

Influence of Dialysis Duration and Modality on Kidney Transplant Outcomes

L. Resende, J. Guerra, A. Santana, C. Mil-Homens, F. Abreu, and A.G. da Costa

ABSTRACT

Background. The influence of pretransplantation dialysis on kidney transplant outcomes has been the subject of longstanding interest. Although increased time on dialysis prior to kidney transplantation is associated with decreased graft and patient survivals, analyses of the impact of dialysis modality on kidney allograft outcome have produced conflicting results.

Objective. The objective of this study was to evaluate the influence of dialysis duration and modality on the function and survival of renal allografts.

Patients. We retrospectively reviewed the clinical data of 421 adults who received first kidney transplantations from cadaveric heart-beating donors performed in our unit from May 1989 to May 2007. Three hundred seventy-four patients (88.8%) were on hemodialysis (HD) prior to kidney transplantation, including 247 patients (58.7%) on treatment for at least 24 months.

Results. Patients with a dialysis duration ≥ 24 months were significantly older (45.9 vs 42.8 years; $P = .013$). Renal function at 3, 12, 60, and 96 months was similar between the 2 groups. Longer duration on dialysis was associated with poorer overall graft and patient survivals. No differences were observed in renal function or graft and patient survivals comparing HD or peritoneal dialysis (PD). Multivariate analysis confirmed the lack of correlation between dialysis duration or modality and allograft failure.

Conclusion. Longer dialysis duration influenced overall graft and patient survival. However, dialysis modality showed no influence on graft function or survival.

From the Department of Nephrology (L.R.), Hospital Central do Funchal, Funchal, and Department of Nephrology and Renal Transplantation (J.G., A.S., C.M., F.A., A.G.d.C.), Hospital de Santa Maria, Lisboa, Portugal.

Address reprint requests to Luis Resende, Hospital dos Marmeleiros, Estrada dos Marmeleiros 9054-535 Monte – Funchal, Portugal. E-mail: lmresende@hotmail.com

FOR SUITABLE patients with end-stage renal disease (ESRD), kidney transplantation is recognized as the therapy of choice, being superior to dialysis in terms of quality of life and long-term mortality risk.¹ Several studies demonstrate that pre-emptive kidney transplantation is advantageous not only for graft survival but also for patient survival.²⁻⁴ However, not all patients have a potential living donor, and therefore undergo hemodialysis (HD) or peritoneal dialysis (PD) while awaiting a cadaveric donor kidney. Increased time on dialysis prior to transplantation has been shown to be a predictor of negative short-term outcomes⁵ and transplant recipient survival.⁶ Regarding the type of pretransplantation renal replacement therapy (RRT), HD is associated with a greater incidence of delayed graft function (DGF) after kidney transplantation.^{7,8} An increased incidence of graft thrombosis has been associated with PD.⁹ A greater rate of acute rejection episodes was associated with PD in some studies;⁷ however, other reports note a similar occurrence between PD and HD.⁵ PD was also associated with a greater rate of posttransplantation infection compared with patients on HD therapy in some¹⁰ but not other studies, which suggest rates to be similar^{7,11} or lower¹² between PD and HD patients. Influence of pretransplantation RRT on graft and patient survivals has produced conflicting results. The aim of this study was to evaluate the influence of dialysis duration and modality on the function and survival of renal allografts.

PATIENTS AND METHODS

Between May 1989 and May 2007, we performed 421 first kidney transplantations from cadaveric heart beating donors in adults (≥ 18 years). All patients were on either HD or PD prior to transplantation. We retrospectively reviewed the clinical data: recipient age and gender, cause of ESRD, dialysis duration, dialysis modality prior to the transplantation, last panel-reactive antibody (PRA), donor age and gender, human leukocyte antigen (HLA) mismatch, cold ischemia time, DGF (characterized as the need for dialysis on the first week posttransplantation), acute rejection episodes (histological diagnosis or antirejection treatment), and renal function at 3, 12, 60, and 96 months. All patients were treated with a calcineurin inhibitor-based immunosuppressive regimen. Induction therapy with a monoclonal or polyclonal antibody was administered to 109 patients. Estimated glomerular filtration rates (eGFR) were calculated using the 4-variable Modification of Diet in Renal Disease (MDRD) Study equation, based on serum creatinine level, age, gender, and race.

Results were expressed as mean values \pm SD. Univariate analysis was performed using the chi-square test and Student *t* test for categorical and continuous data, respectively. Kaplan-Meier analysis was used to calculate actuarial graft survival and log-rank tests to compare survivals. Risk factors for graft failure were examined using multivariate Cox proportional hazard analysis. All *P* values were two-tailed; a *P* value $< .05$ was considered significant.

RESULTS

Among 421 adult patients who underwent a first cadaveric kidney transplantation at our institution from May 1989 to

May 2007, 284 were males (67.5%) and the overall mean age at the time of transplantation was 44.6 ± 12.7 years. Prior to transplantation, 374 patients (88.8%) were on HD and 47 patients (11.2%) were on PD. The mean dialysis duration was 37.6 ± 30.2 months (minimum, 1 month; maximum, 172 months). Mean follow-up time was 73.1 ± 52.7 months.

Patients were divided into 2 groups, according to the dialysis duration < 24 months or ≥ 24 months. Donor, recipient, and transplant characteristics are described in Table 1. Patients with a dialysis duration ≥ 24 months were significantly older (45.9 vs 42.8 years; $P = .013$). No differences were observed in the occurrence of DGF, acute rejection episodes, or graft function at 3, 12, 60, or 96 months. Kaplan-Meier analysis with survival censored for death with a functioning graft showed similar outcomes ($P = .922$). Longer duration on dialysis was associated with poorer overall graft ($P = .047$) and patient survivals ($P = .014$; Fig 1). When comparing HD versus PD therapy, there were no differences in donor and recipient characteristics, occurrence of DGF, acute rejection episodes, or graft function at 3, 12, 60, or 96 months. On Kaplan-Meier analysis censored for death with a functioning graft ($P = .535$), overall graft ($P = .675$), and patient survival ($P = .981$) rates were similar.

Table 1. Donor and Recipient Characteristics

Variable	Duration Dialysis <24 mo (n = 174)	Duration Dialysis ≥ 24 mo (n = 247)	<i>P</i>
Recipient age (y)	42.8 ± 12.8	45.9 ± 12.5	.013
Recipient gender (male/ female)	118/56	166/81	n.s.
ESRD cause			
Diabetic nephropathy	9	19	n.s.
Nephroangiosclerosis	22	20	
Glomerular	50	79	
Other	93	129	
Dialysis duration (mo)	13.6 ± 5.8	54.5 ± 29.0	$< .0001$
Dialysis modality (PD/HD)	22/152	25/222	n.s.
PRA titer $< 50\%/\geq 50\%$	163/11	217/30	n.s.
Donor age (y)	36.7 ± 15.0	38.3 ± 15.6	n.s.
Donor gender (male/ female)	121/53	178/69	n.s.
HLA identities	15/169	14/233	n.s.
mismatch 0/1-6			
Cold ischemia time (h)	19.0 ± 4.8	20.2 ± 4.4	n.s.
DGF	10	17	n.s.
Acute rejection episodes	71	87	n.s.
eGFR MDRD formula (mL/min)			
3 mo	54.2 ± 17.6	55.8 ± 18.7	n.s.
12 mo	56.5 ± 19.3	55.9 ± 19.4	n.s.
60 mo	57.0 ± 19.8	55.8 ± 19.4	n.s.
96 mo	61.0 ± 23.2	57.6 ± 16.9	n.s.

Abbreviation: n.s., not significant.

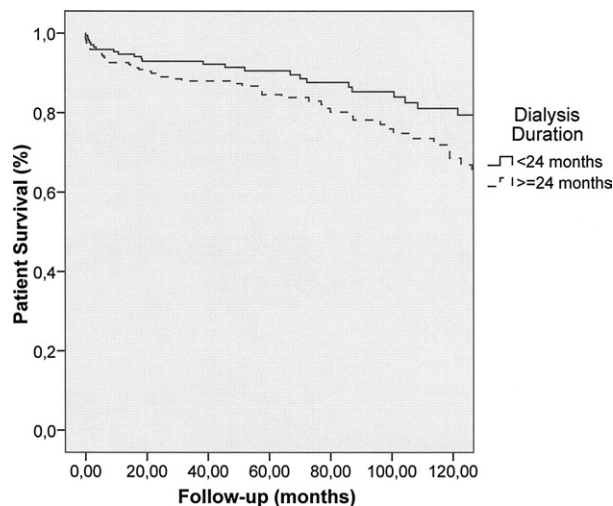


Fig 1. Kaplan-Meier survival curve estimates of patient survival comparing dialysis duration <24 months with dialysis duration \geq 24 months. Patient survival was poorer with longer time on dialysis ($P = .014$; log-rank test).

Multivariate analysis revealed that recipient age ≥ 55 years (Hazard Ratio [HR] = 1.83; $P = .003$; 95% confidence interval [CI], 1.23–2.72), acute rejection episode (HR = 1.96; $P < .0001$; 95% CI, 1.38–2.78), DGF (HR = 1.56; $P = .011$; 95% CI, 1.10–2.20), and PRA $> 50\%$ (HR = 2.43; $P < .0001$; 95% CI, 1.54–3.85) showed adverse effects on allograft survival. The same analysis confirmed a lack of correlation between dialysis duration ≥ 24 months (HR = 1.16; $P = .399$; 95% CI, 0.82–1.65) or modality (HR = 1.03; $P = .928$; 95% CI, 0.58–1.80) and allograft survival.

DISCUSSION

Several studies demonstrated that increased time on dialysis prior to transplantation negatively predict short-term kidney allograft outcomes,^{5,13} acute rejection episodes,¹⁴ and transplant recipient survival.⁶ In our study, longer dialysis duration was associated with poorer overall graft and patient survivals. No differences were noted in the occurrence of DGF, acute rejection episodes, or renal function at 3, 12, 60, or 96 months.

Regarding the impact of dialysis modality on short-term outcomes, HD was associated with a greater incidence of DGF after kidney transplantation.^{7,8} A greater rate of acute rejection episodes has been associated with PD in some studies,⁷ but other showed a similar incidence as HD.⁸ Some studies have reported a positive impact of PD on outcomes after transplantation and on long-term patient

survival,^{7,8,13} whereas other reports did not show long-term graft and patient survivals to be affected by the dialysis modality.⁶ Our results showed no differences between PD and HD on short-term or long-term graft and patient survivals. However, the small number of patients on PD prior to kidney transplantation impaired statistical power when compared with subjects on HD prior to transplantation.

Our study supported the concept that dialysis duration influenced overall graft and patient survivals. The choice of a pretransplantation dialysis modality did not influence transplantation results.

REFERENCES

1. Wolfe RA, Ashby VB, Milford EL, et al: Comparison of mortality in all patients on dialysis, patients on dialysis awaiting transplantation, and recipients of a first cadaveric transplant. *N Engl J Med* 341:1725, 1999
2. Meier-Kriesche HU, Port FK, Ojo AO, et al: Effect of waiting time on renal transplant outcome. *Kidney Int* 58:1311, 2000
3. Kasiske BL, Snyder JJ, Matas AJ, et al: Preemptive kidney transplantation: the advantage and the disadvantaged. *J Am Soc Nephrol* 13:1358, 2002
4. Mange KC, Joffe MM, Feldman HI: Effect of the use or nonuse of long-term dialysis on the subsequent survival of renal transplants from living donors. *N Engl J Med* 344:726, 2001
5. Bleyer AJ, Burkart JM, Russel GB, et al: Dialysis modality and delayed graft function after cadaveric renal transplantation. *J Am Soc Nephrol* 10:154, 1999
6. Cosio FG, Alamir A, Yim S, et al: Patient survival after renal transplantation: I. The impact of dialysis pre-transplant. *Kidney Int* 53:767, 1998
7. Vanholder R, Heering P, Loo AV, et al: Reduced incidence of acute renal graft failure in patients treated with peritoneal dialysis compared with hemodialysis. *Am J Kidney Dis* 33:934, 1999
8. Bleyer AJ, Burkart JM, Russell GB, et al: Dialysis modality and delayed graft function after cadaveric renal transplantation. *J Am Soc Nephrol* 10:154, 1999
9. Ojo AO, Hanson JA, Wolfe RA, et al: Dialysis modality and the risk of allograft thrombosis in adult renal transplant recipients. *Kidney Int* 55:1952, 1999
10. Passalacqua JA, Wiland AM, Fink JC, et al: Increased incidence of postoperative infections associated with peritoneal dialysis in renal transplant recipients. *Transplantation* 68:535, 1999
11. Kang Z, Fang G, Chen W: A comparative study of the outcome of renal transplantation in peritoneal dialysis and hemodialysis patients. *Chin Med Sci J* 7:49, 1992
12. Miemois-Foley J, Paunio M, Lyytikainen O, et al: Bacteremia among kidney transplant recipients: a casecontrol study of risk factors and short-term outcomes. *Scand J Infect Dis* 32:69, 2000
13. Van Biessen W, Veys N, Vanholder R, et al: The impact of the pre-transplant renal replacement modality on outcome after cadaveric kidney transplantation: the ghent experience. *Contrib Nephrol* 150:254, 2006
14. Cacciarelli TV, Sumrani N, DiBenedetto A, et al: Influence of length of time on dialysis before transplantation on long-term renal allograft outcome. *Transplant Proc* 25:2474, 1993