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Does pre-emptive kidney transplantation with a deceased donor improve outcomes? Results from a French transplant network

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Summary

Large analyses have demonstrated that pre-emptive kidney transplantation (PKT) leads to significant improvements in patient and graft survival when compared with transplantation performed after a period of dialysis. We analysed 1585 patients who received a first renal transplantation from a deceased donor between 2000 and 2004 in four French transplantation centres. The objective was to compare the characteristics of the deceased donor transplantations with or without previous dialysis and to evaluate the impact of PKT and length of dialysis on patient and graft outcomes. Mean age of recipients was 48.1 ± 13.4 years, 62% were men, and 118 (7.4%) of them received a pre-emptive transplantation. For the nonpre-emptive patients, mean time on pretransplant dialysis was 3.4 ± 3.2 years. Pretransplant factors independently related to pre-emptive transplantation were year of transplantation, centre and recipients characteristics: gender, diabetes history, blood group and donor age. Patients with pretransplant dialysis were three times more likely to have delayed graft function than pre-emptive transplant patients, and were 10 times more likely to receive post-transplant dialysis. Five-year patient survival was 92.9%. Five-year graft survival was 89.0%. Neither pre-emptive transplantation nor time on dialysis was significantly associated with patient and/or graft survival.

Introduction

As a result of its increasing success, kidney transplantation has now become the preferred therapy for end-stage renal disease (ESRD) patients and the number of patients put on the waiting list is continually growing, leading to a prolonged waiting time. Waiting time on dialysis has been shown to be associated with worse outcomes in comparison with living and deceased donor transplantation both in North American and European studies [1–3]. Despite an initial higher risk of death, long-term survival for patients undergoing transplantation is significantly better compared with patients who are listed but remain on dialysis [1,3,4]. Several large analyses have demonstrated that pre-emptive kidney transplantation (PKT) leads to significant improvements in patient and graft survival when compared with transplantation performed after a period of dialysis therapy [5,6]. Moreover, in some studies, length of pretransplant dialysis seems to have a deleterious effect on patient and graft survival [1,7]. Potentially, PKT could avoid the morbidity of dialysis together with its financial costs and maximize the

chance of maintaining a high quality of life, and PKT with a living donor is probably the optimal treatment of ESRD. However, some studies reported that patients who received pre-emptive transplants from deceased donors have little or no advantage over graft survival in comparison with transplantation after dialysis [8,9]. On the other hand, multiple barriers contribute to the under use of PKT, including late referral to a nephrologist, shortage of deceased donor grafts, risk of premature initiation of renal replacement therapy and risk of nonadherence in patients who may not fully appreciate the privilege of transplantation. As a consequence, frequency of PKT differs largely among countries and is essentially performed with living donors. The UNOS data showed that 13% of the kidney transplantations were pre-emptive from 1995 to 1998, and out of these, 39% were performed with a deceased donor [5]. Among European countries, the highest figure is shown for Scandinavian countries with about 1/3 of grafts provided by deceased donors [10]. In France, between 1997 and 2000, only 9.1% of the patients put on the waiting list were registered pre-emptively, and during this period, living donors represented <5% [11].

Similar practices in the management of kidney transplantation in a network of four French transplantation centres together with a shared prospective clinical database offered us the opportunity to compare the characteristics of the transplantations performed with deceased donors in adults with or without previous dialysis and to evaluate the impact of PKT and length of dialysis on patient and graft outcomes.

Patients and methods

All the patients ≥18 years of age, receiving a first deceased donor transplantation at one of the following institutions (Nancy, Nantes, Paris Necker, Toulouse) of the DIVAT (Données Informatisées Validées en Transplantation) network from 1/1/1990 to 31/12/2004 were included in the analysis. All patients were followed up until death, return to dialysis, last information date or 31 December 2007.

The clinical data were extracted from the computerized database DIVAT, shared by all the participating centres. DIVAT gathers prospectively 250 items per patient that are updated annually and validated by an independent clinical research assistant.

Demographic data recorded were age, gender of the donor and recipient and death cause of donor. Pretransplant variables included presence of diabetes, HLA immunization, dialysis duration and blood group. Transplantation characteristics were transplant centre, year, HLA matching, cold ischaemia time, delayed graft function (DGF), defined as a number of days necessary for the graft function to reach a Cockcroft-calculated creatinine clearance >10 ml/min longer than 6 days [12], need for post-transplantation dialysis, induction therapy with antilymphocyte globulins (ATG) and occurrence of acute rejection.

Statistical analysis

Statistical analysis consisted of (i) description of the study population (values are expressed as mean ± SD or per cent of the population), (ii) analysis of pretransplant factors related to pre-emptive transplantation and pretransplant dialysis, (iii) analysis of relationships between pretransplant dialysis, duration of pretransplant dialysis on one hand, and short-term outcome (DGF and acute rejection) and long-term outcome (patient and graft survival) on the other hand.

For multivariate analysis, *ad hoc* methods were used (i.e. Cox regression, logistical regression, linear regression). These analyses were adjusted by significant factors amongst the following: recipients' characteristics (age, gender, diabetes history, blood group, pretransplant HLA immunization), donor characteristics (age, gender, number of HLA incompatibilities) and transplantation characteristics (year, centre, cold ischaemia time, post-transplant DGF, need for post-transplant dialysis, acute rejection, induction therapy with ATG). All analyses were performed with SAS© software version 8.02 (SAS Institute Inc., Cary, NC, USA).

Results

Among the study cohort of 1607 patients who received a first renal transplantation from a deceased donor between 2000 and 2004, 1585 (98%) had available data and were used for analyses. Mean age of recipients was 48.1 ± 13.4 years, 62% were male, 118 (7.4%) of them received a pre-emptive transplantation. For the nonpreemptive patients, mean time on pretransplant dialysis was 3.4 ± 3.2 years. Recipient, donor and transplantation characteristics in both groups are summarized in Table 1. In univariate analysis, PKT recipients were significantly younger, more frequently female, more likely to be diabetics and less likely to have blood group O. Donors were also younger and less likely to have deceased from a cerebrovascular cause. Regarding transplantation characteristics, cold ischaemia time was shorter and PKT recipients had less DGF and need for post-transplantation dialysis.

Factors related to pretransplant dialysis

Pretransplant factors independently related to pre-emptive transplantation were year and centre of transplantation, recipient characteristics: gender (9% pre-emptive transplants for female vs. 6% for male recipients), diabetes

Table 1. Characteristics of recipients, donors and transplantation.

	Total			Pre-emptive			Pretransplant dialysis			
	N = 1585			*n* = 118 (7.4%)			*n* = 1467 (92.6%)			
	n	%	Mean ± SD	*n*	%	Mean ± SD	*n*	%	Mean ± SD	*P*§
Recipient characteristics										
Age (years)	1585		48.13 ± 13.37		118	44.3 ± 12.9	1467		48.4 ± 13.4	0.0011
Gender										
Female	603	38.04		57	48.3		546	37.2		0.017
Male	982	61.96		61	51.7		921	62.8		
Diabetes history										
No	1246	83.53		40	33.9		221	15.1		<0.0001
Yes	261	16.47		78	66.1		1246	84.9		
Pretransplant dialysis time classes (months)										
0 (Pre-emptive transplantation)	118	7.44		118	100					<0.0001
0–6	80	5.05					80	5.5		
6–12	199	12.56					199	13.6		
12–24	330	20.82					330	22.5		
24–36	226	14.26					226	15.4		
36–48	183	11.55					183	12.5		
>48	449	28.33					449	30.6		
Pretransplant dialysis time* (years)	1467		3.40 ± 3.21				1467		3.40 ± 3.21	
Blood group										
O	622	39.24		26	22		596	40.6		<0.0001
Others	963	60.76		92	78		871	59.4		
Peak PRA, %										
0	1135	87.58		98	90.7		1037	87.3		0.5194
>0 to <50	124	9.57		7	6.5		117	9.8		
>50	37	2.85		3	2.8		34	2.9		
Donor characteristics										
Age (years)	1574		44.86 ± 15.83		113	38.5 ± 15.8	1461		45.4 ± 15.7	<0.0001
Gender										
Female	602	38.52		49	43.4		553	38.1		0.2716
Male	961	61.48		64	56.6		897	61.9		
HLA matching										
No. incompatibilities	1567		2.56 ± 0.82	111		2.6 ± 0.9	1456		2.6 ± 0.8	0.9677
Death cause										
Cerebrovascular event	670	43		33	29.7		637	44		0.0034
Other cause	888	57		78	72.3		810	56		
Transplantation characteristics										
Year of transplant										
2000	290	18.3		26	22		264	18		0.0048
2001	306	19.31		15	12.7		291	19.8		
2002	357	22.51		15	12.7		342	23.3		
2003	289	18.23		26	22		263	17.9		
2004	343	21.64		36	30.5		307	20.9		
Cold ischaemia time (min)	1556		1316.2 ± 539.0	111		1115 ± 451.7	1445		1331.6 ± 542.1	<0.0001
Induction therapy with ATG										
No	225	14.83		10	9.1		215	15.3		0.0786
Yes	1292	85.17		100	90.9		1192	84.7		
Post-transplant delayed graft function**										
No	1011	67.36		92	90.2		919	65.7		<0.0001
Yes	490	32.64		10	9.8		480	34.3		
Need for post-transplant dialysis										
No	1124	73.37		104	98.1		1020	71.5		<0.0001
Yes	408	26.63		2	1.9		406	28.5		

Table 1. continued

	Total			Pre-emptive			Pretransplant dialysis			
	N = 1585			*n* = 118 (7.4%)			*n* = 1467 (92.6%)			
	n	%	Mean ± SD	*n*	%	Mean ± SD	*n*	%	Mean ± SD	*P*§
Acute rejection										
No	1176	74.2		89	75.4		1087	74.1		0.7513
Yes	409	25.8		29	24.6		380	25.9		

ATG, antilymphocyte globulins; SD, standard deviation; PRA, panel reactive antibodies.
*Only patients with nonpre-emptive transplantation.
**Number of days necessary for the graft function to reach a Cockcroft-calculated creatinine clearance >10 ml/min longer than 6 days.
§*P*-value: chi-square or Student's *t*-test.

Table 2. Pretransplant characteristics independently associated with pre-emptive transplantation (logistical regression, *N* = 1585).

		OR	95% CI	Adjusted *P*
Recipient characteristics				
Gender	Female	1.612	[1.064–2.443]	0.0294
Diabetes history	Yes	2.225	[1.419–3.489]	0.0001
Blood group O	Yes	0.390	[0.242–0.629]	0.0001
Donor characteristics				
Age (years)	>50	0.973	[0.960–0.985]	<0.0001
Transplantation characteristics				
Year of transplant	2000	1		0.0344
	2001	0.485	[0.240–0.980]	
	2002	0.495	[0.249–0.984]	
	2003	0.904	[0.483–1.692]	
	2004	1.110	[0.618–1.991]	
Centre*	A	1		<0.0001
	B	0.559	[0.341–0.914]	
	C	0.284	[0.149–0.543]	
	D	0.021	[0.003–0.156]	

OR, odds ratio; CI, confidence interval.
*Blinded centre names.

Table 3. Pretransplant characteristics independently related to time of pretranplant dialysis (multilinear regression, *n* = 1467).

		Regression parameter	SE of parameter	Adjusted *P*
Recipient characteristics				
Diabetes history	Yes	−0.59864	0.21646	0.0058
Blood group O	Yes	1.11010	0.15581	<0.0001
Peak PRA, %	0	1		
	>0 and <50	1.48650	0.28740	<0.0001
	>50	4.41829	0.52230	<0.0001
Transplantation characteristics				
Year		0.13605	0.05498	0.0135
Centre*	A	1		
	B	−0.25711	0.21096	0.2231
	C	2.06404	0.25198	<0.0001
	D	1.59667	0.22076	<0.0001

SE, standard error; PRA, panel reactive antibodies.
*Blinded centre names.

history (15% pre-emptive transplants for diabetic patients vs. 6% for nondiabetics), blood group (4% for group O vs. 10% for other groups) and age of donor (9% for donors under 50 years vs. 4% for donors over 50 years) (Table 2).

For the patients dialysed before transplantation, factors independently related to duration of pretransplant dialysis were year and centre of transplant, recipient diabetes history (2.8 ± 2.5 years for diabetic patients vs. 3.5 ± 3.3 for nondiabetics), blood group (4.1 ± 3.3 years for group O vs. 2.9 ± 3.0 for other groups), HLA immunization (2.9 ± 2.8 years for no immunization, 4.4 ± 3.6 for immunization <50%, 7.9 ± 6.4 for immunization >50%) (Table 3).

Relationship between pretransplant dialysis and post-transplant short-term outcomes

In this 1585 patient population, there were 490 (32.6%) patients with post-transplant DGF, 408 (26.6%) needed post-transplant dialysis, and 409 (25.8%) had at least one episode of acute rejection. In univariate analysis, patients with pretransplant dialysis were three times more likely to have DGF than pre-emptive transplant patients (respectively 34% and 10%), and were 10 times more likely to receive post-transplant dialysis (respectively 28% and 2%). There was no significant difference for acute rejection (25.9% for pretransplant dialysed patients, 24.6% for pre-emptive transplant patients). These results were unchanged in adjusted analysis. In the same way, time on dialysis was independently related to post-transplant DGF, and need for post-transplant dialysis (Table 4).

Table 4. Relationship between pretransplant dialysis and post-transplant short-term outcomes (adjusted logistical regression*).

	Post-transplant delayed graft function		Need for post-transplant dialysis		Acute rejection	
	OR [95% CI]	*P*	OR [95% CI]	*P*	OR [95% CI]	*P*
Pretransplant dialysis						
No (pre-emptive)	1	<0.0001	1	<0.0001	1	0.1145
Yes	3.846 [1.930–7.662]		17.824 [4.325–73.448]		0.659 [0.393–1.106]	
*Time on pretransplant dialysis***						
Years	1.071 [1.027–1.117]	0.0014	1.110 [1.064–1.158]	<0.0001	1.006 [0.959–1.054]	0.8193

*Adjusted by significant factors among: recipients characteristics (age, gender, diabetes history, blood group), HLA immunization, donor characteristics (age, gender, number of HLA incompatibilities, death cause), and transplantation characteristics (year, centre, cold ischaemia time, induction therapy with antilymphocyte globulin).

**Subgroup of patients with nonpre-emptive transplantation.

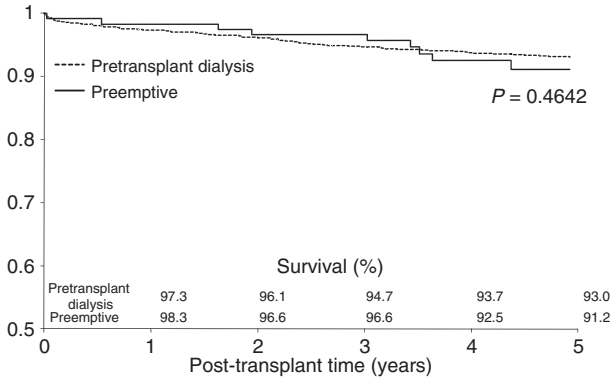

Figure 1 Kaplan–Meier patient survival.

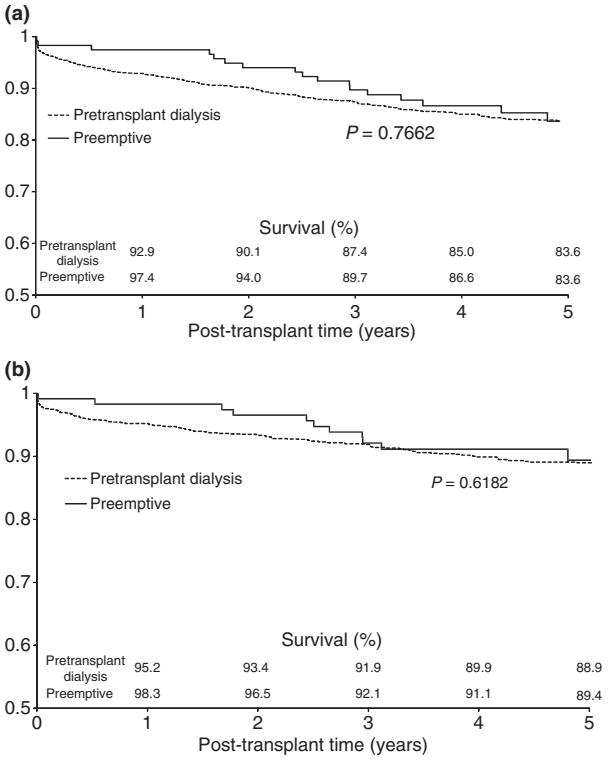

Figure 2 (a) Kaplan–Meier graft survival (death noncensored). (b) Kaplan–Meier graft survival, death-censored.

Relationship between pretransplant dialysis and 5-year outcomes

Five-year patient survival was 92.9%. Five-year graft survival was 89.0%. When death was considered a cause of graft failure, graft survival was 83.6% at 5 years. Figs 1 and 2a and b show the Kaplan–Meier patient and graft survival for PKT and pretransplantation dialysis respectively. Figure 3 shows the Kaplan–Meier graft survival (death noncensored) stratified by waiting time on dialysis. In univariate analysis, neither pre-emptive transplantation nor time on dialysis was significantly associated with outcomes (Table 5). Results were unchanged in multivariate analysis including both factors related to time on dialysis and to prognosis (Table 6).

Discussion

In our network, PKT with a deceased donor, which represented 7% of all first deceased donor kidney transplantations, is infrequent. These results are consistent with the rate of 9.1% of pre-emptive registrations on the waiting list in a French nationwide survey [11]. These rates are lower than those observed in the US and UK where 11% of transplants from deceased donors occured before onset of dialysis [13,14]. In our study, the rate of PKT varied through the study period. In addition, this rate was not consistent across the four centres of the network. This finding could be related to the size of the waiting list and the expected waiting time, which, among the four centres, differ significantly. For patients registered from January

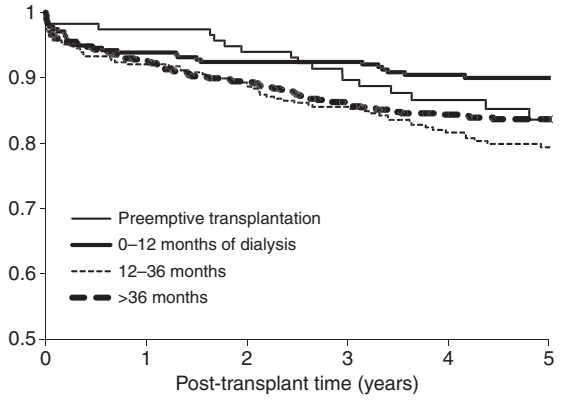

Figure 3 Kaplan–Meier graft survival according to waiting time.

1st 2001 up to December 31st 2004, the median waiting times were 10.9, 21, 30.5 and 39.1 months in centres A, B, C and D respectively [15]. These results suggest a role for donor availability, but this information is lacking in most of the published studies.

In a study performed in the US from 1995 to 1998, it was shown that characteristics of transplant recipients associated with deceased donor PKT included paediatric age, Caucasian race, non-Hispanic ethnicity, private insurance and high education level [5]. In our study, children were excluded because of the national priority for rapid transplantation of paediatric patients. The vast majority of patients were Caucasian, and all expenses related to ESRDs were covered by the national social security; therefore, it is unlikely that socio-economic factors influenced access to transplantation. We found that patients with type 2 diabetes, female gender and blood type other than O were more likely to receive KT before onset of dialysis. These results are also different from US studies where diabetics were less likely to be transplanted without dialysis [5,16]. Diabetics constitute a subgroup of patients for whom PKT with a living donor is associated with a significantly lower mortality risk [17].

Data concerning short-term outcomes are questionable. The definition adopted in our database for DGF is not well adapted for PKT candidates: patients with >10 ml/min GFR might be on the waiting list and their initial allograft dysfunction could be masked by their residual renal function. The same issue could be valid for dialysis requirement after transplantation: not undertaking dialysis in pre-emptive patients might be more related to their residual renal function than early graft function.

Several observational studies have reported that transplantation performed before the need for chronic dialysis is associated with better patient and graft survival than transplantation of patients who are already receiving

Table 5. Relationship between pretransplant dialysis and long-term outcomes (univariate Cox analysis).

	Post-transplant patient survival		Post-transplant graft survival		Combined-endpoint survival	
	RR [95% CI]	*P*	RR [95% CI]	*P*	RR [95% CI]	*P*
Pretransplant dialysis						
No (pre-emptive)	1	0.4647	1	0.6187	1	0.7663
Yes	0.793 [0.427–1.476]		1.160 [0.646–2.085]		1.071 [0.680–1.689]	
*Time on pretransplant dialysis**						
Years	1.016 [0.961–1.075]	0.5708	1.021 [0.977–1.067]	0.3508	1.027 [0.991–1.063]	0.1390

RR, relative risk; CI, confidence interval.
*Subgroup of patients with nonpre-emptive transplantation.

Table 6. relationship between pretransplant dialysis and long-term outcomes (adjusted Cox analysis*).

	Post-transplant survival		Post-transplant graft survival		Combined-endpoint survival	
	RR [95% CI]	*P*	RR [95% CI]	*P*	RR [95% CI]	*P*
Pretransplant dialysis						
No (pre-emptive)	1	0.6189	1	0.7704	1	0.5512
Yes	0.830 [0.398–1.730]		0.910 [0.485–1.709]		0.852 [0.502–1.444]	
*Time on pretransplant dialysis***						
Years	0.965 [0.888–1.049]	0.4009	1.018 [0.962–1.078]	0.5303	1.009 [0.960–1.061]	0.7196

RR, relative risk; CI, confidence interval.
*Adjusted by significant factors among: recipients characteristics (age, gender, diabetes history), donor characteristics (age, gender, number of HLA incompatibilities) and transplantation characteristics (year, centre, cold ischaemia time, induction therapy with antilymphocyte globulin, acute rejection).
**Subgroup of nonpre-emptive transplant patients.

Table 7. Summary of published studies comparing the outcomes of pre-emptive versus non pre-emptive kidney transplantation.

	Patients (*n*)	Country	Period	Type of donor	Pre-emptive (%)	Mean duration of dialysis for nonpre-emptive transplantation	Follow-up period	Outcomes univariate		Outcomes multivariate	
								Deceased donor	Living donor	Deceased donor	Living donor
Roake 1996 [6]	232	UK monocentric	1975–1994	Deceased	50 (matched)	Median = 8 months	NA	Patient survival: S Graft survival: NS	–	NA	–
Asderakis 1998 [14]	1463	UK monocentric	1980–1995	Deceased and living	11		NA	Patient survival: NS Graft survival: NS	NA Graft survival: NS	NA	NA
Cosio 1998 [24]	523	USA monocentric	1984–1991	Deceased	6	17.6 months	84 months	Patient survival: S	–	Patient survival: S Graft survival: NS	–
Papalois 2000 [9]	1849	USA monocentric	1984–1998	Deceased and living	21 (9 deceased, 27 living)	NA	NA	Patient survival at 5 years: S Graft survival: NS	Patients survival at 5 years: S Graft survival: S	NA	NA
Gill 2004 [18]	40 963	USA registry	1987–1996	Deceased and living	14.6 (10 deceased, 27 living)	NA	5.7 years	Patient survival: S Graft survival: S	Patient survival: S Graft survival: S	NA	NA
Meier-Kriesche 2000 [7]	73 103	USA registry	1988–1997	Deceased and living	15	NA	0–10 years	NA	NA	Patient survival: S Graft survival: S	
Witczak 2009 [25]	3400	Norway registry	1989–2007	Deceased and living	23.8	14.4 months	NA	Patient survival: S Graft survival: NS	Patient survival: NS Graft survival: NS	Patient survival: S Graft survival: NS	Patient survival: NS Graft survival: NS
Goldfarb-Rumyantzev 2005 [19]	81 130	USA registry	1990–1999	Deceased and living	0.7	27.1 months	0–10 years	NA	NA	Patient survival: increased risk of death when time on dialysis >1 year Graft survival: increased risk of graft failure when time on dialysis >181 days	
Mange 2001 [21]	8481	USA	1994–1997	Living	21	12 months	>3 years	–	Graft survival at 3 years: S	–	Graft survival at 3 years: S
Kasiske 2002 [5]	38 836	USA registry	1995–1998	Deceased and living	13.2 (7.7 deceased, 24 living)	NA	NA	Patient survival: S Graft survival: S	Patient survival: S Graft survival: S	Patient survival: S Graft survival: S	Patient survival: S Graft survival: S

Table 7. continued

	Patients (*n*)	Country	Period	Type of donor	Pre-emptive (%)	Mean duration of dialysis for nonpre-emptive transplantation	Follow-up period	Outcomes univariate		Outcomes multivariate	
								Deceased donor	Living donor	Deceased donor	Living donor
Perez-Flores 2007 [22]	420	Spain, monocentric	1999–2004	Deceased	8	NA	NA	Patients survival at 2 years: NS Graft survival at 2 years: NS	–	NA	–
Innocenti 2007 [20]	438	USA, monocentric	2000–2002	Living	44	21 months	38 months	–	Patient survival at 3 years: NS Graft survival at 3 years: S	–	Patient survival at 3 years: NS Graft survival at 3 years: NS

NA, not available.

dialysis [5,6,9,14,18,20,21,24,25]. Others have shown that patients who have been on dialysis for a longer period of time are at a higher risk for graft failure than patients who have dialysed for a shorter time [7,19,23]. A summary of published studies comparing the outcomes of pre-emptive versus non pre-emptive kidney transplantation is provided in Table 7. The current study showed that neither pre-emptive transplantation nor time on dialysis was significantly associated with outcomes despite the fact that DGF was more frequent in patients dialysed before transplantation.

Our study included deceased donor transplantation only. In previous studies including only living donors [20,21] or both deceased and living donors [5,7,9,14,18,19,25], pre-emptive living donor kidney transplantation was shown to be associated with better allograft survival [5,9,14,18,21] and/or better patient survival [5,9,18,25]. However, it remains unclear whether PKT from deceased donors is also beneficial. In studies including deceased donors only [6,22,24], there was no demonstration of a better allograft survival in patients with pre-emptive transplantation. In studies including both deceased and living donors and providing separate results for each, a better allograft survival was demonstrated in two studies [5,18] of five [5,9,14,18,25]. A possible explanation for discrepancy in these results would be related to a difference in patient population. A bias in the indication for transplantation could explain the better results observed with PKT as PKT might be offered to patients with less severe comorbid disease. In our study, diabetic patients were more likely to receive PKT, and it is also possible that sicker patients were included in the pre-emptive group. Better patient survival following pre-emptive transplantation with deceased donor has been observed in the univariate analyses of most studies [5,6,9,24], probably linked to other characteristics of patients undergoing transplantation before chronic dialysis. Several characteristics potentially associated with better patient and graft survival may not have been taken into account because of the lack of adjustment on significant variables influencing outcomes, [6,9,14,18] or poorly taken into account in studies based on medico-administrative databases or registries [5,7]. This hypothesis is supported by the fact that socio-economic variables were often ignored in previous studies, even though it has been shown that education level and ethnicity are predictors of receiving a PKT in the first place [5] and that impact of PKT is often more significant for patient survival than for graft survival [9,24,25]. Furthermore, an improvement in the quality of the dialysis procedure and a decreased risk of mortality have been observed during the last decade [25] and could explain the lack of difference in the studies covering more recent periods.

Similarly, in the current study, length of dialysis before transplantation had no detrimental effect on graft and patient survival. A longer waiting time on dialysis was found to be a significant risk factor for death-censored graft survival and patient survival [1,7,25]. This finding was confirmed in another study for specific durations of dialysis as no detrimental effect on graft survival of a short (<6 months) or of a long (>3 years) dialysis course was demonstrated following living donor or deceased donor transplantation [19]. Dialysis course under 1 year had no effect on patient survival following deceased donor transplantation, whereas a negative effect on patient survival was demonstrated as soon as 6 months for recipients of a living kidney [19].

Pre-emptive kidney transplantation from deceased donors may raise ethical issues. The allocation of a limited number of available kidneys poses a constant challenge to maintain an acceptable balance between equity, medical utility and logistical and financial efficiency. In France, no specific recommendation exists concerning inscription of patients on the waiting list, and at the time of the study, date of arrival on the waiting list was the only parameter taken into account in the allocation score. The explanation was that in the absence of a national registry for ESRD, date of dialysis initiation was a stated datum. Currently, REIN ''Registre Epidémiologie et Information en Néphrologie'' covers the whole country and in July 2010 the allocation score was modified, including for waiting time only duration of dialysis.

In summary, neither pre-emptive transplantation nor time on dialysis was found to be significantly associated with patient and/or graft survival in this study analysing data from 1585 patients who received a first renal transplantation from a deceased donor between 2000 and 2004.

Further studies are needed to confirm these results in the modern transplantation era and evaluate implication for the utilization of deceased donor kidneys.

Authorship

MK: designed and performed research and wrote the article. ML, MG, J-PS, CL, FM and LR: contributed important reagents. FA: collected and analysed data.

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