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Case report

Post-Transplant Paradoxes: A Complex Case of Kidney Transplantation and Insights on Managing Chronic Kidney Disease

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Abstract

Introduction. Diabetes, hypertension, or genetic predispositions often cause chronic kidney disease (CKD), which is characterized by a persistent decline in renal function. As CKD develops through five stages, i.e. from a moderate impairment to an end-stage renal failure, a prompt treatment becomes critical. Kidney transplantation is frequently the recommended treatment for individuals with end-stage renal disease, since it provides a better long-term survival and quality of life compared to dialysis. Despite breakthroughs in transplantation and immunology, complications continue to pose substantial hurdles.

Case report. This case report details the clinical progression of a 55-year-old male patient who underwent a living donor kidney transplant. Serious complications with the kidney graft, such as renal vein rupture and hematoma, necessitated rapid revision and a graft implantation during surgery. The patient had hemodynamic instability, requiring hemodialysis and inotropic support. Despite many challenges, we explanted the graft and the routine monitoring revealed no cytotoxic HLA antibodies. Unexpectedly, the patient restored his kidney function, which ultimately led to his release into a stable condition.

The discussion underscores the critical importance of a holistic and multidisciplinary approach in kidney transplantation. Preoperative optimization and careful intraoperative management are key factors for risks reducetion, while regional anesthesia plays a significant role in enhancing patient comfort and outcomes. The paper further highlights the complex, multifactorial nature of post-transplant complications.

Conclusion. This paper reinforces the need for a comprehensive, multidisciplinary approach to kidney transplantation, with particular attention to the unique importance of living donor grafts, ultimately leading to enhanced patient survival and quality of life.

Key words: chronic kidney disease, complications, end-stage renal disease, kidney transplantation

Introduction

The kidneys become damaged and unable to filter blood properly when you have chronic kidney disease (CKD). Diabetes, high blood pressure, heart disease, and a family history of renal failure are the leading causes of kidney disease [1].

CKD, commonly known as chronic kidney failure, causes a progressive decrease in kidney function. Advanced CKD can cause harmful levels of fluid, electrolytes, and waste products to accumulate in your body. In the early stages of CKD, we may have only minimal signs or symptoms [2].

This condition is commonly associated with aging. It can affect anybody; however, it is more frequent in those who are black or of South Asian descent. CKD can worsen with time, and the kidneys may finally quit functioning completely, but this is unusual. Many people with CKD can live their long life [3].

CKD progresses in five phases. The phases are dependent on kidneys' ability to filter waste products from the blood. Blood and urine testing is essential to establish the current stage of CKD. The phases progress from a very mild (stage 1) to renal failure (stage 5). Healthcare practitioners use the glomerular filtration rate (GFR) to estimate the stage of the kidney function [4].

CKD affects approximately 34% of people aged 65 and over, compared to 12% of those aged 45 to 64 years, and 6% of people aged 18 to 44 years. Furthermore, females are somewhat more likely than males to develop CKD (14% vs. 12%) [5].

Routinely the GFR is measured to assess kidney function, and urine albumin measured to detect protein leakage, while serum creatinine levels were used to determine waste products filtering efficiency. Recognizing the

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cause, symptoms, and diagnostic procedures is critical for treating and minimizing the effects of CKD [6].

Kidney transplantation is considered as best treatment option for those with end-stage renal disease (ESRD). Placing patients with ESRD on a waiting list and subsequently receiving kidney transplantation has a higher long-term survival rate than keeping them on dialysis. Moreover, kidney transplant recipients often have a higher quality of life and a 10-year longevity advantage over dialysis patients. There is a definite survival advantage for kidney transplant patients over those who continue on dialysis [7].

A kidney transplant is frequently regarded as the best treatment for renal failure in people who are found suitable for the operation. The benefits of a successful kidney transplant are significant: most patients have improved lifespan and a higher quality of life since they no longer need dialysis. Many people report increased energy, greater ease of work and travel, less food limitations, and better sexual health and fertility. However, the process is not without risks. A kidney transplant is a complex medical surgery with inherent risks, including bleeding. Infections are also prevalent after transplant, necessitating balanced administration of powerful immunosuppressive drugs to avoid organ rejection, with the use of potent antibiotics for their treatment. Patients may need further procedures to treat problems, and while rare, there is a danger that the transplanted kidney may not work well or that renal disease will reappear in the new organ [8].

This paper presents a comprehensive overview of CKD and transplantation throughout our case presentation. However, it also identifies some significant research gaps that require additional investigation. Finally, our report could benefit from a greater emphasis on patient-centered treatment, including the psychological effects and quality of life for transplant patients, as well as the management of a delayed graft function, which currently lacks established guidelines. Addressing these gaps might help us better understand and treat CKD and its consequences.

Case Presentation

Hospitalization for left kidney transplantation was necessary for a 55-year-old male patient with CKD who had reached ESRD. Because kidney transplantation is a specific surgical procedure for both the donor and recipient, careful anesthesia preparation is required to ensure patient safety and good graft function. Preoperative optimization is the process of identifying and managing risks in order to reduce perioperative problems.

The living donor was his mother 78 years old in a good clinical condition and without any known medical history. Independent HLA antibody testing revealed that there were no cytotoxic HLA antibodies against the donor antigens. The recipient on the other hand had DM type I and hemoglobin levels between 9-10 g/dl, and erythropoiesis-stimulating medications were used to address the anemia. The primary goals of intraoperative management were hemodynamic monitorring, intravascular volume maintenance, and judicious anesthetic method selection. Furthermore, we kept the mean arterial pressure between 80 and 110 mmHg. Additionally, we carefully monitored perioperative glucose control due to the administration of high-dose (500 mg) metilprednisolon as an imunosupressant and Manitol 25% for osmotic diuresis. We administered short-acting opioid remifentanil in dose of 0.025 mcg/kg/min and propofol 0.5mg/kg/min intravenously to manage anesthesia together with a single shot erector spine block ultrasound guided. The avoidance of postoperative delirium was helping patients to fully recover.

Collaboration between surgical teams, anesthesiologists, and healthcare providers is critical for effective kidney transplantation results. Our case was very specific, since during the surgery, substantial complications occurred, including bleeding and spontaneous renal vein rupture outside the place of anastomosis. The patient underwent immediate revision of the graft, resecting the renal vein and placing a prosthetic graft. After the surgery, the patient was fully awaken and prepared for transfer outside the operating room. We noticed abrupt bleeding, hemorrhagic shock, and complete deteriorization of the patient when we placed the drain on the bed.

The patient had hypotension (blood pressure of 60/40 mmHg), bradycardia (heart rate of 42 bpm), and steady oxygen saturation (SaO2 of 98%). Upon his unresponsiveness, we initiated immediate treatment with reintubation, inotropic support, and blood products transfusion (with depleted erythrocytes and fresh frozen plasma). Reopening the surgical wound revealed a new vein rupture unrelated to the previous one. New graft was placed but unfortunately, it appeared without sufficient perfusion of the new kidney. Patient stayed in operation theater for 8 hours, but unfortunately the treatment was not successful; the graft was not saved, and explantation was performed.

Following surgery, he had hemodialysis via femoral venous catheter, effectively eliminating 3 liters of fluid. During his stay at the hospital corticosteroid therapy was continued to avoid rebound effect due to high doses used pre- and intraoperatively. Furthermore, we noticed he improved his diuresis. We followed up with complete laboratory tests every day after the surgery, shown in Table 1.

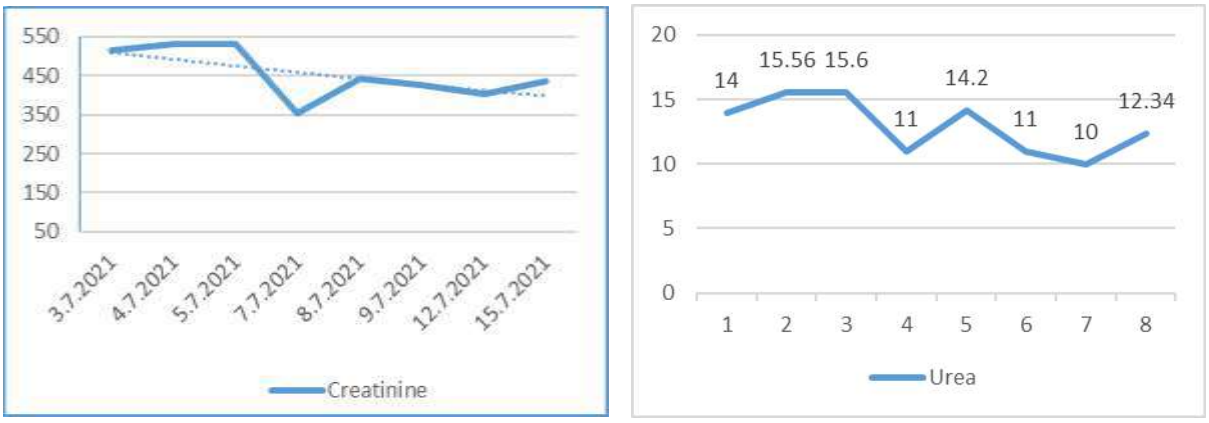

Fig. 1. Creatinine and Urea Levels

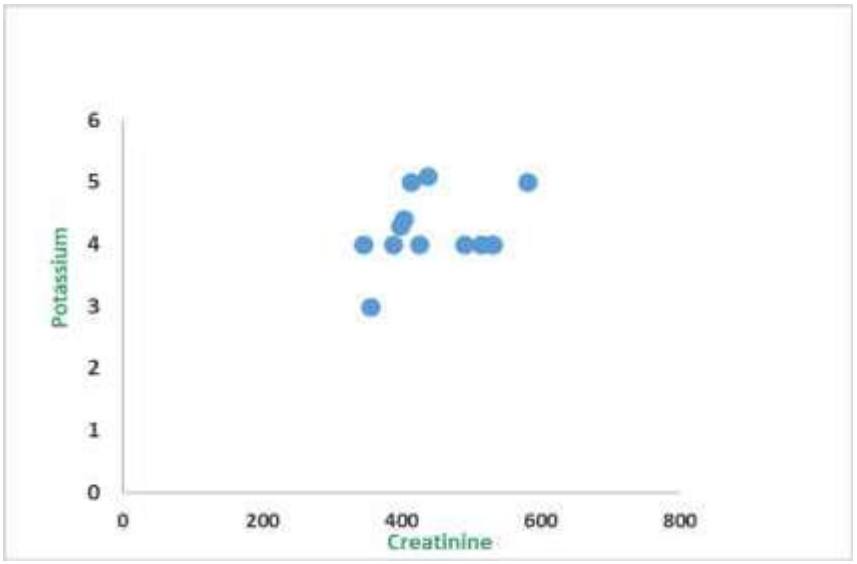

Fig. 2. Relationship Between Creatinine and Potassium Levels in Patient Observations

Our patient's test results showed insufficient but still present renal function. Creatinine levels (514, 531, 530, 355, 444, 425, 403, 436) are substantially higher than normal (Figure 1), which ranges between 45-109 μmol/L depending on age, gender, and muscle mass. The elevation shows that the kidneys are not filtering adequately, which might indicate renal failure or injury. In contrast, the urea levels (14, 15.56, 15.6, 11, 14.2, 11, 10, 12.34) are often within or slightly over the normal range of 4-9 mmol/L. While higher urea (Figure 1) might indicate dehydration, excessive protein consumption, or compromised kidney function, these values are less alarming than creatinine. As additional assessments, urin analyses were done, which were required to further assess kidney function and discover any underlying problems (Table 1).

Table 1. Lab reports during hospitalizations

	03.7	**04.7**	**05.7**	**06.7**	**07.7**	**08.7**	**09.7**	**10.7**	**12.7**	**13.7**	**15.7**
RBC	3.01	3.20	3.16	3.04	2.59	3.29	3.08	3.45	3.21	3.17	3.28
HBG	94	101	98	96	81	98	97	105	98	98	93
MCV	86.4	87.6	88.9	86.2	87.1	88	87.4	90	90	87.1	89.6
Albumins	29.12	33.3	29	30	23.6	28	29	31.5	28	29	35
Total Proteins	44.99	51.5	50	50	38.1	51	49	54	53	56	60.4
CRP	59.63	71.33	81.0	63.1	36.1	44.6	27	21	14.3	15.7	75.9
LDH	190.48	219.48	196	237	210	236	231	226	204	210	223
AP	53.14	67.84	62	72	78	104	111	120	97	98	112
Glucose	6.4	7.14	6.69	7.16	5.48	6.78	5.28	x	4.31	4.72	6.3

*(RBC-red blood cells normal ranges 4,20-5,50 10*12\L, HGB-hemoglobin 120-180 g\L, MCV- mean corpuscular volume 82.9-98.0 fL, Albumines 35-50 g\L, Total Proteines – 63-83 g\L, CRP - 0-6 mg\L, LDH-lactate dehydrogenase borderline 248 U\L, AP-alkaline phosphatases 36-126 U\L, Glucose 3.5-6.1 mmol\l)

Based on the creatinine values, we created a scatter plot to see if the changes in creatinine levels affected potassium levels. The data revealed variable creatinine levels, beginning with 580 on June 28, 2021, and varying between 388 and 437 in the following weeks. Potassium levels were very consistent, primarily around 4, with slight variations up to 5 and a drop to 3 on July 7. The scatter plot revealed no clear correlation (Figure 2) between creatinine and potassium levels, indicating that fluctuations in creatinine did not significantly impact potassium levels. The patient's general health gradually improved, resulting in his hospital discharge in stable condition and receiving appropriate follow-up treatment.

Discussion

To the best of our knowledge, this case represents the first reported instance of its kind. General anesthesia (GA) with total intravenous drugs metabolized through the liver, rather than the kidneys, was employed in our case, along with an erector spinae block under ultrasound guidance using bupivacaine. This approach was chosen due to the surgeons' use of heparin, making spinal anesthesia unsuitable for our patient. While local anesthetics are widely used across medical specialties-including catheter insertions, fistula and graft operations, and kidney transplants-their application in patients with renal impairment is less documented. However, studies demonstrate minimal toxicity and excellent outcomes when local anesthetics like bupivacaine are used during kidney transplantation [9].

Due to a lack of resources and personnel in our resource-constrained centers, prolonged mechanical ventilation after surgery is not an option for patients. The ICU is the only place where this is possible, and it poses a significant risk to immunocompromised patients. Our surgical team prefers intraoperative heparin use over neuroaxial anesthesia for our patients. However, despite the long-standing preference for an epidural catheter, several patients have experienced prolonged bleeding at the catheter site, leading us to avoid its use. That's why the new regional plexus blocks under ultrasound are an excellent option for patients undergoing transplantation and provide long lasting analgesia for up to 12 hours [10-12].

Kidney transplant recipients are at significant risk of requiring dialysis and experiencing increased mortality. While advances in immunosuppression have improved certain outcomes, the slow progress of new treatments emphasizes the necessity of addressing modifiable non-allogeneic risk factors for better long-term outcomes. The quality of the allograft and the immune response of the recipient are controlled by HLA matching and donor-specific antibodies, respectively. In general, these factors determine how long the graft may last. Donor and recipient ages, glomerular disease recurrence, dialysis duration, and pre-existing cardiovascular problems are all influencing outcomes. Despite their importance for patient health, traditional risk factors like hypertension, proteinuria, anemia, dyslipidemia, diabetes, and bone mineral abnormalities often receive less attention than immunity [13]. Regretfully, in our instance, the cause was most likely a poor-quality graft and blood vessels rather than an acute rejection. Even more importantly, it was a pathological defect outside of the anastomosis site.

In a year-long study conducted on 40 kidney transplant patients indicators of post-transplant problems were evaluated. The researchers discovered that recipients had a substantially lower mean age than their donors, who were mostly females. Majority of patients had been on dialysis for an average of 18.1 months before transplantation. Common problems were hypertension, proteinuria, and chronic rejection, with a high mortality rate of six patients dying, mostly from surgical complications. A history of diabetes mellitus, higher pre-transplant blood urea nitrogen (BUN) and createnine levels, recipient age, and higher low-density lipoprotein (LDL) values have all significantly predicted complications. Surprisingly, increased pre-transplant parathyroid hormone (PTH) levels were associated with a minor protective benefit against problems. These data highlight the crucial role of addressing modifiable risk factors in the post-transplant period in improving patient outcomes and reducing complications. The study emphasized the need for more research to develop comprehensive strategies for enhancing care in kidney transplant recipients [14]. Our patient was on dialysis before surgery for only 8 months.

Acute tubular necrosis (ATN) can develop following kidney transplantation, resulting in delayed graft function, in which the transplanted kidney does not generate urine right away. This condition can result from a variety of circumstances, including donor-related concerns such as a low blood pressure during CPR or prolonged kidney storage following removal. As there is no particular therapy for ATN, individuals may require dialysis for a few weeks up to three months whereas most often their kidney function recovers. If creatinine levels remain high with no meaningful decrease, a biopsy may be required to rule out rejection. In rare circumstances, primary non-function occurs when the transplanted kidney never starts working, necessitating its removal and urgent dialysis following surgery. We assume that the patient recovered his kidney function due to an immunological underlying condition and high doses of metilprednisolon administered the day before and on the day of surgery.

Despite this, patients may still be considered for re-transplantation. Furthermore, infections are a persistent concern to transplant recipients due to immunosuppressive medicines, necessitating preventive antibiotics during the first several months. Dehydration is

another issue; whereas dialysis patients previously limited fluid consumption, working kidneys require appropriate water to keep creatinine levels from increasing, especially during a warmer weather. Urine leaks can also occur if the ureter, which drains urine from the kidney to the bladder, becomes disconnected owing to high bladder fullness before healing. This disease usually necessitates surgery to reattach the ureter. After transplantation, monitoring fluid intake and urine frequency is critical for avoiding bladder function issues [15].

Researchers have linked surgical site problems to lower transplant survival and recipient mortality. Furthermore, surgical site infections cause 2.5% of post-transplant rehospitalizations, and patients with these infections are more likely to require a second surgery than those without [16].

Researchers at Qilu Hospital in China looked into the wound-related issues in 118 kidney transplant recipients. The study discovered many significant risk variables, including age over 50, comorbidities, and living donor transplants. The most prevalent complications were delayed wound healing (21.2%) and infections (16.9%), with medications successfully treating infections. There were no significant relationships between problems, gender, BMI, or previous transplants. The findings highlight the need for personalized post-operative treatment in reducing complications and improving patient outcomes [17]. Although guidelines recommend broad spectrum antimicrobial therapy single dose peri-operative still in our country therapy continues during whole hospitalization [18].

According to the current literature and European guidelines, Hand-Assisted Laparoscopic Live Donor Nephrectomy (HALDN) is the preferred method for donor kidney explantation. At our hospital, we began performing HALDN in 2018 and published our initial findings, comparing HALDN with standard open nephrectomy. Our findings confirm that HALDN is a safe and effective minimally invasive procedure, yielding optimal outcomes for both donors and recipients, while emphasizing donor safety and the altruistic nature of live kidney donation. In the example we are presenting, the patient's mother, the donor, underwent HALDN. The graft had warm ischemia time of 1 minute and 25 seconds and a cold ischemia time of 120 minutes. She recovered completely and was released from the hospital five days after the procedure [19].

Conclusion

This case study sheds light on the difficulties and consequences that come with kidney transplantation for people with CKD. Even with significant advancements in immunosuppressive and transplantation techniques, issues and complications sometimes arise. Improving patient outcomes depends on treating these issues effectively, which includes meticulous preoperative optimization and specialized postoperative care. The graft function and general quality of life of transplant patients can be enhanced by highlighting the importance of interdisciplinary approaches. The long-term success of kidney transplantation depends on ongoing assessment and control of modifiable risk factors, particularly as the prevalence of CKD rises.

Conflict of interest statement. None declared.

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