https://doi.org/10.59459/1859-1655/JMM.935

SURVEY OF GRAFT KIDNEY FUNCTION CHARACTERISTICS AND SOME RELATED FACTORS IN KIDNEY TRANSPLANT RECIPIENTS AT MILITARY HOSPITAL 175

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ABSTRACT

Objective: *To evaluate early graft kidney function and influencing factors in living-donor kidney transplant recipients.*

Subjects and methods: *A prospective descriptive study was conducted on 52 living-donor kidney transplant recipients at Military Hospital 175 from July, 2023 to May, 2025. To evaluate renal allograft function based on serum creatinine levels and glomerular filtration rate at 1 and 3 months after transplantation.*

Results: *Most kidney recipients were male (65.4%), with a mean age of 42.3 ± 12.2 years. The mean age of kidney donors was 35.7 ± 7.2 years, and the mean HLA mismatch was 2.8 ± 1.2. Estimated glomerular filtration rate (eGFR) at one month and three months post-transplant was 67.2 ± 16.3 ml/min/1.73m² and 63.8 ± 15.9 ml/min/1.73m², respectively, with no statistically significant difference. Recipient age over 50 years and an age difference greater than 10 years between donor and recipient were associated with lower estimated glomerular filtration rate (eGFR) at one month post-transplant. Among recipients with Tacrolimus concentrations > 5 ng/ml, rapid Tacrolimus metabolizers had a lower estimated glomerular filtration rate (eGFR) at 3 months post-transplant compared with slow or intermediate metabolizers (55.8 ml/min/1.73 m² versus 67.1 ml/min/1.73 m²; p = 0.015). The change in estimated glomerular filtration rate (eGFR) was also less favorable in the rapid metabolizer group (-8.0 ml/min/1.73m² versus -1.0 ml/min/1.73m²; p = 0.032).*

Conclusion: *At three months after kidney transplantation, graft kidney function remained stable, with no patient mortality and a low rate of acute rejection. The rapid Tacrolimus metabolism associated with an early decline in estimated glomerular filtration rate (eGFR) may inform the development of monitoring strategies and individualized immunosuppressive therapy in clinical practice.*

Keywords: End-stage chronic kidney disease, kidney transplantation, kidney function.

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Received: 27/10/2025; scientific review: 12/2025; accepted: 28/5/2026.

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1. INTRODUCTION

Chronic kidney disease (CKD) has become a growing global health burden, with increasingly widespread impacts on public health. It was estimated that in 2023, the total number of people affected by CKD worldwide reached 850 million, accounting for approximately 10% of the global population [1]. End-stage chronic kidney disease represents the most severe stage, in which the glomerular filtration rate (GFR) falls below 15 ml/min/1.73 m² of body surface area, manifesting as uremic syndrome and potentially leading to death if renal replacement therapy is not provided. Kidney transplantation is the optimal treatment for patients with end-stage chronic kidney disease, significantly improving quality of life and prolonging survival [4]. Since 2023, Military Hospital 175 has implemented the kidney transplantation techniques from living donors with encouraging outcomes. Early assessment of graft function (at one and three months post-transplant) is crucial for predicting long-term prognosis and adjusting immunosuppressive regimens appropriately, thereby optimizing the function of the transplanted kidney and improving the long-term prognosis for kidney transplant recipients. However, in Vietnam,

studies evaluating post-transplant kidney function and related factors remain limited and incomplete. Therefore, we conducted this study to describe characteristics and analyze factors associated with kidney graft function in recipients of living-donor kidney transplants at Military Hospital 175.

2. SUBJECTS AND METHODS

2.1 Subjects

A total of 52 patients with end-stage chronic kidney disease who were indicated for and underwent living-donor kidney transplantation at Military Hospital 175 from July 2023 to May 2025 were included.

- Inclusion criteria: patients aged ≥ 18 years; underwent first-time kidney transplantation; complete 3-month post-transplant follow-up; provided informed consent.

- Exclusion criteria: second kidney transplantation; severe postoperative complications requiring immediate graft nephrectomy; incomplete 3-month follow-up or declined participation.

2.2. Methods

- Study design: Prospective descriptive study.

- Sampling method: Convenience sampling.

- Study procedure:

+ Selection of research subjects: patients were informed about the research objectives and procedures and signed informed consent forms.

+ Kidney transplantation and post-transplant treatment: patients underwent kidney transplantation and received standardized post-transplant immunosuppressive therapy according to protocols established at Military Hospital 175.

+ Follow-up, data collection, and data processing.

- Research criteria:

+ Baseline information: demographic characteristics, underlying diseases, donor characteristics, HLA matching results, and donor kidney function.

+ Graft kidney function: serum creatinine and GFR (at one month and three months post-transplantation). GFR was estimated using the CKD-EPI (2009) equation.

+ Blood concentrations of the immunosuppressant drug Tacrolimus at one and three months post-transplantation.

+ Other related variables were extracted from the electronic medical records.

- Data processing: Data were collected and analyzed using SPSS version 26.0; T-test, ANOVA, and multivariable regression analysis were applied.

- Research ethics: This research was approved by the Ethics Committee in Biomedical Research, Military Hospital 175. All data collected were used for research purposes only and kept confidential.

3. RESULTS

3.1. General characteristics of donors and recipients

Table 1. General characteristics of donors and recipients

General characteristics (n = 52)		Result
Age (years) ($\bar{X}$ ± SD)	Donor	35.7 ± 7.2
	Recipient	42.3 ± 12.2
Recipient sex (n, %)	Male	34 (65.4)
	Female	18 (34.6)
Causes of CKD (n, %)	Hypertension	19 (36.5)
	Glomerulonephritis	13 (25.0)
	Polycystic kidney disease	12 (23.1)
	Diabetes mellitus	5 (9.6)
	Lupus nephritis	2 (3.8)
	Others	1 (1.9)
Pre-transplant treatment (n, %)	Hemodialysis	40 (76.9)
	Peritoneal dialysis	4 (7.7)
	No dialysis	8 (15.4)
HLA mismatch ($\bar{X}$ ± SD)		2.8 ± 1.2

The mean age of recipients was 42.3 ± 12.2 years, with male recipients accounting for 65.4%. The mean donor age was 35.7 ± 7.2 years. The mean HLA mismatch score was 2.8 ± 1.2. A total of 76.9% of recipients had previously undergone renal replacement therapy with hemodialysis before transplantation.

3.2. Characteristics of kidney graft function after kidney transplantation

Table 2. Kidney graft function

Parameter	One month post-transplant (n = 52)	Three months post-transplant (n = 52)	p
Creatinine (µmol/L)	107.6 ± 26.8	113.5 ± 29.4	0.32
GFR (ml/min/1.73m²) (Min-Max)	67.2 ± 16.3 (29.8-100.4)	63.8 ± 15.9 (29.3-100.2)	0.28
GFR ≥ 60 ml/min (n, %)	30 (57.7)	31 (59.4)	
GFR < 60 ml/min (n, %)	22 (42.3)	21 (40.4)	

The mean glomerular filtration rate (GFR) at one month and three months after kidney transplantation was 67.2 ± 16.3 mL/min/1.73m² and 63.8 ± 15.9 mL/min/1.73m², respectively. The decline in GFR between the two time points was not statistically significant (p = 0.28).

3.3. Impact of Age and Drug Metabolism on Graft Kidney Function

Table 3. Factors associated with Graft Kidney Function at one month and three months after Kidney Transplantation

Factor	eGFR at one month (ml/min/1,73m²)		p	eGFR at three months (ml/min/1,73m²)		p
	Yes	No		Yes	No	
Recipient age > 50 years	60.4 ± 12.2	68.5 ± 14.4	0.048	58.8 ± 11.3	64.9 ± 14.7	0.150
Donor age > 40 years	60.8 ± 10.4	67.6 ± 14.8	0.095	59.1 ± 6.7	64.4 ± 15.2	0.125
Age difference (recipient–donor) > 10 years	62.2 ± 14.9	70.8 ± 12.7	0.027	59.9 ± 14.1	67.1 ± 13.7	0.078
Fast Tacrolimus metabolism	66.0 ± 14.7	66.3 ± 13.6	0.946	62.1 ± 15.7	65.6 ± 10.7	0.363

The eGFR at one month post-transplantation in recipients older than 50 years was significantly lower than that in recipients aged ≤ 50 years (60.4 ± 12.2 ml/min/1.73m² vs. 68.5 ± 14.4 ml/min/1.73m²; p = 0.048). Similarly, recipients with an age difference greater than 10 years between recipient and donor also had significantly lower eGFR at one month post-transplantation compared with those with an age difference ≤ 10 years (62.2 ± 14.9 ml/min/1.73m² vs. 70.8 ± 12.7 ml/min/1.73m²; p = 0.027).

Table 4. Comparison of eGFR between fast and slow/intermediate metabolizer groups with Tacrolimus trough concentration ≥ 5 ng/ml at discharge

Parameter (Mean ± SD)	Fast (n = 17)	Slow/Intermediate (n = 17)	p
eGFR at one month (ml/min/1.73m²)	62.8 ± 16.1	66.3 ± 13.7	0.499
eGFR at three months (ml/min/1.73m²)	55.8 ± 13.2	67.1 ± 10.5	0.015
Decline in eGFR (three months – one month)	-8.0 ± 7.9	-1.0 ± 9.1	0.032

Among the 34 recipients with Tacrolimus trough concentrations ≥ 5 ng/ml at discharge, fast metabolizers had lower eGFR at 3 months and a greater decline in eGFR compared with the intermediate/slow metabolizer group, with statistically significant differences.

4. DISCUSSION

4.1. General characteristics

The mean age of recipients was 42.3 ± 12.2 years, and most recipients were male (65.4%). Regarding the causes of kidney failure, hypertension accounted for the highest proportion (36.5%). This etiological distribution is generally consistent with global trends, in which hypertension and diabetes mellitus are increasingly the predominant causes of end-stage kidney disease requiring dialysis and kidney transplantation [3]. Most recipients had undergone renal replacement therapy before transplantation, primarily hemodialysis (76.9%). Notably, 15.4% of recipients had not received dialysis before transplantation. This relatively high proportion reflects the policy of prioritizing early kidney transplantation during the pre-dialysis stage (pre-emptive transplantation), which has been shown to improve long-term outcomes [3].

4.2. Early graft kidney function and associated factors

The mean eGFR at one month post-transplantation was 67.2 ± 16.3 ml/min/1.73m² and decreased slightly to 63.8 ± 15.9 ml/min/1.73m² at three months post-transplantation; however, the difference was not statistically significant (p = 0.28). These findings indicate stable graft kidney function during the early postoperative period, consistent with the 100% graft survival rate at three months and the low incidence of acute rejection (3.8%). Our findings are comparable with most national and international reports on living-donor kidney transplantation [5, 6].

Analysis of influencing factors showed that recipient age > 50 years and an age difference > 10 years between recipient and donor were significantly associated with eGFR at one month after kidney transplantation (p = 0.048 and p = 0.027, respectively). These findings support existing evidence in the literature [4], suggesting that recipient age may negatively affect graft kidney function. No statistically significant associations were observed between post-transplant eGFR and other factors such as donor age, degree of HLA mismatch, or post-transplant complications. However, the study by Naesens M [7] demonstrated that older donor age and donor kidney function were also predictors of short- and intermediate-term graft function after transplantation. This discrepancy may be due to the small sample size of our study, potentially leading to biased results.

4.3. Role of Tacrolimus metabolism

Tacrolimus is a cornerstone immunosuppressive agent in kidney transplantation, characterized by a narrow therapeutic window and marked interindividual pharmacokinetic variability. The concentration-to-dose ratio (C/D ratio) is an indirect indicator reflecting Tacrolimus metabolism through the CYP3A5 enzyme system.

In our study, analysis of all 52 recipients did not demonstrate a statistically significant difference in eGFR between the fast Tacrolimus metabolizer group and the slow/intermediate metabolizer group. However, when the analysis was restricted to the 34 recipients who achieved the therapeutic threshold (Tacrolimus trough concentration at discharge ≥ 5 ng/ml), a clear difference emerged. The fast Tacrolimus metabolizer group had significantly lower eGFR at three months post-transplantation compared with the slow/intermediate metabolizer group (55.8 ± 13.2 ml/min/1.73m² vs. 67.1 ± 10.5 ml/min/1.73m²; p = 0.015). In addition, the decline in eGFR was more unfavorable in the fast metabolizer group (-8.0 ± 7.9 ml/min/1.73m² vs. -1.0 ± 9.1 ml/min/1.73m²; p = 0.032). Stratification according to Tacrolimus concentration was performed to control for confounding factors and provided a value comparable to multivariable analysis, which is appropriate for a moderate sample size study and helps avoid overfitting when constructing multivariable regression models.

These findings may be related to greater fluctuations in drug concentration among fast metabolizers. In this group, although trough concentrations remained ≥ 5 ng/ml, the peak concentration (Cmax) and area under the concentration-time curve (AUC) of Tacrolimus may have been substantially higher than those in slow metabolizers, resulting in greater overall drug exposure and a higher risk of nephrotoxicity leading to early graft dysfunction [8]. Furthermore, in fast metabolizers, Tacrolimus concentrations tend to fluctuate below the therapeutic threshold at certain time points, thereby increasing the risk of subacute antibody-mediated rejection and the formation of donor-specific antibodies (DSA), indirectly causing graft microvascular injury and long-term decline in eGFR [8]. Regular calculation and monitoring of the C/D ratio may therefore represent a useful strategy for individualizing Tacrolimus dosing, particularly during the first three months after kidney transplantation, which is a critical period determining long-term graft prognosis. At major transplant centers, combining CYP3A5 genotyping (to determine metabolizer status before transplantation) with post-transplant

C/D ratio monitoring is increasingly recommended as a step toward personalized medicine in kidney transplantation [9].

Limitations: our study had a relatively small sample size (n = 52) and a short follow-up duration (three months). These limitations may have reduced statistical power and prevented the detection of all clinically significant associations. In addition, CYP3A5 genotyping was not performed; therefore, classification of metabolizer status based solely on the C/D ratio was indirect and may have been influenced by other factors such as drug interactions and dietary habits. Moreover, several potentially prognostic indicators, including renal vascular resistive index measured by Doppler ultrasonography, Tacrolimus concentrations at multiple daily time points, and DSA testing, were not comprehensively collected or evaluated. Future studies should address these limitations by expanding the sample size, extending follow-up to at least one year, and incorporating more detailed clinical parameters.

5. CONCLUSION

This study of 52 living-donor kidney transplant recipients at Military Hospital 175 from July 2023 to May 2025 demonstrated stable early graft kidney function, with mean eGFR values of 67.2 ± 16.3 ml/min/1.73m² at 1 month and 63.8 ± 15.9 ml/min/1.73m² at three months post-transplantation. Graft survival at three months was 100%, and the incidence of acute rejection was low (3.8%).

Among recipients with Tacrolimus concentrations ≥ 5 ng/ml at discharge, fast metabolizers (low C/D ratio) had significantly lower eGFR at three months post-transplantation and a greater decline in eGFR compared with the remaining recipients. These findings may help guide monitoring strategies and individualized immunosuppressive therapy in clinical practice.

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