CHARACTERISTICS OF KIDNEY TRANSPLANT OUTPATIENTS FROM NEPHROLOGY DEPARTMENT, HUE CENTRAL HOSPITAL: A SINGLE-CENTER STUDY

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Kidney transplantation (KTx) is the optimal treatment for improving survival and quality of life for end-stage renal disease (ESRD) patients. A total of 289 kidney transplant recipients were followed in Nephrology Department, Hue Central Hospital, with a significant male predominance (73.36%). The mean age of the cohort was 41.6±11.27 years old, with most patients being between 20 and 40 years old. Among our study cohort, many patients maintained long-term graft function, with 199 patients (n= 68.86%) having a graft survival period of 2-5 years, and 73 patients maintaining graft function for more than 5 years. The average estimated glomerular filtration rate (eGFR) was 54.74±15.56 ml/min/1.73m^2, with a corresponding serum creatinine level of 113.9±79.22 µmol/L. Metabolic complications were prevalent in the post-transplant period. Hyperglycemia was observed in 35.89% (n=103) of patients, dyslipidemia in 32.4% (n=93), and hyperuricemia in 46.34% (n=133). Post-transplant anemia (PTA) affected 24.74% (n=71) of patients with similar proportions across genders. Notably, post-transplant erythrocytosis (PTE) was found in 12.2% (n=35) of the cohort, with all affected patients being male. Our observational retrospective study indicates that metabolic-related and hematological complications are common in kidney transplant recipients. Improved management of these complications should be a key focus in post-transplant follow-up care.

Keywords: Chronic kidney disease (CKD), end-stage renal disease (ESRD), Kidney transplantation (KTx), post-transplant metabolic disorders, post-transplant hematological complications.

I. INTRODUCTION

Recent years, kidney transplantation (KTx) is the optimal treatment for improving survival and quality of life for end-stage renal disease (ESRD) patients. Compared with dialysis, patients who undergo kidney transplants experience a better quality of life and gain more years of life expectancy.[1] With advances in surgical techniques, immunosuppressive and maintain protocols, one-year kidney allograft survival rate improves significantly to more than 95%.[2] Furthermore, KTx is preferred as the most cost-saving optimal treatment among renal replacement therapy modalities, which could solve the heavy financial burden, especially in low- and middle-income countries.[3]

Vietnam successfully performed the first case of kidney transplantation in 1992. There are currently 17 transplantation centers in Vietnam, including 2 pediatric kidney transplantation centers. Hue Central Hospital, with Military 103 Hospital, Viet Duc Hospital, Military 108 Hospital, Bach Mai Hospital, and Cho Ray Hospital, are leading transplantation centers with high innovation surgical and followed procedures. Until 2022, there were 5255 renal

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transplantation cases, consisting of 205 brain-dead donor (DBD) cases, 5 circulatory death donors (DCD).[4]

Even though kidney transplantation is an effective therapeutic option for end-stage kidney disease, the improvement in long-term survival of transplant patients is limited, primarily depending on post-transplant complications. With the improvement of immunosuppressive induction and maintenance regimens, the incidence of rejection was reduced significantly, which dropped from 26% to 5% (1992-2004).[5] Common complications, including post-transplant diabetes mellitus (PTDM), hyperuricemia, dyslipidemia, as parts of metabolic disorders also affect the survival and prognosis of kidney transplant patients.[6] PTDM affecting 10-40% of solid organ recipients, hyperuricemia occurring in 25%-84% of kidney recipients, and dyslipidemia exceeding 60% prevalence. Hematological complications are highly prevalent post-kidney transplant, with post-transplant anemia (PTA) (27-35% at one year), leukopenia (43.4%), and post-transplant erythrocytosis (15%) being the most common. Uncontrolled those complications post-transplantation are associated with significantly worse clinical outcomes, including increased all-cause mortality and cardiovascular mortality.[7] Therefore, post-transplant complications are major aspects to be concerned with long-term benefits for patients.

Since performing its first successful kidney transplant in 2001, Hue Central Hospital has become a leading transplant center in Vietnam. The hospital has now completed nearly 2,000 organ and stem cell transplantation cases, with approximately 1,700 of those being kidney transplants. The hospital's transplant program also includes heart, liver, and corneal transplants. Kidney transplant recipients are followed up at various centers, ensuring comprehensive post-operative care. Currently, Hue Central Hospital has approximately 1000 kidney transplant outpatients, divided into 2 departments. This study focuses on review kidney transplantation, demographic features, pre-transplant dialysis status, graft function, common disorders post transplantation on out-patients followed up in Nephrology department, Hue Central Hospital, Vietnam until early 2025.

II. MATERIAL AND METHODS

1. Study design and Data collection

A single-center observational retrospective cohort study was conducted in Nephrology Department, Hue Central Hospital, Vietnam. Data was collected cross-sectionally at one point in time from the patient's monthly routine check-up. Patients have done laboratory tests early in morning, before the administration of immunosuppressant medication, including complete blood count (CBC), fasting blood glucose, serum urea, serum creatinine (sCr), alanine transaminase (ALT), aspartate transaminase (AST), acid uric, total cholesterol, HDL-cholesterol, non-HDL-cholesterol, triglyceride, electrolytes, urinalysis simultaneously. All patients using data collection are followed up in Nephrology Departments, Hue Central Hospital. The data was collected based on the results of patient examinations during the same month as their scheduled follow-up visit, from July 2024 to September 2024. Results recording and analysis were performed from October 2024 to November 2025.

2. Inclusion and Exclusion Criteria

Inclusion Criteria

- Patients ≥ 6 months post transplantation.
- Follow-up monthly at Nephrology Department, Hue Central Hospital.

- No critical illness at the time or within the month prior to data collection.

- Agree to participate in data collection.

Exclusion Criteria

- Hospitalizing patients within the month prior to data collection.

- Data from deceased patients during data collection period will exclude laboratory tests.

3. Patient population and characteristics

Our study population included 289 kidney transplant patients who are followed up out-patiently in the Nephrology Department, Hue Central Hospital, Vietnam, from 2003 to early 2025. Patients were divided into groups based on the duration of the graft survival, including: < 1 year, 2-5-year, 6-10-year, 11-15-year, and > 15 year. Impaired function of transplanted kidneys when the eGFR less than 15 mL/min/1.73m^2.

Pre-transplantation characteristics included renal replacement therapy, year of renal replacement therapy, and comorbidities. Post-transplant complication definitions were based on World Health Organization (WHO) and International Diabetes Foundation, including:

- Hyperglycemia: Fasting blood glucose level > 5.6 mmol/L or using anti-diabetic drug.

- Lipid disorder: Triglyceride > 1.7 mmol/L or High-density lipoprotein (HDL)- Cholesterol < 2.7 mmol/L for male and < 2.2 mmol/L for female.

- Hyperuricemia: Serum acid uric level > 422 µmol/L for male and > 360 µmol/L for female.

- Post-transplant anemia (PTA): Hemoglobin (Hb) < 13g/dL for male and < 12g/dL for female.

- Post-transplant erythrocytosis (PTE): Hemoglobin (Hb) > 17g/dL and Hematocrit (Hct) > 51%, persist for > 6 months.

- Leucopenia: White blood cell (WBC) < 4x10^9/L.

Biochemical markers were evaluated monthly for at least 3 months. All blood samples were drawn after a confirmed minimum fasting period of 8 to 12 hours fasting. The abnormal result is determined when at least 2 repetitions in monthly tests e correct.

Estimated glomerular filtration rate (eGFR) and GFR categories were used according to Kidney Disease Improving Global Outcomes (KDIGO) 2024 clinical practice guideline for the evaluation and management of chronic kidney disease. eGFR was calculated by using 2009 CKD-EPI creatinine formula.

$$eGFR = A \times (Scr/B)^C \times 0.993^{age} \times (1.159 \text{ if black*})$$

where *A, B*, and *C* are the following:

Female		Male	
Scr ≤0.7	*A* = 144	Scr ≤0.9	*A* = 141
	B = 0.7		*B* = 0.9
	C = -0.329		*C* = -0.411
Scr >0.7	*A* = 144	Scr >0.9	*A* = 141
	B = 0.7		*B* = 0.9
	C = -1.209		*C* = -1.209

Statistical analysis

All statistical analyses were conducted using Microsoft Excel and GraphPad Prism 9. Continuous variables, such as age and eGFR, are expressed as mean ± standard deviation (SD). Categorical variables, including gender and the presence of complications, are presented as frequencies and percentages.

4. Research Ethics

The study was approved by the Biomedical Research Ethics Committee of Hue Central Hospital (Approval No. 17/BVH-HDDD), 11th December 2025.

III. RESULTS

Patient demographic features

This study analyzed a cohort of 289 kidney transplant recipients who underwent transplantation between 2003 and 2025. All participants were still actively followed at Nephrology Department, Hue Central Hospital at the time of the study. The patient cohort consisted of 212 males (73.36%) and 77 females (26.64%). The average age of the recipients was 41.56 ± 11.27 years old. Most patients were between 21 and 60 years old, with 139 individuals in the 21-40 age group and 123 in the 41-60 age group, collectively accounting for approximately 90% of the study population. Only 5 patients were under 20, while 22 were over 60 years old. A small subset of the population, 3 patients (1.04%), underwent a second kidney transplant (Table 1).

Table 1. Demographic characteristics of transplant patients

	Male (n=212)	Female(n=77)	Total(n=289)
Age			
Mean (SD)	42.17(±10.70)	39.88(±12.55)	41.56(±11.27)
Age group (%)			
<=20	2(0.94%)	3(3.9%)	5(1.73%)
21-40	97(45.75%)	42(54.55%)	139(48.10%)
41-60	98(46.23%)	25(32.47%)	123(42.56%)
>60	15(7.08%)	7(9.08%)	22(7.61%)

Pre-transplantation Management

In the pre-transplantation period, almost all patients had reached end-stage kidney disease (ESKD) and required renal replacement therapy. Of the total cohort, 242 patients (83.74%) were on dialysis. The predominant form of dialysis was hemodialysis (HD). Only 8 patients utilized peritoneal dialysis (PD) as their primary pre-transplantation therapy, with 2 of these individuals subsequently transitioning to HD. Additionally, 39 patients (13.49%) maintained residual kidney function and were managed with medical treatment alone, without the need for pre-transplantation dialysis (Table 2).

Table 2. Pre-transplant dialysis condition

	Male (n=212)	Female(n=77)	Total(n=289)
Dialysis (%)			
None	25	14	39(13.49%)
HD	180	62	242(83.74%)
PD	6	0	6(2.08%)
PD/HD	1	1	2(0.69%)
2nd Transplantation	3	0	3(1.04%)

Patient and Graft survival

A cohort of 289 kidney transplant patients followed up until June 2025. During the data collecting period, two patient deaths were recorded, attributed to causes: one from ischemic stroke and the other from severe pneumonia. The remaining 287 patients are currently alive with functioning grafts. The average estimated glomerular filtration rate (eGFR) for the cohort was 54.74±15.56 mL/min/1.73m^2, while the mean serum creatinine (sCr) level was 113.90±79.22 μmol/L. Graft function was compromised in a small subset of the cohort, with 7 patients (2.42%) exhibiting a reduced eGFR of less than 15 mL/min/1.73m^2. Among these, 2 patients (0.69%) experienced graft failure and are now hemodialysis dependent. Many patients demonstrated long-term functioning-graft survival. The distribution of graft survival periods includes 199 patients (68.86%) who have had a graft survival period of 2-5 years, and 55 patients (19.03%) who have had a graft survival period of 6-10 years. A notable number of patients, 16 (5.54%), achieved more than 10 years of graft survival, including 4 patients (1.38%) with a graft survival exceeding 15 years (Table 3). The largest proportion of the cohort fell within the 2-5 years post-transplant category (N = 199), which also demonstrated the highest mean eGFR at 55.80 ± 15.17 mL/min/1.73m². In the initial post-transplant phase (≤ 1 year, n=17), the mean eGFR was slightly lower at 50.68 ± 13.44 mL/min/1.73m². Beyond the 5-year mark, a progressive decline in renal allograft function was observed. The mean eGFR decreased to 53.49 ± 17.14 mL/min/1.73m² in the 6-10 years group (n=55) and further declined to 49.19 ± 18.30 mL/min/1.73m² in the 11-15 years group (n=12). The most significant reduction in graft function was noted in the > 15 years group (32.61 ± 3.69 mL/min/1.73m²); however, this observation is limited by the very small sample size (n= 4).

Table 3. Patient and Graft Survival Rate

	Total (n=289)		
Patient Survival			
Death	2		
Graft Function			
eGFR(ml/min/1.73m^2)	54.74±15.56		
S. Creatinine(µmol/L)	113.90±79.22		
Reduce function	7		
Graft failure	2		
Graft survival rate (yrs)		**Mean eGFR**	**SD**
0-1	17(5.88%)	50.68	13.44
2-5	199(68.86%)	55.8	15.17
6-10	55(19.03%)	53.49	17.14
11-15	12(4.16%)	49.19	18.3
>15	4(1.38%)	32.61	3.69

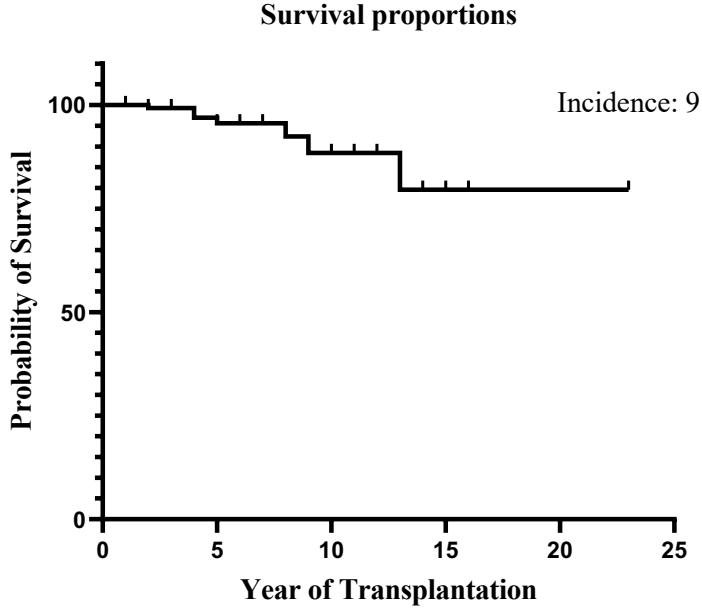

Figure 1. Kaplan-Meier curves for graft function

The "X" represents year of transplantation and "Y" axis probability of graft function. Incidence includes graft function (eGFR) < 15 ml/min/1.73m^2 and death-censored graft loss

Metabolic disorders and Hematological complications

Our study cohort of 287 patients with graft functioning observed metabolic and hematological complications (Table 4). Metabolic disorders are the most frequent complications post kidney transplantation. Hyperuricemia is the most prevalent event, affecting 133 patients (46.34%), while hyperglycemia and dyslipidemia are present in 103 patients (35.89%), and 93 patients (32.40%), respectively. Additionally, the coexistence of two metabolic issues is also common: hyperglycemia and hyperuricemia in 45 patients (15.68%), hyperglycemia and dyslipidemia in 42 patients (14.63%), and dyslipidemia and hyperuricemia in 40 patients (13.94%). A small subset of 16 patients (5.57%) experienced all three metabolic disorders simultaneously. Hematological complications were also recorded. Anemia was the most common hematological issue, found in 71 patients (24.74%), while erythrocytosis was seen in 35 patients (12.20%). Furthermore, leucopenia was the least common hematological complication, affecting 31 patients (10.80%).

Table 4. Metabolic and Hematological complications

	Total (n=287)
Metabolic disorders events	
Hyperglycemia	103(35.89%)
Dyslipidemia	93(32.4%)
Hyperuricemia	133(46.34%)
Hyperglycemia/Dyslipidemia	42(14.63%)
Hyperglycemia/Hyperuricemia	45(15.68%)
Dyslipidemia/ Hyperuricemia	40(13.94%
3/3 events	16(5.57%)
Hematological Complications	
Anemia	71(24.74%)
Erythrocytosis	35(12.20%)
Leucopenia	31(10.80%)

IV. DISCUSSION AND LIMITATION

Discussion

While kidney transplantation remains the optimal treatment for end-stage renal disease effectively releasing patients from dialysis and restoring a relatively normal quality of life, it necessitates lifelong maintenance immunosuppression. This therapeutic requirement introduces a predictable profile of adverse effects, most notably metabolic and benign hematological disorders. Rather than being fatal, these are well-recognized, chronic complications that can be effectively managed with modern clinical protocols to optimize long-term graft survival and

patient well-being. Metabolic syndrome encompassing hyperglycemia, dyslipidemia, and hyperuricemia is highly prevalent following kidney transplantation. These parameters are well-defined risk factors for cardiovascular disease (CVD) and can influence allograft outcomes.[8] The development of post-transplant metabolic disorders is frequently driven by the intersection of lifestyle changes and the metabolic profiles of immunosuppressive drugs.[9] Corticosteroids and calcineurin inhibitors (CNIs), such as tacrolimus and cyclosporine, are known to induce or exacerbate hyperglycemia and dyslipidemia by impairing insulin secretion and increasing peripheral insulin resistance.[10] In our study cohort, over one-third of kidney transplant patients experienced hyperglycemia, which aligns with the widely reported 20-30% prevalence of post-transplant diabetes mellitus (PTDM).[11] While historical data linked uncontrolled PTDM to increased risks of major adverse cardiovascular events (MACEs) and graft attrition, current international diagnostic criteria and management guidelines (such as those by KDIGO and ADA) are well-updated and provide clear therapeutic pathways. Early screening and intervention are now routine. PTDM and post-transplant hyperglycemia can be robustly managed through a combination of dietary adjustments and modern oral anti-diabetic medications. Evidence supporting the efficacy and safety of newer glycemic control agents in transplant recipients continues to grow, allowing clinicians to manage blood glucose effectively while avoiding adverse interactions with immunosuppressive regimens.[12,13] Similarly, dyslipidemia is a highly prevalent, modifiable complication. In our cohort, 32.4% of patients presented with dyslipidemia, a rate somewhat lower than the up to 78% prevalence reported in broader transplant literature. Abnormal lipid profiles, while exacerbating cardiovascular risk and potentially contributing to chronic graft vasculopathy if neglected, are highly responsive to intervention.[14] Modern management of post-transplant dyslipidemia is well-standardized, initiating with lifestyle modifications including dietary intervention, weight management, and physical activity followed by pharmacotherapy. While clinicians must carefully monitor for drug-drug interactions between lipid-lowering agents (e.g., statins) and immunosuppressants (particularly CNIs and mTOR inhibitors), routine pharmacological management is both safe and highly effective at achieving target lipid profiles.[15,16] Controlling metabolic profile is necessary to improve long-term graft survival, reduce cardiovascular issues, chronic graft dysfunction, and patient mortality. Furthermore, benign hematological events, such as post-transplant erythrocytosis (PTE) and post-transplant anemia (PTA), are common complications. These are typically non-fatal consequences related to the direct or indirect effects of antimetabolites (e.g., mycophenolate mofetil [MMF] and azathioprine [AZA]), graft function status.[17] The diagnostic guidance for these conditions is well-established. They can be successfully managed through individualized, targeted strategies, such as the judicious dose titration of specific immunosuppressants, iron supplementation, erythropoiesis-stimulating agents (ESAs), or therapeutic phlebotomy. Balancing optimal immunosuppression with hematological stability is a standard component of post-transplant care that ensures both graft preservation and patient safety. In conclusion, our retrospective study highlights the expected prevalence of metabolic and hematological shifts in kidney transplant recipients. Because the definitions, screening protocols, and therapeutic guidelines for these conditions are well-updated and accessible, establishing routine, proactive follow-up strategies allow for

successful long-term management. Mitigating these modifiable factors is essential for minimizing cardiovascular risk and preserving long-term allograft function.

Limitations

Several limitations of the present study warrant consideration. First, the investigation employed a retrospective, single-center design restricted to a specific cohort within the Nephrology Department of Hue Central Hospital. This localized sampling introduces potential selection bias and limits the external validity of the findings. Consequently, the study was precluded from conducting a comprehensive, multicenter evaluation of critical long-term outcomes, such as post-transplant mortality, long-term allograft survival, and broad metabolic or hematological complications. Furthermore, these institutional constraints suggest the findings may not fully represent the broader renal transplant population even within our own hospital. Second, the retrospective nature of the data collection, confined to a one-year observation period (June 2024 to June 2025), resulted in incomplete pre-transplant biochemical profiles, particularly for patients with a transplant vintage exceeding five years. Furthermore, In the study population, only approximately 25% of kidney transplant patients (n=71) had graft retention times of 5 years or more, thus limiting the representativeness and scope of the study for metabolic and hematological disorders in long-term kidney transplant patients. This data scarcity restricted our ability to rigorously evaluate baseline covariates and their impact on post-transplant management.. Future multicenter investigations with expanded, prospectively followed cohorts are necessary to comprehensively evaluate metabolic complications and long-term outcomes in this patient population.

V. CONCLUSION

This retrospective observational study highlights the substantial burden of metabolic and hematological complications among kidney transplant recipients. While transplantation remains the optimal treatment for end-stage kidney disease, our findings underscore that this patient population remains highly vulnerable to systemic dysregulations in the post-engraftment period. The high prevalence of these complications poses a significant risk not only to long-term allograft viability but also to overall patient survival, primarily by exacerbating cardiovascular and infectious risks. Routine vigilant screening and the implementation of proactive, targeted management strategies for metabolic and hematological abnormalities should become fundamental components of standard follow-up protocols. Ultimately, optimizing the management of these chronic comorbidities is essential for improving the quality of life, preserving allograft function, and reducing long-term mortality in kidney transplant recipients.

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