure are $153,397 in the first year.

Figure 2: Mean Monthly Medical Costs for Patients With Graft Failure by eGFR Measure, Month of Failure Indexed to Month 0



Discussion

- Each year, over 20,000 individuals in the US receive a kidney transplant [1], with approximately 2.4% of those experiencing early graft failure.
- Renal function, in terms of both early graft failure and eGFR for those without early graft failure, exhibits strong associations with total monthly medical costs. The association between eGFR and costs is weaker for eGFR measured near discharge.
- The key limitation is the use of observational data; causal relationships have not been demonstrated.

Conclusions

Total medical costs in the first year post-transplant are strongly correlated with eGFR at various times post-discharge. Time histories of resource utilization indicate that graft failure in the first year is a very expensive process unfolding over several months. Reductions in early graft failures could yield significant human and economic benefits.

REFERENCES: [1] Hart, A et al. Am J Transplant. 2019;19:19–123.