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Comparison of longitudinal quality of life outcomes in preemptive and dialyzed patients on waiting list for kidney transplantation

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Abstract

Purpose:

The waiting list period for kidney transplantation can be lengthy and associated with a deteriorated health-related quality of life (HRQoL). It might also be experienced differently depending on the experience of renal replacement therapy (preemptive or dialyzed patients), and the type of dialysis. The main objective of this study is to measure and compare HRQoL changes in preemptive, hemodialysis (HD) and peritoneal dialysis (PD) patients during the waiting list period for kidney transplantation.

Methods:

A sample of adult patients on kidney transplant waiting list from three French University Hospital centers was recruited. HRQoL was measured using the SF-36 and a specific questionnaire (ReTransQoL), which were collected every six months before transplantation in preemptive, HD and PD patients. Mixed-effects models taking into account time and possible confounding factors were used to compare HRQoL changes between the three groups.

Results:

Preemptive (n=230), HD (n=177) and PD patients (n=39) were enrolled. The renal replacement therapy modalities, time (time on waiting list and age at registration) and gender were associated with HRQoL changes. The HD and PD patients had a significantly lower perceived HRQoL on Role Physical, Social Functioning and Role Emotional dimensions than the preemptive patients, with lower scores for PD compared to HD patients. The HRQoL scores of all patients were lower compared to the French general population for all dimensions.

Conclusions:

A better understanding of pre-transplantation patients' experience can help improving patient care with adapted educational programs and psychological support depending on the type of renal replacement therapy.

Keywords: quality of life, waiting list, kidney transplantation, preemptive, dialysis

Introduction

For decades, the number of patients on waiting list for kidney transplantation remains higher than that of kidney donors [1,2]. The waiting time can thus be lengthy: the median waiting time for kidney transplant was 4 years in 2011 in the United States [1] and in 2016, approximately 18% of adults on waiting list had a waiting time higher than 5 years [3]. The median waiting time in Europe was 4 years in 2016 [2], and 5 years in 2013 in Korea [4]. Qualitative studies have reported that the uncertainty of transplantation, the expectation of a call for transplantation, and the disappointment of not being called soon enough [4,5] make this waiting list period usually difficult to live for patients. It was also reported that the waiting list period is associated with an increase in anxious and depressive symptoms [6], and a deteriorated health-related quality of life (HRQoL) of dialyzed patients compared to the general population [7], which can lead to a risk of non-compliance to treatment [8] and poor prognosis [9]. The waiting list period might also be experienced differently for hemodialysis, peritoneal dialysis and preemptive patients (i.e. patients never experiencing dialysis). We can hypothesize, for example, that patients on dialysis have a lower HRQoL than preemptive patients due to their dialysis experience and fear of associated complications. We can also hypothesize that HRQoL might be different depending on dialysis modalities (hemodialysis and peritoneal dialysis) due to time and travel constraints (dialysis every day or several times a week, day or night, in a dialysis center or at home). Thus, it is possible that the needs for clinical and psychological support are not the same for all patients on waiting list. Moreover, while HRQoL of renal transplant and dialyzed patients was shown to be associated with the long-term patient and graft survival [10,11], the HRQoL of preemptive patients on waiting list remains poorly known and, more generally, data are lacking on the comparison of the HRQoL of preemptive and dialyzed patients on waiting list. Most studies have focused on HRQoL of dialyzed patients and are usually cross-sectional. Longitudinal data are useful to better understand the experiences of patients on waiting list for kidney transplantation and how it may change over time. Only a recent longitudinal study including preemptive and dialyzed patients on waiting list for kidney transplantation was conducted [12] focusing on the HRQoL of older patients (> 65 years old). In this study, changes in HRQoL were studied over time and it was shown that HRQoL decreased during the first year on the waiting list. However, no comparison between preemptive and dialyzed patients was made except at baseline (wait listing) where the HRQoL of the latter was found to be lower as compared to the former. Hence, longitudinal studies comparing changes in HRQoL between renal replacement therapy modalities are lacking.

The objectives of this study are: (i) to measure changes in HRQoL in preemptive, hemodialysis and peritoneal dialysis patients during the waiting list period for kidney transplantation and to compare HRQoL changes between

these three groups, (ii) to compare the HRQoL of these patients with that of the general population, and (iii) to identify factors associated with HRQoL changes. Investigating the differences in HRQoL changes according to renal replacement therapy modalities and identifying associated covariates can provide insights to adapt supportive or medical care if appropriate.

Methods

Study population

The PreKit-QoL study [13] is a French multicenter, prospective and controlled study. Adult patients on kidney transplant waiting list since September 2014 are prospectively pre-included in three groups: patients expected to receive a preemptive kidney transplant (no dialysis), patients under hemodialysis or peritoneal dialysis (for less than 36 months). All patients on waiting list for a kidney transplantation are approached for participating to the study and recruited from three University Hospital centers participating in the DIVAT cohort (Données Informatisées et VALidées en Transplantation, www.divat.fr, approved by the Comité National de l'Informatique et des Libertés CNIL, n°914184) in France: Nantes, Nice, and Lyon. Patients over 18 years old, and registered on the waiting list for first kidney transplantation without other transplanted organ can be pre-included. Patients in the preemptive kidney transplant group can be switched to dialysis before transplantation. Our study focuses on patients on the kidney transplant waiting list who are pre-included until 390 transplanted patients are included. The choice of the sample size is described in the study protocol [13]. Kidney transplanted patients are subsequently included in the PreKit-QoL study and followed for five years post transplantation (ongoing).

The PreKit-QoL study is registered on the ClinicalTrials.gov Registry (RC14_0078, NCT02154815), has obtained approval from the ethical Committee for Persons' Protection (CPP, Tours, 2014-S8), and from the advisory committee on research data and information in health (CCTIRS, Paris, 14.314).

Sociodemographic and clinical data

Sociodemographic data and clinical data are collected at the first visit on waiting list for kidney transplantation: age, gender, weight, height, initial disease (glomerulonephritis, diabetes, etc.), anti-HLA immunization, cardiovascular history, diabetes history, cancer history, dialysis technique, and dates (birth, first dialysis, registration on waiting list, death).

Health-related quality of life

HRQoL is measured with specific and generic questionnaires (ReTransQol [14] and SF-36 [15,16]), respectively in the three groups every 6 months during the waiting list period. The ReTransQol questionnaire is a specific self-administered HRQoL questionnaire developed for kidney transplant recipients. Of the five dimensions of the

ReTransQoL questionnaire (Physical Health, Social Functioning, Medical Care, Treatment and Fear of Losing Graft), three dimensions adapted to the pre-transplant period are studied (Physical Health, Social Functioning and Medical Care). Therefore, the reliability, scalability and validity of the ReTransQoL questionnaire were assessed on our waiting list patient population. The reliability (using Cronbach's alpha [17]), the scalability (using Loevinger's H [18]), and validity (using divergent and convergent validity of the items) were assessed. A threshold greater than or equal to 0.70 for Cronbach's alpha and a threshold greater than or equal to 0.3 for the Loevinger coefficient are considered as indicators of adequate internal consistency reliability and scalability. The divergent and convergent validity are assumed if the items have a correlation coefficient with the score of their own dimension greater than those computed with others scores (divergent validity), and greater than 0.4 (convergent validity). The SF-36 questionnaire is a validated questionnaire composed of 36 items in eight dimensions (Physical Functioning, Role Physical, Bodily Pain, General Health, Vitality, Social Functioning, Role Emotional and Mental Health). The scores of each dimension for both questionnaires range from 0 to 100, a higher score indicating a better HRQoL.

Statistical analysis

A descriptive analysis was performed to compare characteristics and mean HRQoL scores of the preemptive, hemodialysis, and peritoneal dialysis patients' groups at the first study visit on waiting list. Categorical variables were compared using chi-squared tests and continuous variables using one-way analysis of variance (ANOVA). Bonferroni post-hoc tests were also computed to compare the three groups 2 by 2. For the SF-36 questionnaire, the HRQoL scores of patients on waiting list were compared to scores of the general population using a normative score ratio [19] according to age and gender. The normative score ratio was computed for each dimension of the SF-36 as the ratio of the observed patient's score to the norm score which corresponds to the HRQoL mean score of the general French population of the same age and gender [19]. A mean normative score ratio lower than 1 means that the observed HRQoL mean score of the patients is lower than the norm HRQoL score of the general population of same age and gender. The change over time of the observed scores and of the normative score ratios for the SF-36 as well as changes of the observed scores for the ReTransQoL questionnaire of the three patients' groups was described for each dimension (mean score and its 95% confidence interval). Linear mixed-effects models taking into account time and possible confounding factors were used to compare HRQoL changes between the three groups. Variables included in the model were gender, time on waiting list (simple, quadratic and cubic effects), age at the registration on waiting list (in classes), renal replacement therapy group and interactions between time and group, and between time and age as fixed effects. These variables were removed one by one if

they were not significant at 5% level of significance, except time on waiting list and group. All statistical analyses were performed with Stata software version 15.0 (StataCorp, College Station, TX).

Results

Since September 2014, 446 patients on the waiting list for kidney transplantation were enrolled in the study. Among the 446 patients, 230 patients were in the preemptive group, 177 in the hemodialysis group and 39 in the peritoneal dialysis group. The reliability and scalability of the ReTransQoL questionnaire computed on the whole sample were satisfactory for all three dimensions: Social Functioning (5 items, Cronbach's $\alpha = 0.76$, Loevinger coefficient H = 0.42), Medical Care (8 items, $\alpha = 0.85$, H = 0.46) and Physical Health (8 items, $\alpha = 0.80$, H = 0.38). With respect to validity, 19 out of 21 items met convergent validity (item "Do you feel like you are sufficiently informed about complications of the graft?" of the Medical Care dimension and item "Do you engage in physical exercise?" of Physical Health dimension had a correlation coefficient with the score of their own dimension less than 0.40 with a value of 0.37 and 0.34, respectively), and all items met divergent validity.

Patients characteristics and HRQoL

The preemptive, hemodialysis and peritoneal dialysis patients' groups were largely comparable at baseline (table 1) except for center and age where patients under peritoneal dialysis seem to be younger than the patients from the other groups. The mean observed scores of the ReTransQoL and of the SF-36 questionnaires and the mean normative score ratios at the first study visit on waiting list are presented in table 2. Missing values were evenly distributed between the three groups. The preemptive patients group had a significantly higher HRQoL than patients under dialysis (hemodialysis or peritoneal dialysis) for the Physical Health dimension of the ReTransQoL questionnaire, and for the Role Physical, Bodily Pain, Social Functioning and Role Emotional dimensions of the SF-36 questionnaire. Moreover, we observed that the hemodialysis patients group had a significantly higher HRQoL than the peritoneal dialysis patients group for the Social Functioning dimension of the ReTransQoL questionnaire (e.g. of an item of this dimension: "Do you feel isolated?") and for the General Health dimension of the SF-36 questionnaire.

Regarding the mean normative score ratios of the SF-36 questionnaire, the lowest ratios were observed for the Role Physical dimension and the higher ratios for the Mental Health dimension. The upper bound of the 95% confidence interval of the mean normative score ratios was lower than 1 for all patients' groups for all dimensions meaning that their HRQoL was significantly lower than the general population. For example, a normative score ratio of 0.33 for the Role Physical dimension in the peritoneal dialysis patients group means that these patients

may have some problems at work and in daily life activities due to their physical condition as compared to individuals in the general population of the same age and gender (their mean score is reduced by a third).

Figure 1 shows the change in the mean observed scores of the dimensions of the ReTransQoL questionnaire between the peritoneal dialysis, hemodialysis and preemptive patients' groups over time. HRQoL scores in the peritoneal dialysis patient's groups tend to be lower than those in the hemodialysis and preemptive patients' groups for the Social Functioning and Physical Health dimensions over time. Figure 2 shows the change in mean observed normative score ratios over time for the dimensions of the SF-36 questionnaire along with a dashed line at the value of 1 where the observed score and the score of the general population would be the same. The 95% confidence intervals did not include 1 for the General Health and Role Physical dimensions at all times (except for the last time for the peritoneal dialysis patients' groups) for all groups meaning that the observed HRQoL scores were lower than the HRQoL of the general population of same age and gender. By contrast, for the Mental Health dimension, for all groups, the normative score ratios were close to the HRQoL of the general population of same age and gender and higher compared to the others dimensions.

Multivariable analysis: ReTransQoL scores

Multivariable analysis was performed adjusting for gender, time on waiting list (simple, quadratic and cubic effect), age at the registration on waiting list (in classes), group and interactions between time on waiting list and group, and between time on waiting list and age at registration. Results of the final multivariable model for the observed scores of each dimension of the ReTransQoL questionnaire are presented in table 3. HRQoL scores of the preemptive patients group significantly decreased as time spent on waiting list increased for the Social Functioning dimension (-1.6 points per year on average, $p = 0.003$). Taking into account interaction between group and time on waiting list, the Physical Health level of the preemptive and hemodialysis patients' groups significantly decreased as time spent on waiting list increases (-1.8 points per year on average, $p = 0.006$) while the Physical Health level of the peritoneal dialysis patients group significantly increased (+1.8 points per year on average). Nevertheless, we note that the peritoneal dialysis patients' group had a lower level of Physical Health score at registration on waiting list (-10.1 points compared to the two others groups).

Regarding covariates, HRQoL scores of patients over 40 years old at registration on waiting list are significantly higher during the follow-up than those of patients under 40 years old (+7.0 points on average, $p < 0.05$) for the Physical Health dimension. For the three dimensions of the ReTransQoL questionnaire and for all groups, the mean scores of men were significantly higher than those of women during the follow-up (+7.0 points on average for the

Social Functioning and Physical Health dimensions ($p < 0.0001$), +3.0 points for the Medical Care dimension ($p = 0.025$)).

Multivariable analysis: SF-36 scores

Table 4 presents the results of the final multivariable model on the observed scores for each dimension of the SF-36 questionnaire. HRQoL scores of all patients' groups significantly decreased as time spent on waiting list increased (time effect) for the Bodily Pain dimension (-5.5 points on average per year spent on waiting list, $p = 0.046$). The Vitality level of the preemptive and hemodialysis patients' groups also significantly decreased as time spent on waiting list increased (-1.8 points on average per year spent on waiting list, $p = 0.022$), while the Vitality level of the peritoneal dialysis patients group significantly increased as time spent on waiting list increased (+2.4 points per year spent on waiting list taking into account interaction between group and time on waiting list). But, we note that the peritoneal dialysis patients group had a lower level of Vitality at registration on waiting list than the preemptive and hemodialysis patients' groups (-10.1 points compared to the two others groups). HRQoL of hemodialysis patients group significantly increased as time spent on waiting list for the Physical Functioning dimension (+1.3 points on average per year spent on waiting list taking into account interaction between group and time on waiting list). But, we note that the hemodialysis patients group had a lower level of Physical Functioning at registration on waiting list than the preemptive and peritoneal dialysis patients' groups (-7.7 points compared to the two others groups). No time effect was observed for the others dimensions of the SF-36 questionnaire but effects of the renal replacement therapy modalities were evidenced. Patients in the dialysis groups had significantly lower scores than preemptive patients during follow-up, particularly for the peritoneal dialysis group, for the Role Physical (-9.4 points for the hemodialysis group ($p = 0.004$), and -22.2 points for the peritoneal dialysis group ($p < 0.0001$)), Social Functioning (-7.3 points for the hemodialysis group ($p < 0.0001$), and -9.6 points for the peritoneal dialysis group ($p = 0.003$)), and Role Emotional dimensions (-9.8 points for the hemodialysis group ($p = 0.004$), and -16.7 points for the peritoneal dialysis group ($p = 0.004$)). Patients in hemodialysis also had significantly lower level of Physical Functioning than the preemptive patients at registration on waiting list (-7.7 points, $p = 0.001$). And patients in peritoneal dialysis had significantly lower scores than the preemptive patients at registration on waiting list and during follow-up for the Bodily Pain dimension (-8.7 points, $p = 0.006$) and only at registration on waiting list for the Vitality (-10.1 points, $p = 0.005$) dimension.

Regarding covariates of the multivariable analysis, HRQoL scores of patients over 60 years old at the registration on waiting list were significantly higher as time spent on waiting list for the Role Physical dimension and the Role Emotional dimension (respectively +4.7 points and +3.7 points on average per year spent on waiting list taking

into account interaction between age and time on waiting list). At the registration on waiting list, patients over 40 years old had higher HRQoL level than patients under 40 years old for the General Health dimension (+5.8 for patients between 40 and 60 years old ($p = 0.044$); +8.6 points for patients over 60 years old ($p = 0.002$)). And patients over 60 years old had higher HRQoL level for the Vitality dimension (+6.1 points, $p = 0.040$) than patients under 60 years old. Also, men had significantly higher HRQoL scores (gender effect) than women in all dimensions of the SF-36 questionnaire (ranging from +5.2 to +10.5 points on average), except for the Role Physical dimension.

Discussion

The aim of this study was to measure and compare HRQoL changes between renal replacement therapy modalities (preemptive, hemodialysis and peritoneal dialysis) and with the general population during the waiting list period for kidney transplantation.

We found that the renal replacement therapy modalities, time on waiting list, age and gender were associated with HRQoL changes during this period. Our study shows that dialyzed patients (hemodialysis and/or peritoneal dialysis) have a significantly lower perceived HRQoL scores than preemptive patients on all dimensions of the SF-36 questionnaire except for the General Health and Mental Health dimension. A recent study [12] comparing dialysis and preemptive patients over 65 years on waiting list, reported that dialyzed patients have significantly lower scores than preemptive patients in the Physical Functioning and Role Physical dimensions only (generic domains of the KDQOL-SF questionnaire). As suggested by the authors, the elderly patients' population is mainly retired and may experience dialysis differently from working patients, which may explain why few dimensions were impacted compared to our study. Also, we found that peritoneal dialysis patients had lower perceived HRQoL regarding Role Physical, Social Functioning and Role Emotional dimensions (SF-36 questionnaire) than the hemodialysis patients. A study [7] which focused on dialysis patients (peritoneal dialysis versus hemodialysis) showed similar results and suggested that the intensity of the daily dialysis may be responsible for the low peritoneal dialysis patients' HRQoL compared to 3 times per week dialysis for patients on hemodialysis. These results were somehow expected because dialysis has an important impact on the daily life of patients regarding physical, cognitive or social functioning aspects [20]. Nevertheless, in the literature, comparison of HRQoL between renal replacement therapy groups is controversial [21,22]: HRQoL of peritoneal dialysis patients has been shown as being lower or higher [7,23] or not significantly different [24] than HRQoL of hemodialysis patients depending on the HRQoL dimension.

In our study, the HRQoL scores of preemptive or dialyzed patients usually decreased with the time spent on waiting list except for the Physical Health dimension (ReTransQoL) and the Vitality dimension (SF-36) for the peritoneal dialysis patients' group, and for the Physical Functioning (SF-36) for the hemodialysis patients' group. It has already been described that the time on waiting list should be reduced to limit anxious and depressive symptoms [6] and improve HRQoL [7].

In the multivariable analysis, an age effect was evidenced for the Physical Health (ReTransQoL), General Health and Vitality (SF-36) dimensions. The HRQoL scores of patients over 40 years old for the Physical Health (ReTransQoL) and General Health (SF-36) dimensions at the registration on waiting list were higher compared to patients under 40 years old. Also, the HRQoL scores of patients over 60 years old for the Vitality dimension (SF-36) at the registration on waiting list were higher as compared to patients under 60 years old. A study has also described a better HRQoL in older patients with chronic kidney disease [25]. The authors suggest that the experience of older patients is more in accordance with their expectations unlike that of younger patients, so younger patients assess lower HRQoL than older patients. A gender effect was observed on all subscales of the ReTransQoL and SF-36 questionnaires (except for the Role Physical dimension) with women having a lower level on these HRQoL dimensions than men. Such HRQoL scores differences between men and women are usually expected and observed in patients undergoing renal replacement therapies [26], and also in the French general population [19].

Our study shows that HRQoL scores for all groups are lower than those of the French population for almost all dimensions of the SF-36 questionnaire at registration on waiting list (the upper bound of the 95% confidence interval of the mean normative score ratios is lower than 1). We can nevertheless note that the Mental Health level is close to the French population for all renal replacement therapy groups (preemptive, hemodialysis and peritoneal dialysis).

Some limitations can be outlined. First, the time already spent on waiting list and on dialysis at the first visit of the study is heterogeneous and can impact patients' experience [6]. The time spent on waiting list was therefore introduced in the multivariable analysis as a potential confounding factor. By contrast, the time spent on dialysis was not introduced in the multivariable analysis because it was not applicable for preemptive patients. Second, socio-demographic factors as marital status or employment status which can influence HRQoL of patients on waiting list for kidney transplant were not available for the analysis. Indeed, being married has been reported as being associated with higher scores on the Mental Health dimension in patients on waiting list for kidney transplantation [7]. Last, caution should be taken regarding the generalizability of the study since the number of

peritoneal dialysis patients was limited compared to the preemptive and hemodialysis patients' groups. Moreover, the number of preemptive patients were overrepresented (50% of the sample) since, in 2015, 12% of patients received a preemptive kidney transplant in France [27].

Future research is required to explore changes in other aspects of HRQoL such as subjective well-being, anxiety and depressive disorders or perceived stress, between preemptive and dialyzed patients over time. In addition, it is important to follow patients from the registration on waiting list to better understand changes in HRQoL during this period. Reduced HRQoL on waiting list might also affect post-transplant outcomes and deserves further investigation. It has been also reported that HRQoL after kidney transplantation impacts on medication adherence [28] and on mortality and graft failure [10,29], hence highlighting the importance of patient-reported outcomes monitoring. Several studies [30,31] suggests that there is an adaptation process in patients with chronic disease who can change their perception and meaning of the measured construct over time (e.g. quality of life), this phenomenon is called response shift [30]. In our case, response shift might be expected for these patients on waiting list and probably even more after transplantation which constitutes a clear catalyst. Indeed, patients' perception of HRQoL and of life priorities may change following kidney transplantation and it could be hypothesized that response shift might not occur in the same way depending on the renal replacement therapy modality that patients experienced before transplantation. Hence, response shift should also be investigated in these patients to better understand patients' adaptation and experience before and after transplantation.

In conclusion, our study confirms the importance of taking into account the HRQoL of patients on waiting list for kidney transplantation in medical care [32,33]. Indeed, HRQoL of the preemptive, hemodialysis and peritoneal dialysis patients' groups on waiting list for kidney transplantation was quite lower than the HRQoL of the general population at the registration on waiting list and thereafter, and HRQoL of the peritoneal dialysis patients group was often lower than the two others groups. Hence, it highlights the need for supportive care for patients on waiting list, that could be personalized depending on the type of renal replacement therapy.

Conflict of Interest Statement

None declared

Authors' Contribution

L.A. analyzed the data and drafted the paper; J.B.H., M.B. and V.S. supervised the work and revised the paper; M.G., A.M., E.M. and E.C. revised the paper; all authors approved the final version of the manuscript.

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Table 1 : Characteristics of preemptive group, hemodialysis group and peritoneal dialysis group at the first visit before transplantation

	Preemptive group (n = 230)	Hemodialysis group (n = 177)	Peritoneal dialysis group (n = 39)	p-value
Center, n (%)				
Lyon	19 (58 %)	9 (27 %)	5 (15 %)	< 0.001
Nantes	151 (59 %)	80 (32 %)	23 (9 %)	
Nice	60 (38 %)	88 (55 %)	11 (7 %)	
Sociodemographic data				
Age at registration on waiting list, n (%)				0.08
≤ 40 years old	26 (48 %)	21 (39 %)	7 (13 %)	
Between 40 and 60 years old	97 (52 %)	66 (36 %)	22 (12 %)	
> 60 years old	107 (52 %)	90 (43 %)	10 (5 %)	
Age (years, mean ± SD [range])	58.1 ± 13.1 [20-82]	58.6 ± 14.1 [19-86]	52.3 ± 12.3 [21-77]	0.02
Gender, n (%)				0.62
Female	88 (55 %)	60 (37 %)	13 (8 %)	
Male	142 (50 %)	117 (41 %)	26 (9 %)	
Transplantation associated data				
BMI (kg/m ² , mean ± SD [range])	25.6 ± 4.4 [15.6-39.5]	26.3 ± 4.5 [13.5-38.9]	25.3 ± 3.8 [18.1-33.3]	0.19
Blood group, n (%)				0.70
O	106 (48 %)	93 (42 %)	22 (10 %)	
A	94 (56 %)	61 (37 %)	12 (7 %)	
B	19 (47 %)	17 (43 %)	4 (10 %)	
AB	11 (61 %)	6 (33 %)	1 (6 %)	
Initial disease, n (%)				0.15
Diabetes	22 (37 %)	32 (53 %)	6 (10 %)	
Glomerulonephritis	14 (56 %)	8 (32 %)	3 (12 %)	
Tubulo-interstitial nephritis	21 (60 %)	13 (37 %)	1 (3 %)	
Vascular disease	20 (41 %)	23 (47 %)	6 (12 %)	
Others	153 (55 %)	101 (37 %)	23 (8 %)	
Comorbidity, n (%)				
Diabetes	39 (41 %)	45 (47 %)	11 (12 %)	0.06
Cardiovascular	205 (52 %)	154 (39 %)	37 (9 %)	0.36
Cancer	29 (64 %)	13 (29%)	3 (7 %)	0.19
Anti-HLA immunization*, n (%)	43 (58 %)	24 (32 %)	7 (10 %)	0.12
Therapeutic patient education, n (%)	123 (56 %)	76 (34 %)	23 (10 %)	0.05
Time on waiting list transplantation (months, mean ± SD [range])	8.5 ± 12.7 [0-85]	10.5 ± 12.0 [0-63]	7.6 ± 8.1 [0-38]	0.18
Time on dialysis (months, mean ± SD [range])	n/a	14.1 ± 9.4 [0-35]	8.7 ± 7.8 [0-28]	0.001

SD : standard deviation ; n/a : not applicable ; BMI : Body Mass Index.

*: Presence of missing data : 78 missing data for anti-HLA immunization and 1 missing data for dialysis technique

Table 2 : Descriptive analysis of scores at the first visit of the study on waiting list between preemptive group, hemodialysis group and peritoneal dialysis group.

	Missing data	Preemptive group (n = 230)		Hemodialysis group (n = 177)		Peritoneal dialysis group (n = 39)		p-value
		Mean observed score (SD)	Mean normative score ratio [95% CI]	Mean observed score (SD)	Mean normative score ratio [95% CI]	Mean observed score (SD)	Mean normative score ratio [95% CI]	
ReTransQol								
Social Functioning (SF)	26	71.7 ± 16.9	n/a	71.0 ± 19.6	n/a	67.3 ± 16.2	n/a	0.371 ‡†
Physical Health (PH)	36	55.8 ± 16.9	n/a	51.8 ± 17.9	n/a	44.2 ± 15.2	n/a	< 0.001 •‡
Medical Care (MC)	33	71.8 ± 14.2	n/a	69.5 ± 16.5	n/a	70.0 ± 11.8	n/a	0.327 •
SF-36								
Physical Functioning (PF)	12	73.7 ± 23.9	0.90 [0.86;0.94]	67.3 ± 23.9	0.83 [0.79;0.88]	68.6 ± 22.4	0.80 [0.72;0.89]	0.025 •
Role Physical (RP)	15	53.6 ± 40.6	0.68 [0.61;0.75]	38.7 ± 41.1	0.50 [0.41;0.58]	27.0 ± 35.1	0.33 [0.19;0.47]	< 0.001 •‡
Bodily Pain (BP)	20	65.8 ± 24.3	0.94 [0.89;0.98]	61.0 ± 22.7	0.87 [0.82;0.92]	53.1 ± 22.1	0.73 [0.62;0.84]	0.004 •‡
General Health (GH)	13	46.3 ± 20.0	0.70 [0.66;0.74]	48.5 ± 20.5	0.74 [0.68;0.79]	40.6 ± 15.7	0.60 [0.52;0.68]	0.080 ‡†
Vitality (VT)	16	47.4 ± 20.9	0.80 [0.75;0.84]	46.7 ± 20.6	0.79 [0.73;0.84]	39.3 ± 20.5	0.65 [0.54;0.76]	0.085 ‡
Social Functioning (SF)	30	70.7 ± 23.6	0.87 [0.83;0.91]	64.6 ± 24.1	0.80 [0.75;0.84]	63.9 ± 23.7	0.77 [0.68;0.87]	0.030 •‡
Role Emotional (RE)	13	60.3 ± 41.2	0.74 [0.67;0.81]	47.1 ± 46.1	0.58 [0.50;0.67]	41.4 ± 42.2	0.50 [0.33;0.66]	0.002 •‡
Mental Health (MH)	12	65.5 ± 18.1	0.95 [0.91;0.98]	63.4 ± 20.6	0.91 [0.97;0.96]	61.5 ± 20.1	0.89 [0.79;0.98]	0.361 ‡

Observed scores are presented as mean ± SD. Normative score ratios (the ratio of observed score to the normative score) are presented as mean [95% CI]. Dimension scores of the ReTransQol questionnaire are standardized from 0 to 100.

P-value is associated with ANOVA test on observed scores for the ReTransQol and the SF-36 questionnaire, for each dimension between the three groups.

Post-hoc tests are computed for comparison by group (p < 0,05) : • : Bonferroni test is significant for comparison between preemptive group and hemodialysis group ; ‡ : Bonferroni test is significant for comparison between preemptive group and peritoneal dialysis group; † : Bonferroni test is significant for comparison between hemodialysis group and peritoneal group. SD : standard deviation ; CI : confidence interval ; n/a : not applicable

Table 3 : Results of the multivariate analysis of the observed scores of the ReTransQol questionnaire

		Intercept	Gender	Time on waiting list (months)	Age at registration on waiting list		Interaction between age at registration on waiting list and time on waiting list		Group		Interaction between group and time on waiting list	
					Patients between 40 and 60 years old	Patients over 60 years old	Patients between 40 and 60 years old	Patients over 60 years old	Hemodialysis group	Peritoneal dialysis group	Hemodialysis group	Peritoneal dialysis group
Social Functioning (SF)	Estimate (SE)	68.3 (1.6)	7.0 (1.7)	-0.13 (0.04)	--	--	--	--	-1.0 (1.3)	-4.6 (2.4)	--	--
	p-value	< 0.0001	< 0.0001	0.003	--	--	--	--	0.45	0.057	--	--
Physical Health (PH)	Estimate (SE)	45.0 (2.8)	7.5 (1.7)	-0.15 (0.05)	6.8 (2.7)	6.9 (2.6)	--	--	-2.6 (1.7)	-10.1 (3.0)	0.09 (0.07)	0.30 (0.14)
	p-value	< 0.0001	< 0.0001	0.006	0.011	0.009	--	--	0.12	0.001	0.22	0.042
Medical Care (MC)	Estimate (SE)	69.6 (1.3)	3.1 (1.4)	-0.004 (0.04)	--	--	--	--	-1.8 (1.1)	-3.2 (2.0)	--	--
	p-value	< 0.0001	0.025	0.91	--	--	--	--	0.12	0.11	--	--

The reference group of gender is female. The reference group of age at registration on waiting list is the group of patients under 40 years old at registration on waiting list. Preemptive group is the reference of group variable. In the model, time on waiting list is continuous variable. SE: standard error; -- : removed variable; † : Presence of significant quadratic and cubic effects on time on waiting list

Table 4 : Results of the multivariate analysis of the scores of the SF-36 questionnaire

		Intercept	Gender	Time on waiting list (months)	Age at registration on waiting list		Interaction between age at registration on waiting list and time on waiting list		Group		Interaction between group and time on waiting list	
					Patients between 40 and 60 years old	Patients over 60 years old	Patients between 40 and 60 years old	Patients over 60 years old	Hemodialysis group	Peritoneal dialysis group	Hemodialysis group	Peritoneal dialysis group
Physical Functioning (PF)	Estimate (SE)	66.9 (2.2)	10.5 (2.2)	-0.14 (0.08)	--	--	--	--	-7.7 (2.3)	-3.7 (4.2)	0.25 (0.10)	0.03 (0.20)
	p-value	< 0.0001	< 0.0001	0.064	--	--	--	--	0.001	0.38	0.015	0.87
Role Physical (RP)	Estimate (SE)	55.0 (6.9)	--	-0.48 (0.34)	-4.1 (7.6)	-7.3 (7.5)	0.52 (0.37)	0.87 (0.39)	-9.4 (3.2)	-22.2 (5.5)	--	--
	p-value	< 0.0001	--	0.16	0.59	0.33	0.16	0.027	0.004	< 0.0001	--	--
Bodily Pain (BP)	Estimate (SE)	62.4 (2.2)	5.9 (2.1)	-0.46 (0.23) †	--	--	--	--	-3.5 (1.9)	-8.7 (3.2)	--	--
	p-value	< 0.0001	0.005	0.046	--	--	--	--	0.061	0.006	--	--
General Health (GH)	Estimate (SE)	36.1 (3.0)	6.5 (1.8)	-0.07 (0.05)	5.8 (2.9)	8.6 (2.8)	--	--	2.8 (1.5)	-4.9 (2.6)	--	--
	p-value	< 0.0001	< 0.0001	0.14	0.044	0.002	--	--	0.053	0.058	--	--
Vitality (VT)	Estimate (SE)	40.0 (3.1)	5.5 (1.9)	-0.15 (0.07)	5.1 (3.0)	6.1 (3.0)	--	--	-1.4 (1.9)	-10.1 (3.6)	0.14 (0.09)	0.35 (0.17)
	p-value	< 0.0001	0.004	0.027	0.095	0.040	--	--	0.49	0.005	0.12	0.042
Social Functioning (SF)	Estimate (SE)	67.1 (2.0)	6.8 (2.1)	0.006 (0.06)	--	--	--	--	-7.3 (1.9)	-9.6 (3.2)	--	--
	p-value	< 0.0001	0.002	0.92	--	--	--	--	< 0.0001	0.003	--	--
Role Emotional (RE)	Estimate (SE)	60.8 (7.7)	9.6 (3.8)	-0.59 (0.36)	-6.7 (8.0)	-12.3 (7.9)	0.64 (0.39)	0.90 (0.42)	-9.8 (3.4)	-16.7 (5.8)	--	--
	p-value	< 0.0001	0.011	0.10	0.40	0.12	0.10	0.032	0.004	0.004	--	--
Mental Health (MH)	Estimate (SE)	61.8 (1.6)	5.2 (1.8)	0.007 (0.05)	--	--	--	--	-1.6 (1.4)	-4.1 (2.5)	--	--
	p-value	< 0.0001	0.003	0.89	--	--	--	--	0.28	0.10	--	--

The reference group of gender is female. The reference group of age at registration on waiting list is the group of patients under 40 years old at registration on waiting list.

Preemptive group is the reference of group variable. In the model, time on waiting list is continuous variable.

SE: standard error; -- : removed variable; † : Presence of significant quadratic and cubic effects on time on waiting list

Figure legends:

Figure 1: Change in the mean observed scores of the dimensions of the ReTransQol questionnaire between groups over time. Scores are standardized from 0 to 100. 95% confidence intervals are computed by bootstrap. Time on waiting list is divided into classes, only class centers are indicated.

Figure 2: Change in the mean normative score ratio of dimension of the SF-36 questionnaire between groups over time. 95% confidence intervals are computed by bootstrap. Time on waiting list is divided into classes, only class centers are indicated. The dash line fixed at normative score ratio of 1 correspond to norm score of general population.

Figure 1

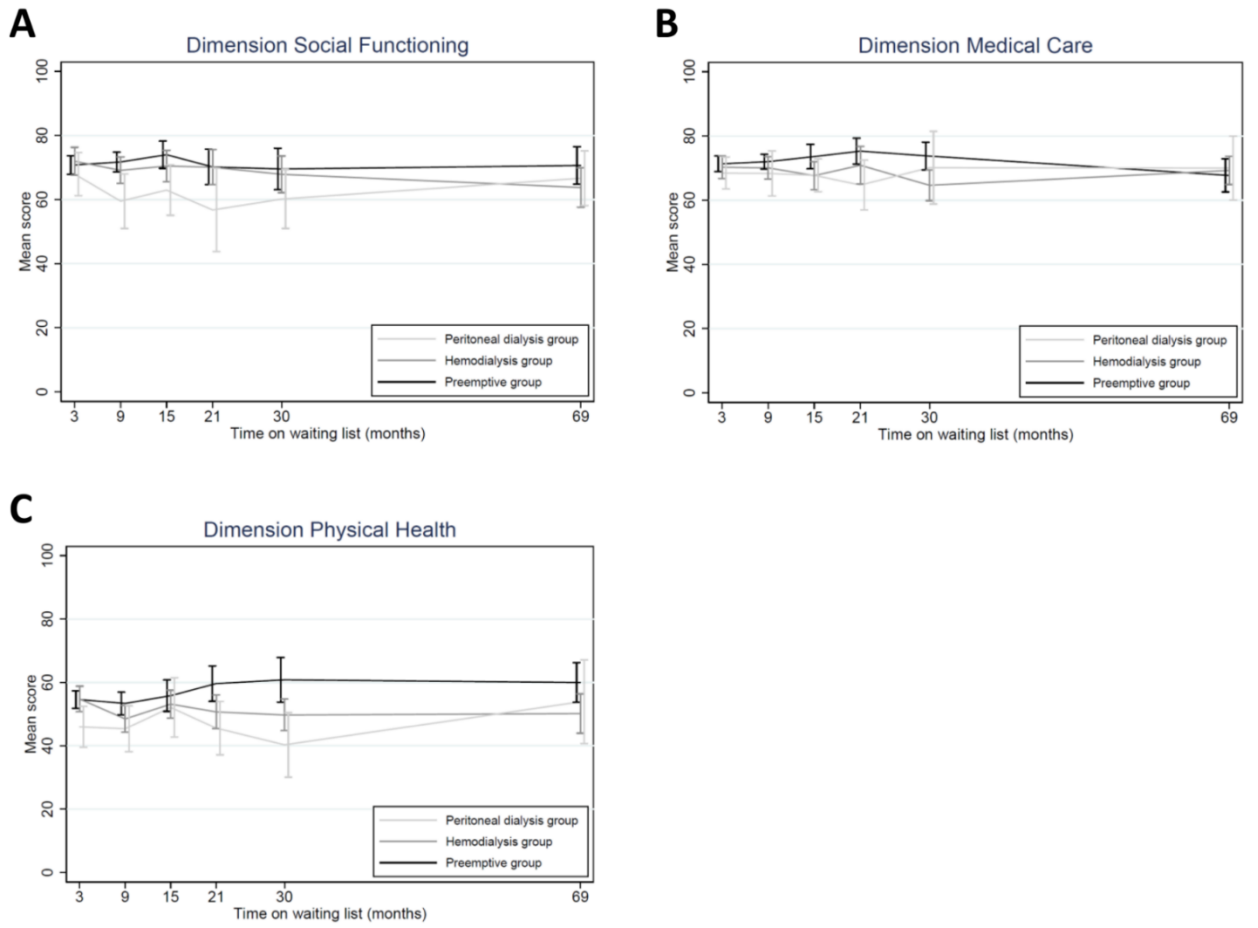


Figure 2

