EVALUATION THE RESULTS OF REANIMATION AFTER KIDNEY TRANSPLANT IN CHILDREN

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ABSTRACT

Introduction: *Pediatric kidney transplants has been increasing in recent years, as the procedure provides long-lasting and favorable outcomes; however many complications can occur in post-transplant period. The early perioperative care plays a significant role in reducing complications and improving the quality of treatment.*

Objectives: *To describe the clinical, laboratory, and early complications in perioperative period post kidney transplant surgery.*

Methods: *We conducted a descriptive cross-sectional study in the Surgical intensive care unit of the Vietnam National Children's Hospital. Data of patients underwent renal transplant procedure were collected from January 2014 to April 2022.*

Results: *The study included 33 patients with an average age of 11.1 ± 3.3 years, of which 70% were male, the average weight of them was 28 ± 10 kg. The median mechanical ventilation time was 6.1 hours (IQR 4.0 - 12.3). 53.3% of patients required vasopressors/ inotropes. Hypertension was documented in 22 patients (73.3%); of which, 19/22 required intravenous antihypertensive drugs. Polyuria gradually improve after surgery, urea and creatinine levels turned to normal after 3 days. 9 patients (30%) reported complications in which postoperative bleeding was the most common cause (4/33 patients) followed by urinary tract infection (3/33 patients). Only one case of delayed graft function and one case of renal artery stenosis were observed.*

Conclusion: *A high incidence of perioperative complications after kidney transplant surgery was documented. Continuous postoperative clinical monitoring is imperative for early detection and treatment of these complications.*

Keyword: *renal transplant, perioperative care, complications*

I. INTRODUCTION

Mature B cell lymphoma (B-NHL) accounts for 50-60Kidney transplant is the gold standard method for treating end-stage kidney disease in children. The surgery yields efficient results in preserving kidney function with fewer long-term complications. Post-transplant care is a crucial phase aiding in kidney function recovery, preventing and treating complications, thereby enhancing the method's effectiveness. Early complications in kidney transplant include bleeding, infection, renal artery stenosis, among others. Despite advancements in surgical techniques and immunosuppressive drugs increasing the graft survival rate, there remain issues related to post-operative management, especially in the immediate post-surgery recovery phase. In Vietnam, there is limited research describing the clinical progression and treatment outcomes during the post-transplantation recovery period. Hence, our study aims to achieve two objectives:

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- o Describe the clinical, subclinical characteristics in the recovery phase after kidney transplant in children at the National Children's Hospital.
- o Evaluate early complications during the recovery phase after kidney transplant.

II. RESEARCH SUBJECT AND METHOD:

2.1. Study subject

33 patients under 18 years old underwent kidney transplant at the National Children's Hospital from January 2014 to April 2022.

2.2. Research method

- Study design: Descriptive cross-sectional study.

- Retrospective review of medical records of all children who underwent kidney transplant at the National Children's Hospital between January 2014 and April 2022.

- Information about clinical progression and examinations during the immediate post-surgery phase until discharge from the intensive care unit was collected: respiratory, circulatory, renal-urinary, digestive, blood counts, electrolytes, blood urea, blood creatinine, blood gas indices.

- Evaluation of early complications during the post-surgery recovery phase including:

+ Surgical complications:

- o Urinary complications: obstruction, bleeding, urinary leakage
- o Vascular complications: renal artery stenosis, arterial thrombosis, venous thrombosis
- o Wound dehiscence
- o Other post-operative bleeding

+ Early graft rejection: hyperacute rejection, antibody-mediated rejection, acute rejection, borderline rejection

+ Internal complications:

- o Delayed graft function
- o Calcineurin inhibitor nephrotoxicity
- o Fluid and electrolyte disturbances
- o Hypertension
- o Infections: viral, bacterial (sepsis, pneumonia, urinary tract infection, wound infection), fungal.

2.3. Data analysis

Data analysis will be conducted using STATA 17.0 software to determine changes in clinical and post-operative indices and to identify the incidence rate of early complications during the post-surgery recovery process.

Table 1. Intraoperative progression

Characteristics	Value (N=30)
Surgery duration (minute), *median (IQR)*	276 (245 - 305)
Highest CVP (mmHg), *mean ± SD (min - max)*	13,9 ± 2,5 (10,0 - 20,0)
Highest systolic blood pressure, *median (IQR)*	130 (120 -140)
Highest diastolic blood pressure, *median (IQR)*	70 (60 - 75)
Iliac vein clamping time (minute), *median (IQR)*	40 (15 - 70)
Iliac artery clamping time (minute), *median (IQR)*	21 (10 - 30)

After surgery, the median mechanical ventilation duration was 6.1 hours (IQR: 4.0 - 12.3). 53.3% of patients required vasoactive drugs or increased cardiac contractility, and 73.3% needed antihypertensive drugs due to elevated blood pressure, with Loxen being the most commonly used antihypertensive drug (63.3%).

Table 2. Postoperative Progression in the Recovery Phase

Characteristics	Value (N=30)
Respiratory	
Mechanical ventilation duration after surgery (hour), *Median (IQR)*	6.1 (4.0 - 12.3)
Oxygen ventilation duration after weaning (hour), *Median (IQR)*	14.5 (7.5 - 21.0)
Endotracheal reintubation, frequency *(percentage %)*	1 (3.3)
Circulatory	
Use of vasoactive drugs/cardiac contractility	
Use of dopamine (≥ 5µg/kg/ph), frequency *(percentage %)*	16 (53.3)

Table *(continued)*

Characteristics	Value (N=30)
Combination of two types, frequency *(percentage %)*	1 (3.3)
Combination of three types, frequency *(percentage %)*	5 (16.7)
Maximum VIS on day 1, median *(IQR)*	5 (5 - 10)
Maximum VIS on day 2, median *(IQR)*	16.9 (11.9 - 22.5)
Maximum VIS on day 3, median *(IQR)*	7.5 (6.9 - 27.5)
Postoperative hypertension requiring drug use, frequency *(percentage %)*	22 (73.3)
Use of Loxen, frequency *(percentage %)*	19 (63.3)
Use of Amlor, frequency *(percentage %)*	3 (10.0)
Time of onset of hypertension (hour), *median (IQR)*	6.8 (0.9 - 36.9)
Duration of hypertension (hour), *median (IQR)*	4.0 (1.2 - 7.0)
Hypertension grade I, frequency *(percentage %)*	1 (4.2)
Hypertension grade II, frequency *(percentage %)*	23 (95.8)
Postoperative blood transfusion, frequency *(percentage %)*	13 (43.3)
Red blood cell mass, frequency *(percentage %)*	11 (36.7)
Red blood cell and platelet mass, frequency *(percentage %)*	1 (3.3)

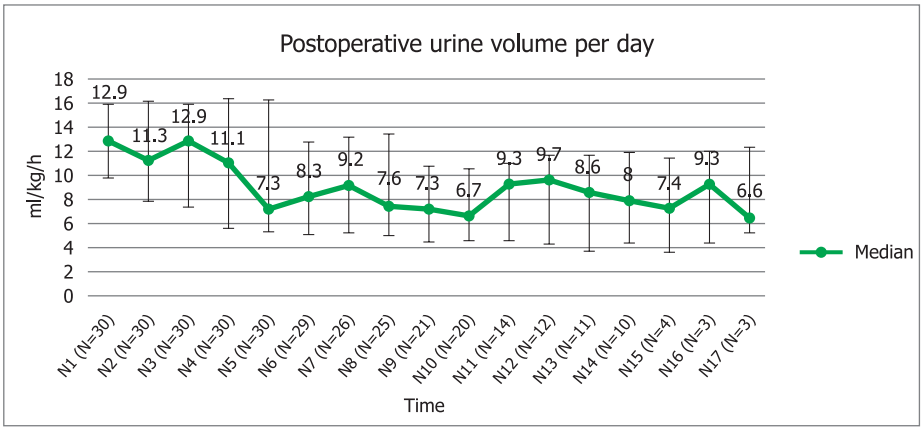
All patients in the study received postoperative immunosuppressive drugs, with Prednisolone, Cellcept and Basiliximab being the most commonly used, at rates of 100%, 100% and 80%, respectively.

Table 3. Use of immunosuppressive drugs

Immunosuppressive Drug	Value (N=30)
Prednisolone dose after surgery, frequency *(percentage %)*	30 (100)
Use of Tacrolimus after surgery, frequency *(percentage %)*	23 (76.7)
Use of Cyclosporin A after surgery, frequency *(percentage %)*	7 (23.3)
Use of Cellcept after surgery, frequency *(percentage %)*	30 (100)
Use of Basiliximab after surgery, frequency *(percentage %)*	24 (80.0)

The urine volume of patients was monitored daily until discharge from the intensive care unit. The median urine volume in the first 24 hours was 12.9 ml/kg/h, reaching a maximum of 32.2 ml/kg/h. The urine volume typically decreased after 3 days.

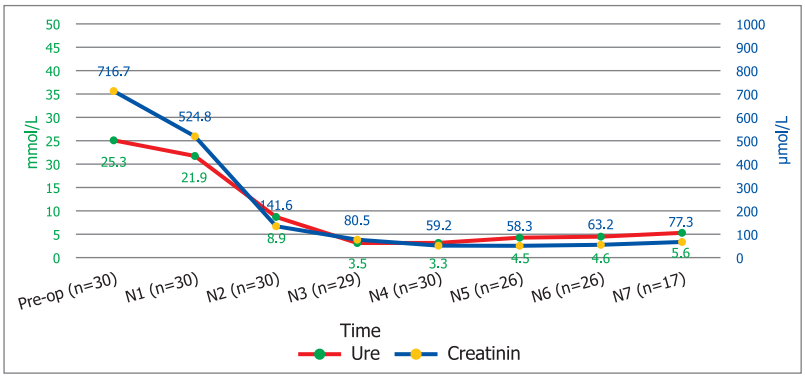
Chart 1. Postoperative urine volume per day (ml/kg/h)



(N decreases gradually due to patients being transferred to other units)

Before surgery, both urea and creatinine levels were high, with medians of 25.3 and 716.7 mmol/l, respectively. After the third day, there was a decreasing trend in urea and creatinine levels, approaching normal values with medians of 3.5 and 80.5, respectively. Electrolyte concentrations, including potassium and sodium, showed minimal variation throughout the monitoring period. Fluid output decreased gradually each day and ceased by the 7th postoperative day.

Chart 2. Median blood urea and creatinine levels before and after surgery



In this study, no patient mortality was recorded during the recovery phase, with a general complication rate of 30%. The most common surgical complications were gross hematuria (26.7%) and postoperative bleeding (13.3%). The most frequent internal complication was urinary tract infection (10%). There were no cases of acute graft rejection, but delayed graft function and renal artery stenosis were observed in only one patient case.

Table 4. Early complications in the postoperative pecovery phase

Complications	Frequency (percentage %)
Gross hematuria	8 (26.7)
Postoperative bleeding	4 (13.3)
Urinary tract infection	3 (10)
Sepsis	1 (3.3)
Pneumonia	1 (3.3)
Delayed graft function	1 (3.3)
Renal artery stenosis	1 (3.3)
Renal vein thrombosis	0 (0)
Ureteral obstruction	0 (0)
Urinary leakage	0 (0)
Lymphatic leakage	0 (0)
Acute rejection	0 (0)
CNI nephrotoxicity	0 (0)
Wound infection	0 (0)

IV. DISCUSSION

In our study, the ages of patients ranged from 5 to 16 years, with an average weight of 28 ± 10 kg. The age and weight of the children significantly influenced the increase in complications and affected the postoperative recovery process in various aspects, particularly concerning fluid control, electrolyte balance, and directly related to the vascular anastomosis technique. The lowest weight recorded among the patients in our study was 13 kg.

All post-kidney transplant patients in our study only used postoperative analgesia. Consequently, the mechanical ventilation duration for these patients was notably short, with a median ventilation time of 6.1 hours. Only one patient in this study required reintubation due to delayed graft function, leading to fluid overload, pneumonia and sepsis.

Hypertension can occur in various stages following kidney transplant, each stage having multiple contributing factors. Our study recorded hypertension in 73.3% of patients, similar to reported rates in other pediatric studies showing hypertension in 58–89% of children [1,2]. Early postoperative hypertension is often due to the side effects of immunosuppressive drugs (especially corticosteroids), as all patients in our study received corticosteroids during and after surgery. Most hypertensive patients required antihypertensive drugs such as Loxen (63.3%) and amlodipine (10%). We refrained from using the group of agents that inhibit renin-angiotensin due to the ongoing debate regarding their effectiveness and side effects, especially in the absence of a defined cause of renal artery constriction, in controlling blood pressure in post-kidney transplant patients during the recovery phase. Low blood pressure during and after surgery contributes to adverse effects on the graft kidney, reducing renal blood flow and graft function. Hence, to ensure adequate renal perfusion, we maintained a high CVP (10-20 cmHg) and higher arterial blood pressure compared to age (+1SD) [3]. Therefore, we often employed vasodilator medications and increased cardiac contractility to elevate arterial blood pressure above +1SD compared to age. Among these, Dopamine was our initial choice (accounting for 53.3%), given its impact on the dopaminergic system, thereby enhancing renal perfusion.

Postoperative polyuria after kidney transplant is a common occurrence. The median urine volume in the first 24 hours was 12.9 ml/kg/h, reaching a maximum of 32.2 ml/kg/h. Polyuria can persist for up to 17 days in some patients. These findings align with Nguyen Minh Tuan's study (2020) on adult kidney transplant recipients [4]. Therefore, monitoring urine volume, appropriate fluid replacement, and adjusting electrolyte disturbances during this phase are necessary. Alongside polyuria, clinical markers reflecting renal function, such as urea, creatinine, and electrolyte concentrations, tended to stabilize after approximately 3 days. We did not observe any significantly severe electrolyte imbalances. This reflects the early recovery of blood filtration function and the regulatory capacity of the transplanted kidney for electrolytes post-surgery. Currently, kidney transplant patients at the National Children's Hospital adhere to the monitoring and treatment protocols established by the Intensive Care Department of the hospital's Surgical Department. Daily monitoring of kidney function, electrolytes, and urine output is a standard practice, especially in the initial days of the recovery phase.

In our study, the postoperative phase recorded a 30% incidence of early complications, without any reported cases of mortality. Extrarenal complications predominated, with bleeding and hematuria being the most prevalent. This rate was higher than some domestic reports in adult patients, where a study by Nguyen Minh Tuan (2020) noted an overall complication rate of 20%, including vascular complications in 7/84 cases [4]. Our findings also indicated a higher complication rate compared to certain reports in pediatric patients, such as those by Oliver in Germany, where the overall complication rate after surgery was 15.4%, with 6.8% vascular complications and 4.5% bleeding [5], similar to

the findings reported by Jin Kim in Canada [6]. We observed one case (3.3%) of renal artery stenosis. Post-kidney transplant reports in adults at Hospital 115 reported a potential renal artery stenosis rate of up to 12.2% (4/33 patients) [7]. In children, Giulia reported a renal artery stenosis detection rate of 4.6% via Doppler ultrasound in a retrospective study of 216 transplanted children in Italy [8]. Author Fontaine also reported a renal artery stenosis rate of 9.7% among 715 transplanted children in France, with a need for renal vein intervention at 31.9% [9]. Overall, the incidence of renal artery stenosis in children is lower than in reports for adults, attributed to reduced endothelial damage (arterial intimal fibrosis) in children compared to adults. In younger children, due to smaller vessel sizes, multiple factors can contribute to renal artery stenosis in acute stages, such as organizational edema, anastomotic stenosis, etc. In our study, the diagnosed case of renal artery stenosis was a 10-year-old male. Post-surgery, the child developed hypertension managed with amlodipine. Doppler ultrasound and resistive index (RI) measurement two days after surgery revealed renal artery stenosis with increased resistance at the stenotic site, suspected due to organizational edema. A reassessment of the transplanted kidney's vasculature two days later showed good flow through the renal artery.

Delayed graft function has been reported by various authors with rates ranging from 2-70%, primarily due to inconsistent definitions of delayed graft function across studies [10]. We only observed one patient with delayed graft function, a 13-year-old boy, following kidney transplant surgery. His post-transplant urine output was low (2.2 ml/kg/h in the first 3 days), with fluid overload and no reduction in urea and creatinine levels in the initial 3 days after transplantation. A kidney biopsy on the fourth day revealed acute tubular necrosis without signs of graft rejection. After six days of dialysis, the graft function improved, and the patient stabilized, successfully extubated after 8 days and discharged later in stable condition. Post-transplant ultrasound did not reveal any abnormalities at the site.

In our study, we did not observe any graft rejection complications, possibly due to the use of immunosuppressive medications. All patients received immunosuppressive drugs, including Cellcept and Corticosteroids, combined with either Tacrolimus, Basiliximab, or Cyclosporin A. The goal of using these immunosuppressive medications was to prevent graft rejection while minimizing potential drug side effects. However, there is still a lack of optimized immunosuppressive protocols specifically tailored for pediatric patients.

V. CONCLUSION

Kidney transplant surgery yields favorable outcomes during the recovery phase. However, the rate of complications remains high. Close monitoring of hemodynamics, fluid balance, correction of electrolyte imbalances, and early detection of surgical complications are necessary.

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