

Complications After Kidney Transplantation

Editor

Mutlu DEĞER



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ISBN 978-625-362-092-9	Page and Cover Design Typesetting and Cover Design by Akademisyen
Book Title Complications After Kidney Transplantation	Publisher Certificate Number 47518
Editor Mutlu DEĞER ORCID iD: 0000-0002-8357-5744	Printing and Binding Vadi Printingpress
Publishing Coordinator Yasin DİLMEN	Bisac Code MED088000
	DOI 10.37609/akya.4215

Library ID Card
Complications After Kidney Transplantation / ed. Mutlu Değer.
Ankara : Akademisyen Yayınevi Kitabevi, 2026.
385 p. : figure. ; 160x235 mm.
Includes References.
ISBN 9786253620929

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Chapter 1

IMMUNOSUPPRESSIVE DRUGS USED IN KIDNEY TRANSPLANTATION

Bulent KAYA¹

Abstract

Kidney transplantation is the preferred treatment for end-stage kidney disease, and its success relies on the effective use of immunosuppressive therapy. This review summarizes current approaches to induction and maintenance immunosuppression, with a focus on risk-based treatment strategies.

Induction therapy includes lymphocyte-depleting agents such as antithymocyte globulin and alemtuzumab, as well as non-depleting agents like basiliximab, selected according to immunological risk. Maintenance regimens are primarily based on calcineurin inhibitors, antiproliferative agents, and corticosteroids. Key determinants of therapy selection include human leukocyte antigen mismatch, panel reactive antibody levels, and donor-specific antibodies.

Therapeutic drug monitoring is essential for optimizing immunosuppressive efficacy and minimizing toxicity. While potent agents improve rejection prevention in high-risk patients, they are associated with increased risks of infection and malignancy.

In summary, modern immunosuppressive management in kidney transplantation is based on individualized risk assessment and careful balancing of efficacy and safety to achieve optimal graft and patient outcomes.

Keywords: kidney transplantation, immunosuppression, induction therapy, maintenance therapy , therapeutic drug monitoring

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While potent lymphocyte-depleting agents such as ATG and alemtuzumab provide effective rejection prophylaxis in high-risk recipients, their use is limited by increased susceptibility to infections and malignancies. Conversely, non-depleting agents like basiliximab offer a safer alternative in low-risk populations, underscoring the importance of appropriate patient stratification.

Maintenance therapy based on CNI, antiproliferative agents, and corticosteroids remains the backbone of long-term management; however, drug-related toxicity and long-term complications continue to pose significant challenges. In this context, TDM has become indispensable for optimizing therapeutic exposure and reducing adverse outcomes.

Overall, the success of KT depends not only on preventing acute rejection but also on minimizing long-term complications through careful balancing of immunosuppressive intensity. Future strategies should focus on refining personalized treatment algorithms to improve both graft longevity and patient survival.

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Chapter 2

ACUTE REJECTION IN KIDNEY TRANSPLANTATION

Bulent KAYA¹

Abstract

Acute rejection remains a major threat to kidney allograft survival despite substantial advances in immunosuppressive therapy. The incidence of acute rejection has markedly declined over the past three decades; however, it continues to contribute significantly to graft dysfunction and loss. The two principal forms of acute rejection are T cell-mediated rejection (TCMR) and antibody-mediated rejection (ABMR). TCMR is characterized by lymphocytic infiltration and tubular injury, whereas ABMR results from donor-specific antibody-mediated endothelial injury and is associated with microvascular inflammation, C4d deposition, and transplant glomerulopathy. Mixed rejection may also occur and is associated with worse outcomes. ABMR is now recognized as the leading cause of late graft loss, while TCMR remains an important independent risk factor and may precipitate antibody-mediated injury. Diagnosis is based on histopathologic evaluation of kidney allograft biopsy, and treatment depends on the rejection phenotype and severity. Standard therapies include glucocorticoids, antithymocyte globulin, plasmapheresis, and intravenous immunoglobulin. Optimal prevention relies on adequate immunosuppression, medication adherence, and careful donor-recipient matching. Emerging molecular diagnostics and novel targeted therapies may improve future rejection management.

Keywords: kidney transplantation, acute rejection, antibody-mediated rejection, t cell-mediated rejection, donor-specific antibodies

INTRODUCTION

Kidney transplantation is the most effective treatment for patients with end-stage kidney disease. With advances in modern immunosuppressive therapy, short-

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immunological mechanisms, clinical course, histopathological features, and treatment strategies; therefore, accurate diagnosis based on biopsy, donor-specific antibody assessment, and emerging molecular tools is essential. Early recognition, individualized immunosuppressive management, medication adherence, and careful immunologic risk assessment are central to preserving graft function. Although current therapies have improved short-term outcomes, long-term graft survival continues to be limited by persistent immune-mediated injury. Future advances in molecular diagnostics, biomarker-guided monitoring, and targeted therapies may provide more precise and effective approaches to the prevention and treatment of acute rejection.

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Chapter 3

INFECTIONS AND PROPHYLAXIS FOLLOWING KIDNEY TRANSPLANTATION

Damla ERTURK¹

Abstract

Although kidney transplantation is one of the most effective treatment options for end-stage renal disease, infections in the post transplant period are among the primary complications that determine patient and graft outcomes. The incidence and spectrum of these infections vary depending on surgical complications, allograft function, the intensity of the immunosuppressive regimen used, and prophylactic measures. In the early period, surgical site infections, catheter and catheter related infections, and hospital acquired bacterial infections are predominant, while opportunistic pathogens such as cytomegalovirus (CMV), BK polyomavirus, and *Pneumocystis jirovecii* become more prominent within the first 6 months. In the late phase, community-acquired infections predominate; however, the risk of opportunistic infections persists in patients receiving intensive or repeated immunosuppression. Urinary tract infections are the most common group of infections in kidney transplant recipients and are particularly associated with graft dysfunction, bacteremia, and hospitalization in the early phase. Although fungal infections are less common, they require early diagnosis and appropriate antifungal treatment due to their high mortality rate. Prophylactic and preemptive strategies play a critical role in the management of these infections, which directly impact both patient and graft survival. In this section, post-kidney transplant infections are addressed within a time-based framework; their clinical characteristics, diagnostic approach, treatment principles, and current prophylaxis strategies are summarized.

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Successful management requires evaluating a time based approach in conjunction with the patient's current immunosuppression status, implementing structured viral monitoring programs, rational antimicrobial use, and multidisciplinary collaboration. Through appropriate prophylaxis, early diagnosis, and rapid, targeted treatment, both the infection burden and graft loss due to infection can be significantly reduced.

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Chapter 4

EARLY POSTOPERATIVE SURGICAL COMPLICATIONS AFTER KIDNEY TRANSPLANTATION

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ABSTRACT

Kidney transplantation is the most ideal treatment method for end-stage renal disease; however, early surgical complications developing within the first 30 to 90 days postoperatively remain a significant threat to graft and patient survival. This chapter reviews the incidence, pathophysiology, diagnosis, and management of major early urological and surgical complications, including ureteral strictures, urinary leaks, ureteral necrosis, and perigraft collections (hematomas, urinomas, lymphoceles, and abscesses). Ischemia, primarily due to the disruption of the “golden triangle” blood supply, and the presence of multiple arteries in the donor are the main risk factors for ureteral complications. The early diagnostic process relies heavily on ultrasonography, biochemical fluid analysis, and targeted radiological imaging. Treatment strategies emphasize the critical role of prompt intervention, ranging from percutaneous drainage and endoscopic procedures to early surgical revision. Furthermore, the advantages and disadvantages of routine prophylactic Double-J stent placement are discussed, highlighting its protective role against strictures and leaks when properly managed alongside the risk of infection. In conclusion, a multidisciplinary approach involving nephrology, transplant surgery, and interventional radiology ensures the successful management of these early complications, achieving long-term graft survival rates similar to those of uncomplicated transplants.

Keywords: kidney transplantation; early postoperative complications; ureteral stricture; urinary leak; lymphocele; urinoma.

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complication is accompanied by a perigraft hematoma or a severe infection, the risk of early graft loss significantly increases. Furthermore, the severity of the complications developing in the first 30 days post-transplant deeply affects the clinical course; while high-grade (Clavien Grade 3-4) surgical complications increase hospital readmission rates, even low-grade complications can elevate the risk of death with a functional graft in the long term. Although these conditions requiring early hospitalization negatively affect graft functions within the first year, their long-term effects remain limited.

Thoroughly analyzing the recipient and donor-related factors in the development of complications is of great importance. The presence of multiple arteries in the donor kidney and the use of expanded criteria donors (ECD) stand out as independent factors that elevate the risk of vascular and urological complications by increasing the probability of the graft remaining ischemic. On the other hand, an older recipient age (60 years and above) does not increase the risk of surgical complications compared to young recipients; when correct patient selection is made, kidney transplantation is a surgically highly safe procedure in patients of advanced age as well. However, additional factors such as diabetes, a high body mass index, and prior dialysis duration create extra risks in terms of both wound site and infectious complications.

Finally; minimizing the incidence and destructive effects of early surgical complications relies on the meticulous preservation of the donor graft's distal ureteral blood supply, called the "golden triangle," uncompromising adherence to surgical principles, and the routine use of prophylactic Double-J stents for anastomosis safety. In the post-transplant period, it is of vital importance for the nephrology, transplant surgery, and interventional radiology teams to work in coordination so that complications can be treated in a timely manner without leading to graft loss.

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Chapter 5

POST-TRANSPLANT VASCULAR COMPLICATIONS IN KIDNEY TRANSPLANT RECIPIENTS

Onur BENLİ¹

Abstract

Vascular complications after kidney transplantation are relatively uncommon but may have a major impact on graft survival and patient morbidity. These complications involve the graft arterial inflow, graft venous outflow, or recipient iliac vessels, and may present in the early or late post-transplant period. Their mechanisms are multifactorial and commonly reflect varying contributions of vessel wall injury, disturbed flow, and thrombotic predisposition. Among them, transplant renal artery stenosis is the most frequent vascular complication and is often amenable to endovascular or surgical treatment, whereas arterial and venous thrombosis remain major causes of early graft loss. Biopsy-related arteriovenous fistulae and intrarenal pseudoaneurysms are usually benign but may require intervention in selected patients. Mechanical lesions such as arterial kinking, venous compression, and iliac vessel pathology should also be recognized, as delayed diagnosis may result in irreversible graft injury. This chapter reviews the classification, mechanisms, risk determinants, clinical presentation, imaging findings, and treatment principles of the major vascular complications after kidney transplantation, with emphasis on practical diagnostic reasoning and timely management.

Keywords: kidney transplantation; vascular complications; transplant renal artery stenosis; renal vein thrombosis; arteriovenous fistula; pseudoaneurysm.

INTRODUCTION

Kidney transplantation is the preferred treatment for patients with end-stage renal disease. Despite advances in surgical techniques, immunosuppressive therapy, and

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CONCLUSION

Although vascular complications after kidney transplantation may appear uncommon, their clinical impact is disproportionately large. Among these complications, TRAS is often recognized after the immediate postoperative period and is frequently treatable, whereas arterial and venous thrombosis remain among the leading causes of early graft loss. Although post-biopsy AVF and intrarenal pseudoaneurysm more often follow a benign course, they require intervention in selected patients. Iliac vessel complications, because of their effects on both graft and extremity circulation, should be assessed carefully, especially in recipients with atherosclerotic disease.

From a practical standpoint, the fundamental principle is to consider vascular complications early in the setting of sudden graft dysfunction and to use Doppler ultrasonography without delay. Delay between diagnosis and treatment, particularly in thrombotic complications, may lead to irreversible graft loss. In contrast, in clinically significant stenotic or procedure-related lesions, timely endovascular or surgical intervention may preserve graft function.

Therefore, in post-transplant follow-up, a high index of suspicion for vascular complications, a standardized imaging approach, and close collaboration between surgical and endovascular teams are essential to preserving graft function.

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Chapter 6

WOUND, SOFT TISSUE AND RECONSTRUCTIVE COMPLICATIONS AFTER KIDNEY TRANSPLANTATION

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Abstract

Wound-related, soft tissue, and reconstructive complications remain important causes of morbidity after kidney transplantation despite advances in surgical technique, perioperative care, and immunosuppressive therapy. Common complications include surgical site infection, hematoma, seroma, lymphocele, wound dehiscence, skin necrosis, and incisional hernia. Kidney transplant recipients are particularly vulnerable because diabetes mellitus, obesity, malnutrition, vascular disease, and chronic immunosuppression may impair wound healing.

Early recognition is essential, as delayed diagnosis may lead to deep infection, graft dysfunction, prolonged hospitalization, repeated operations, or complex abdominal wall defects. Clinical evaluation should be supported by laboratory studies and imaging, with ultrasonography serving as the first-line modality for perigraft collections. Management ranges from conservative wound care and targeted antimicrobial therapy to drainage procedures, operative debridement, fascial repair, and reconstructive surgery.

Reconstructive options include delayed closure, skin grafting, local or regional flaps, mesh reinforcement, and abdominal wall reconstruction in selected cases. Negative pressure wound therapy is a useful adjunct in both treatment and staged reconstruction. Optimal outcomes depend on timely intervention and a multidisciplinary approach involving transplant surgeons, nephrologists, infectious disease specialists, radiologists, and reconstructive surgeons.

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delayed recognition may result in deep infection, graft dysfunction, prolonged hospitalization, repeated operations, or complex abdominal wall defects.

Successful management depends on early diagnosis, accurate differentiation of fluid collections and infectious processes, prompt control of local pathology, and optimization of systemic factors that impair healing. Because transplant recipients frequently present with diabetes, obesity, vascular disease, malnutrition, and chronic immunosuppression, treatment strategies must be individualized rather than extrapolated from routine general surgical patients.

Reconstructive surgery has an important role in selected cases, ranging from delayed closure and skin grafting to flap coverage and formal abdominal wall reconstruction. Early involvement of reconstructive surgeons may simplify management, reduce morbidity, and improve functional outcomes in complex wounds.

Ultimately, the best results are achieved through a multidisciplinary approach involving transplant surgeons, nephrologists, infectious disease specialists, radiologists, wound care teams, and reconstructive surgeons. As transplant populations become older and medically more complex, continued refinement of preventive strategies, minimally invasive interventions, biomaterials, and personalized immunosuppressive protocols will be essential to further reduce postoperative wound complications and preserve long-term graft success.

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Chapter 7

LATE SURGICAL COMPLICATIONS AFTER KIDNEY TRANSPLANTATION

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Abstract

Late-stage surgical complications affecting long-term graft survival after kidney transplantation typically present with atypical symptoms—such as an increase in creatinine, decreased urine output, or asymptomatic hydronephrosis—rather than classic pain or fever. This is due to the immunosuppressive drugs used by patients and the lack of a neural network (denervation) in the transplanted kidney.

Ureteral strictures, which are among the leading complications and develop due to ischemic injury in most cases, are managed using ultrasonography for diagnosis and the insertion of a percutaneous nephrostomy to preserve kidney function. While endoscopic methods such as lasers or balloons are preferred for strictures shorter than three centimeters, surgical repair (reconstruction) utilizing the patient's own healthy ureter is mandatory for longer and resistant cases.

Stone disease, another significant issue, has a bidirectional relationship with ureteral strictures and infections, and patients do not experience typical kidney stone pain. In the treatment of stones, those smaller than 4 mm are monitored, while depending on the size and location, extracorporeal shock wave lithotripsy (ESWL), retrograde intrarenal surgery (RIRS) performed with flexible ureteroscopes, or percutaneous nephrolithotomy (PCNL) for stones larger than 2 cm are applied.

In these patients, who have an increased risk of cancer due to the suppression of the immune system, macroscopic hematuria (visible blood in the urine) should always be considered a critical early symptom for urothelial carcinoma; cystoscopy and careful imaging that does not put kidney function at risk must be performed. Additionally, it is of vital importance to conduct annual ultrasound screenings

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A forgotten/encrusted stent can lead to stone formation and infection; a stent follow-up protocol (timely removal) can be documented as a quality indicator. In transplant patients who are on immunosuppressive therapy and have a single functioning kidney, forgotten ureteral stents represent a urological problem with highly devastating consequences. The rates of encrustation, stone formation, and fragmentation increase exponentially in stents left in the body for an extended period (e.g., more than 6 months). An encrusted stent leads to obstructive nephropathy, resistant infections, and urosepsis, putting both the graft and the patient's life at risk. Although there are rare cases in the literature of stents forgotten for 13 years that fortunately did not develop encrustation, the removal of encrusted stents generally requires a challenging and multimodal endourological approach combining methods such as ESWL, ureteroscopy (URS), and percutaneous nephrolithotomy (PCNL). To completely prevent such severe morbidities, the clinical implementation of a stent registry and follow-up protocol to ensure the timely removal of stents (typically within 2-4 weeks) should be recognized as a crucial indicator of quality and patient safety.

CONCLUSION

Late surgical complications following kidney transplantation remain a significant clinical challenge that directly impacts long-term graft survival and patient quality of life. Ureteral strictures, stone disease, urological malignancies, and ureteral fistulas/stent-related complications each require a tailored, multidisciplinary approach. The atypical clinical presentation caused by denervation and immunosuppression necessitates a high index of suspicion and strict follow-up protocols. Early diagnosis through ultrasonography, timely decompression, and appropriate endourological or surgical interventions are critical for preserving graft function. Additionally, the elevated cancer risk in immunosuppressed patients mandates lifelong urological surveillance. Implementing institutional stent follow-up registries and adhering to evidence-based guidelines, such as the updated 2026 EAU Guidelines on Renal Transplantation, are essential quality measures to minimize preventable complications and improve overall transplant outcomes.

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Chapter 8

HEMATOLOGICAL COMPLICATIONS AFTER RENAL TRANSPLANTATION

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Abstract

Hematologic complications after renal transplantation are significant clinical issues that can occur in both the early and late post-transplant periods and directly affect patient prognosis. The most common of these complications include anemia, leukopenia, and thrombocytopenia; and their etiology involves surgical blood loss, graft dysfunction, immunosuppressive medications, infections, and nutritional deficiencies. Additionally, more specific conditions such as post-transplant erythrocytosis, post-transplant lymphoproliferative disease, and thrombotic microangiopathy may also be observed. Management focuses on addressing the underlying cause and includes modification of immunosuppression, treatment of infections, and targeted therapies when necessary. This section discusses the pathogenesis, diagnostic approach, and current treatment strategies for hematologic complications that develop after renal transplantation.

Keywords: Renal transplantation, Hematologic complications, Anemia, Immunosuppression, Post-transplant lymphoproliferative disease

INTRODUCTION

After renal transplantation, a wide range of hematologic complications may arise due to both the surgical procedure and the immunosuppressive therapies used to prevent graft rejection. While the most common disorders are post-transplant anemia and erythrocytosis, many hematological disorders, such as post-transplant lymphoproliferative disease and thrombotic microangiopathy, which are rare but associated with increased morbidity and mortality, play a significant role in the management of the post-transplant period. In this section, hematological

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Hemophagocytic Syndrome

Hemophagocytic syndrome is a rare but potentially fatal hematologic disorder that occurs following renal transplantation. The pathogenesis of the disease involves uncontrolled macrophage activation resulting from T/NK cell dysfunction, leading to hyperinflammation associated with a cytokine storm. Patients present to the clinic with fever, hepatosplenomegaly, pancytopenia, lymphadenopathy, rash, jaundice, and neurological symptoms. Post-transplant lymphoproliferative disease and various infections: particularly EBV, as well as CMV, herpes simplex virus, and fungal infections can trigger the development of hemophagocytic syndrome. For diagnosis, the condition should first be considered in patients with suspicious clinical findings, and the diagnosis must be supported by laboratory tests, primarily elevated ferritin levels, as well as elevated triglycerides and low fibrinogen. Both the diagnosis and treatment of the disease require multidisciplinary management.

CONCLUSION

Hematologic complications observed in the post-kidney transplant period are among the leading causes of morbidity and mortality in kidney transplant patients. Early diagnosis and identification of the etiology are of great importance in the treatment of these complications. The effective implementation of appropriate immunosuppressive therapy and infection prevention measures, along with regular monitoring of hematologic side effects, are key factors in reducing the incidence and severity of these complications. Furthermore, collaboration among nephrology, hematology, infectious diseases, and organ transplantation teams is of utmost importance in these patients.

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Chapter 9

CARDIOVASCULAR COMPLICATIONS AFTER KIDNEY TRANSPLANTATION

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ABSTRACT

Cardiovascular disease remains the leading cause of morbidity and mortality in kidney transplant recipients, accounting for 20–30% of all post-transplant deaths and arises from a multifactorial interaction between traditional risk factors — hypertension, dyslipidemia, diabetes mellitus, and smoking — and transplant-specific determinants including immunosuppressive drug toxicity, graft dysfunction, acute rejection, and prolonged pre-transplant dialysis. Immunosuppressive agents drive a distinct pathophysiological cascade — calcineurin inhibitors increase the risk of hypertension and dyslipidemia relative to tacrolimus, corticosteroids promote metabolic syndrome and post-transplant diabetes mellitus, and mTOR inhibitors exacerbate dyslipidemia via PCSK9 upregulation — collectively culminating in accelerated atherosclerosis, coronary artery disease, and de novo heart failure occurring in 10–18% of recipients within 36 months of transplantation. Addressing this burden demands a risk-stratified, multidisciplinary strategy that integrates pretransplant cardiac screening, guideline-directed blood pressure and lipid control, immunosuppression optimisation, and the judicious adoption of emerging cardiorenal therapies — and it is only through dedicated randomised trials in this population that the persistent evidence gap can be closed and the full promise of kidney transplantation realised.

Keywords: kidney transplantation; cardiovascular disease; immunosuppressive therapy; post-transplant hypertension; post-transplant diabetes mellitus; coronary artery disease; heart failure; risk stratification

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hypertriglyceridemia and hypercholesterolemia. Paradoxically, despite their adverse metabolic profile, mTOR inhibitors may exert some anti-atherosclerotic effects by inhibiting intimal proliferation and stabilizing plaques, though their overall impact on cardiovascular events remains complex and requires careful patient selection.

This drug-induced dyslipidemia, often presenting as a more atherogenic profile with small, dense LDL particles susceptible to oxidation, directly contributes to the progression of atherosclerosis. The link between post-transplant cholesterol levels and adverse outcomes is well-established. Early studies identified hypercholesterolemia as an independent predictor of post-transplant vascular disease and a significant factor influencing patient survival. However, management is complicated by drug-drug interactions, as CNIs (especially CsA) can inhibit statin metabolism via the cytochrome P450 system, increasing the risk of myopathy. Therefore, statins like fluvastatin or pravastatin, which have fewer interactions, are often preferred, and careful dose adjustments are necessary.

CONCLUSION

Cardiovascular disease remains the leading cause of death and morbidity after kidney transplantation, driven by traditional risk factors and transplant-specific contributors — most notably immunosuppressive drug toxicity. A risk-stratified, multidisciplinary approach combining pretransplant screening, guideline-directed medical therapy, and individualized immunosuppression remains essential.

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Chapter 10

GASTROINTESTINAL COMPLICATIONS AND PANCREATITIS AFTER KIDNEY TRANSPLANTATION

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Abstract

Gastrointestinal complications are common after kidney transplantation and are an important cause of morbidity in transplant recipients. These complications arise from multiple mechanisms, including immunosuppressive drug toxicity, opportunistic infections, metabolic disturbances, and pre-existing gastrointestinal diseases. Post-transplant diarrhea is the most frequent clinical manifestation and may interfere with the absorption of immunosuppressive medications. Upper gastrointestinal disorders, such as gastritis and peptic ulcer disease, are also frequently encountered, particularly in patients receiving corticosteroids or antithrombotic therapy. Acute pancreatitis is less common but remains clinically relevant because of its potential severity. This chapter reviews the epidemiology, pathophysiology, clinical presentation, diagnostic evaluation, and management of gastrointestinal complications after kidney transplantation, with particular emphasis on post-transplant diarrhea and pancreatitis.

Keywords: kidney transplantation; gastrointestinal complications; post-transplant diarrhea; acute pancreatitis; immunosuppressive therapy; opportunistic infections; peptic ulcer disease; transplant recipients.

INTRODUCTION

Gastrointestinal complications constitute one of the most frequently encountered categories of non-renal medical problems following kidney transplantation. Advances in transplant surgery and modern immunosuppressive therapy have significantly improved graft survival and longevity. Consequently, long-

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toxicity from infectious causes. Although less frequent, acute pancreatitis represents a potentially serious complication that warrants prompt recognition and management. Early diagnosis, appropriate adjustment of immunosuppressive therapy, and multidisciplinary care are essential for optimizing patient outcomes and preserving graft function.

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Chapter 11

HEPATOBIILIARY PROBLEMS AFTER KIDNEY TRANSPLANTATION

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Abstract

Hepatobiliary complications are frequently encountered in kidney transplant recipients and represent an underappreciated cause of morbidity in this population. The post-transplant milieu — characterized by chronic immunosuppression, polypharmacy, and metabolic derangement — creates a unique substrate for hepatic injury that differs substantially from that seen in the general population. This chapter provides a comprehensive review of the principal categories of hepatobiliary disease following kidney transplantation, including drug-induced liver injury (DILI) attributable to immunosuppressants, antifungals, antibiotics, and statins; viral hepatitis reactivation and de novo infection with hepatitis B (HBV) and hepatitis C (HCV) viruses; biliary tract disease including cholelithiasis, cholangitis, and choledocholithiasis; and metabolic-associated fatty liver disease (MAFLD/NAFLD) driven by post-transplant metabolic syndrome. Diagnostic evaluation is structured around liver function test (LFT) pattern analysis — hepatocellular, cholestatic, or mixed — supplemented by viral serology, abdominal imaging, and liver biopsy where indicated. A stepwise algorithmic approach and multidisciplinary management framework are presented. Figures illustrating the diagnostic algorithm and pathophysiological mechanisms are provided to facilitate clinical application. With up to 50% of kidney transplant recipients experiencing clinically relevant LFT abnormalities at some point post-transplant, systematic surveillance and early intervention are paramount to preserving both hepatic and allograft function.

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prevention and hepatoprotection. Advances in antiviral therapy for HBV and HCV, evolving immunosuppressive strategies, and emerging metabolic therapies offer increasingly effective tools for the prevention and treatment of post-transplant liver disease. Multidisciplinary collaboration, regular monitoring, and patient engagement remain the cornerstones of optimal hepatobiliary care in this vulnerable population.

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Chapter 12

IMMUNOSUPPRESSIVE DRUGS AND OCULAR COMPLICATIONS AFTER KIDNEY TRANSPLANTATION

Burak ULAS¹

Abstract

Kidney transplantation is the treatment of choice for patients with end-stage renal disease and has substantially improved long-term survival and quality of life. The success of transplantation, however, relies on lifelong immunosuppressive therapy, which is associated with a wide range of systemic adverse effects, including potentially vision-threatening ocular complications. As the life expectancy of transplant recipients continues to increase, recognition and prevention of drug-related ocular morbidity have become increasingly important components of comprehensive post-transplant care.

Ocular complications in kidney transplant recipients arise through multiple mechanisms, including direct pharmacologic toxicity, microvascular dysregulation, neurotoxicity, impaired tissue repair, and increased susceptibility to opportunistic infections. This chapter provides a comprehensive and clinically oriented overview of ocular complications associated with the major classes of immunosuppressive agents used in renal transplantation, including corticosteroids, calcineurin inhibitors, mammalian target of rapamycin (mTOR) inhibitors, and antimetabolites. Corticosteroids remain the most common cause of ocular morbidity, frequently leading to posterior subcapsular cataract, steroid-induced glaucoma, and central serous chorioretinopathy. Calcineurin inhibitors, particularly tacrolimus and cyclosporine, may produce neuro-ophthalmic complications such as toxic optic neuropathy and posterior reversible encephalopathy syndrome. In contrast, mTOR inhibitors primarily affect ocular surface integrity and wound healing, whereas antimetabolites contribute mainly

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ophthalmic adverse effects, and clinically important pharmacokinetic interactions with immunosuppressive drugs.

Immunosuppressive drug-related ocular complications represent a significant and clinically consequential component of long-term morbidity after kidney transplantation. Their impact extends beyond visual symptoms alone, influencing functional independence, quality of life, perioperative recovery, and the broader safety profile of chronic transplant therapy. Greater awareness, systematic ophthalmologic surveillance, and integrated multidisciplinary care are essential to minimizing preventable visual loss while maintaining durable graft survival. As post-transplant care continues to evolve toward more personalized and outcome-oriented models, ophthalmologic monitoring should be increasingly recognized as a necessary pillar of high-quality kidney transplant medicine.

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Chapter 13

INFECTIOUS, NON-INFECTIOUS AND VASCULAR COMPLICATIONS OF THE EYE AFTER KIDNEY TRANSPLANTATION

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Abstract

Although kidney transplantation is the gold standard treatment for patients with end-stage renal failure, the lifelong immunosuppressive therapy required for graft survival makes patients susceptible to serious ocular complications. This study examines post-transplant ocular conditions under three main headings: infectious, non-infectious, and vascular. Within the infectious complications, herpes viruses are the most common viral pathogens causing serious post-transplant ocular infections. The most important clinical conditions include cytomegalovirus retinitis, herpes simplex virus keratitis, herpes zoster ophthalmicus, herpetic acute retinal necrosis, and Epstein-Barr virus retinitis, and the diagnostic and treatment strategies for these important pathologies are highlighted. Toxoplasma chorioretinitis, caused by the obligate intracellular protozoan parasite *Toxoplasma gondii*, is a destructive ocular infection and its important aspects are discussed in this section. Ocular bacterial infections in renal transplant recipients are serious complications caused by opportunistic pathogens due to the effects of immunosuppression. In this group, ocular syphilis, cat scratch disease, and tuberculosis are primarily examined. On the other hand, when fungal infections are considered, *Aspergillus* is one of the most common causes of systemic fungal diseases in kidney transplant recipients. In the section on non-infectious and vascular complications, tubulointerstitial nephritis and uveitis syndrome, hypertensive retinopathy, diabetic retinopathy, and retinal vein occlusion are covered. Because immunosuppressive drugs can mask typical signs of ocular inflammation, early diagnosis of vision-threatening conditions in kidney transplant recipients is difficult. To prevent diagnostic delays and permanent

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this type of retinal vascular occlusion. Fundus fluorescein angiography is used to confirm the diagnosis and identify ischemic areas. Optical coherence tomography is critically important, especially for the quantitative assessment of retinal thickness and edema. In the treatment plan, laser photocoagulation is applied for ischemic cases, while vitrectomy surgery may be necessary in complicated cases. To minimize the risk of vision loss, regular ophthalmological check-ups are vital for high-risk transplant patients.

CONCLUSION

Kidney transplantation is the definitive treatment for end-stage renal failure, but the lifelong immunosuppressive therapy required to preserve graft function exposes the eye to a wide range of infectious, non-infectious, and vascular complications. This section summarizes the major viral, parasitic, bacterial, and fungal opportunistic infections, autoimmune pathologies, and vascular occlusive events that can develop after transplantation. Since immunosuppression can mask the classic signs of ocular inflammation, timely diagnosis requires repeated ophthalmological examinations and structured multidisciplinary follow-up. Therefore, routine ophthalmological screening should be considered an integral component of post-transplant patient care.

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Chapter 14

BONE AND JOINT PROBLEMS AFTER KIDNEY TRANSPLANTATION

Melih BAGİR¹

Abstract

Kidney transplantation is a treatment method for terminal renal insufficiency. Bone and joint issues commonly occur after kidney transplantation. Osteoporosis, osteopenia, fractures, renal osteodystrophy and osteomalacia are the most relevant problems subsequent to transplantation. Sarcopenia, a decrease in muscle mass, can also be observed. All these problems result in a deterioration in patients' quality of life, which is closely related to morbidity and mortality rates. Immunosuppressive drugs after transplantation were identified as the main etiology of these musculoskeletal problems. Recent studies support reducing corticosteroid dosages and using alternative immunosuppressive drugs to prevent graft-versus-host disease, thereby reducing bone and joint complications. As a result, customized treatment selection has been shown to be the key factor for minimizing these problems. In this section, we explained the bone and joint problems, their diagnosis, and the up-to-date treatment methods after renal transplantation.

Keywords: Renal transplant, musculoskeletal, metabolic

INTRODUCTION

Renal transplantation is an effective treatment for terminal renal insufficiency. After transplantation, the patient's clinical condition is strongly correlated with quality of life. Bone and joint problems are frequently encountered after renal transplantation. These pathologies could be either problems prior to transplantation, related to renal insufficiency, or to immunosuppressive treatment

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Chapter 15

POST-TRANSPLANT BONE MINERAL DISEASE

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Abstract

Kidney transplantation is associated with mineral and bone disorders that contribute to an increased risk of fractures and, consequently, to higher morbidity and mortality. Post-transplant mineral and bone disorders encompass not only the persistent effects of chronic kidney disease–mineral and bone disorder present before transplantation, but also new pathophysiological processes driven by persistent hyperparathyroidism, elevated fibroblast growth factor-23 levels, vitamin D deficiency, calcium–phosphate imbalance, immunosuppressive therapies, and changes in graft function. The assessment of bone disorder in kidney transplant recipients includes the identification of clinical risk factors, monitoring of biochemical parameters, evaluation of bone mineral density by dual-energy X-ray absorptiometry, and, in selected cases, bone biopsy. However, currently available diagnostic tools have certain limitations in precisely determining fracture risk and characterizing the type of bone turnover. Primary management strategies include non-pharmacological measures, such as reducing fall risk, promoting exercise, and modifying lifestyle- alongside adequate calcium and vitamin D supplementation. Individualized treatment options may include bisphosphonates, denosumab, calcimimetics, osteoanabolic agents, and parathyroidectomy. Evidence remains limited regarding the long-term effects of these interventions on fracture outcomes, graft safety, and their efficacy across different patterns of bone turnover. This review aims to provide a comprehensive overview of the current literature on the pathophysiology, epidemiology, risk

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Future research in this field should focus on evaluating current therapeutic strategies, with particular emphasis on long-term outcomes beyond the first year after KT. High-quality studies are required to generate stronger evidence based on clinical outcomes and to better define the efficacy and safety of bisphosphonates and other therapeutic options in the management of both skeletal and extraskeletal complications associated with PTBD.

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Chapter 16

IMMUNOSUPPRESSION-RELATED EARLY NEUROLOGICAL COMPLICATIONS AFTER KIDNEY TRANSPLANTATION

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Abstract

Neurological complications after kidney transplantation may appear early in the postoperative period and are frequently related to immunosuppressive treatment, metabolic vulnerability, infection, vascular instability, or drug interactions. Among immunosuppression-related disorders, calcineurin inhibitor (CNI) neurotoxicity is the most clinically relevant entity. Tacrolimus and cyclosporine may cause a broad neurological spectrum ranging from tremor, headache, insomnia, paresthesia, and mild cognitive symptoms to encephalopathy, seizures, posterior reversible encephalopathy syndrome (PRES), and, rarely, coma or focal neurological deficits. The presentation may be subtle because fever, leukocytosis, and inflammatory responses can be blunted in immunosuppressed recipients. Early recognition is essential because neurological toxicity may be reversible when precipitating factors are corrected and immunosuppressive therapy is appropriately adjusted. Mechanistic target of rapamycin (mTOR) inhibitors and corticosteroids may also contribute to neurological and psychiatric symptoms, either directly or through metabolic, vascular, and pharmacokinetic mechanisms. Acute delirium and metabolic encephalopathy require a structured differential diagnosis including hypoxia, dysglycemia, electrolyte disturbances, renal or hepatic dysfunction, infection, hypertensive emergency, and medication toxicity. Seizures and status epilepticus in kidney transplant recipients demand rapid standard treatment while considering renal function, dialysis, interactions with immunosuppressants, and avoidance of enzyme-inducing antiseizure medications whenever possible. This chapter summarizes the clinical spectrum,

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according to standard emergency principles while considering renal function and drug interactions. The distinction between refractory and super-refractory status epilepticus must be preserved: super-refractory status epilepticus is defined by persistence or recurrence after at least 24 hours of anesthetic therapy, not by persistence beyond 60 minutes.

Optimal care requires collaboration among transplant surgeons, nephrologists, neurologists, intensivists, infectious disease specialists, pharmacists, and radiologists. As transplant recipients become older and medically more complex, careful monitoring, medication reconciliation, individualized immunosuppression, and early neurological consultation will remain central to preventing avoidable morbidity.

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Chapter 17

MEDIUM AND LONG-TERM NEUROLOGICAL COMPLICATIONS AFTER KIDNEY TRANSPLANTATION

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Abstract

Neurological complications after renal transplantation represent an important source of morbidity and may substantially affect long-term functional status, treatment adherence, quality of life, and graft outcomes. Although these complications may occur at any time after transplantation, medium- and long-term neurological manifestations require particular attention because they are often related to chronic immunosuppression, opportunistic infections, vascular risk factors, metabolic disturbances, and drug-related neurotoxicity. This chapter reviews the major neurological complications encountered after the first month following renal transplantation, including central nervous system infections, posttransplant lymphoproliferative disease with CNS involvement, cerebrovascular disease, chronic cognitive impairment, peripheral neuropathy, and myopathy. A practical time-based framework is used, defining the medium term as 1 to 6 months and the long term as the period beyond 6 months after transplantation. Opportunistic and reactivation infections such as cryptococcal meningitis, progressive multifocal leukoencephalopathy, cytomegalovirus infection, cerebral aspergillosis, and toxoplasmosis are discussed with emphasis on clinical presentation, diagnostic workup, neuroimaging findings, antimicrobial therapy, and immunosuppression management. Central nervous system posttransplant lymphoproliferative disease is addressed as a rare but serious late complication that requires EBV assessment, systemic staging, and histopathological confirmation. The chapter also highlights the increased burden of cerebrovascular disease and cognitive impairment in renal transplant recipients, together

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Bölüm 18

RECURRENT DISEASES AFTER KIDNEY TRANSPLANTATION

Mutlu DEGER¹

Abstract

Recurrent disease after kidney transplantation remains an important cause of proteinuria, graft dysfunction, and allograft loss. This review summarizes the epidemiology, pathogenesis, clinical presentation, diagnosis, risk factors, and treatment of the most relevant recurrent diseases, including membranous nephropathy, primary focal segmental glomerulosclerosis, IgA nephropathy, lupus nephritis, C3 glomerulopathy, and amyloidosis. Recurrence is driven by persistent recipient-specific mechanisms such as autoantibodies, circulating permeability factors, galactose-deficient IgA1 immune complexes, complement dysregulation, or ongoing systemic inflammatory or clonal plasma cell disorders. Clinical manifestations range from isolated proteinuria and microscopic hematuria to nephrotic syndrome and progressive graft dysfunction, although recurrence may also be subclinical.

Kidney allograft biopsy remains the diagnostic cornerstone and is essential for distinguishing recurrence from rejection, calcineurin inhibitor toxicity, and chronic allograft injury. Serologic and biomarker-based tools, including anti-PLA2R, anti-nephrin, complement markers, and disease-specific hematologic parameters, may support risk stratification and follow-up but do not replace histologic confirmation. Pretransplant disease quiescence, assessment of antibody burden, and identification of genetic or monoclonal causes are critical for recurrence prevention.

Management is disease-specific and combines optimized supportive care with tailored immunosuppression or targeted therapy. Rituximab, plasmapheresis, corticosteroids, calcineurin inhibitors, complement-directed agents, and

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Chapter 19

MALIGNANCIES AFTER KIDNEY TRANSPLANTATION

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Abstract

The risk of malignancy after kidney transplantation is significantly higher than in the general population and is among the most critical complications affecting long-term survival and quality of life in transplant recipients. In the pretransplant period, disease-free waiting periods, determined by the cancer's biological behavior and stage, are fundamental to ensuring oncological safety. In the posttransplant period, cumulative immunosuppressive burden is the most important modifiable risk factor. T-cell-depleting induction therapies and calcineurin inhibitors (CNIs), in particular, increase the risk of cancer. Furthermore, Torque Teno Virus (TTV) burden is a notable functional biomarker that reflects the patient's immune competence and predicts the risk of malignancy that may develop due to excessive immunosuppression. Among de novo malignancies frequently seen in kidney transplant recipients, cutaneous squamous cell carcinoma tends to be more aggressive, multifocal, and to present at an earlier age than in the general population. Lymphoproliferative diseases, which are a significant risk in the early post-transplant phase, are among the most aggressive cancers linked to viral reactivation. In the urogenital system, native kidney renal cell carcinoma is notably prominent. The basic principles of malignancy management are based on establishing a delicate balance between oncological efficacy and the preservation of graft function, and on a multidisciplinary decision-making process. In this context, individualizing therapy and reducing the cumulative immunosuppressive burden, the most important modifiable risk factor, is the fundamental treatment strategy. The strategic switch from CNIs to mTOR inhibitors (sirolimus/

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combination of low-dose calcineurin inhibitors (CNIs) (e.g., tacrolimus target level 3-5 ng/mL) and steroids, while others advocate switching to mTOR inhibitors for antitumor synergy. However, low-dose CNIs do not always prevent rejection.

Nephrotoxicity: In addition to directly triggering rejection, ICIs can cause acute renal injury (AKI) due to acute tubulointerstitial nephritis in transplant kidneys.

Drug Interactions: Pharmacokinetic interactions and the cumulative nephrotoxicity potential of immunosuppressants (CNIs, mTOR inhibitors) and ICIs should be carefully managed in the treatment plan.

- **Risk of Graft Loss and Planning for Conversion to Dialysis**
- Planning should be initiated in cases of advanced cancer or when aggressive treatments threaten the graft.
- **Dialysis Guarantee:** Unlike other organ transplants, graft loss is not fatal for kidney transplant recipients; dialysis is available as a backup option.
- **End-of-Life Decisions:** Completely discontinuing immunosuppression in patients with advanced malignancy is a difficult decision. Gradual discontinuation of medications and switching to high-dose steroids may be considered to prevent rejection symptoms. An integrated approach, including the palliative care team, is necessary in this process.

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Chapter 20

PREGNANCY AFTER KIDNEY TRANSPLANTATION

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Abstract

Kidney transplantation is the kidney replacement therapy method with the highest probability of restoring reproductive potential in women with advanced chronic kidney disease. Following a successful transplant, ovulatory cycles and spontaneous fertility often return within the first few months, frequently within the first six months; this makes pregnancy a realistic possibility for many women who were subfertile during dialysis or in the course of advanced renal failure. However, pregnancy should never be considered a routine occurrence in kidney transplant recipients. Pregnancy is a high-risk clinical situation, carrying not only the physiological burden of pregnancy itself but also the combined effects of chronic kidney disease, a single functioning graft, the need for lifelong immunosuppression, and the associated disease burden of hypertension, proteinuria, and the risk of infection.

Despite all these challenges, current data are generally encouraging with careful planning. Data from registry systems and meta-analyses show that live births are possible in the majority of pregnancies following kidney transplantation, with live birth rates often ranging from approximately 73–79%. These findings demonstrate that successful motherhood is possible in this patient group. However, despite acceptable live birth rates, rates of hypertensive pregnancy disorders, preterm birth, cesarean section, and fetal growth restriction are significantly higher compared to the general obstetric population. Therefore, the primary goal of care is not only to allow pregnancy but also to ensure conception occurs at the safest possible time and under the most appropriate clinical conditions.

Keywords: Kidney transplantation; pregnancy; fertility; chronic kidney disease; immunosuppressive therapy; high-risk pregnancy; live birth; preterm birth; hypertensive disorders of pregnancy; graft function.

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recipient-specific risk factors. Therefore, prevention and management require individualized immunosuppressive strategies, regular oncological screening, early detection of high-risk lesions, and careful monitoring of viral and immune biomarkers such as Torque Teno Virus. When malignancy develops, treatment should balance effective cancer control with preservation of graft function, and decisions regarding immunosuppression reduction, conversion to mTOR inhibitors, surgery, systemic therapy, or immune checkpoint inhibitors must be made through a multidisciplinary approach. Overall, personalized risk assessment and close collaboration between oncology, nephrology, and transplant teams are essential to improve long-term outcomes in kidney transplant recipients.

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Chapter 21

BLADDER DISORDERS AND VOIDING DYSFUNCTION AFTER KIDNEY TRANSPLANTATION

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Abstract

Kidney transplantation is the most effective treatment for end-stage renal disease; however, long-term graft survival largely depends on the functional integrity of the lower urinary tract. Bladder disorders and voiding dysfunction after transplantation are common, particularly in patients with a history of prolonged anuria or oliguria. These conditions are associated with reduced bladder capacity, impaired compliance, and detrusor dysfunction. Comprehensive evaluation, including clinical assessment, uroflowmetry, post-void residual measurement, and selective urodynamic studies, is essential for identifying high-risk patients. Common dysfunction patterns include low-capacity bladder, overactive bladder, hypocontractile bladder, and neurogenic bladder. If untreated, these conditions may lead to complications such as urinary tract infections, vesicoureteral reflux, and obstructive uropathy, ultimately compromising graft function. A stepwise management approach, incorporating pharmacological therapy, clean intermittent catheterization, and surgical interventions, is crucial for optimizing outcomes and preserving long-term graft function.

INTRODUCTION

Kidney transplantation represents the treatment method with the best survival and quality of life rates for end-stage renal disease (ESRD). However, the healthy function of the graft after transplantation largely depends on the ability of the lower urinary tract (LUT) to safely store and empty the urine load from the new graft. Bladder disorders and voiding dysfunctions due to prolonged anuric or oliguric periods in transplant patients emerge after transplantation.

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determinants of transplant success and long-term graft survival. Functional monitoring initiated in the preoperative period and continued in the postoperative process; especially in patients whose clinical symptoms have become subtle due to prolonged anuria or who have a history of complex urological pathology, it allows for the early detection of underlying dysfunctions. It has been shown that timely and targeted treatment approaches (such as early surgical interventions, clean intermittent catheterization, or the creation of catheterizable channels), applied based on data obtained from urodynamic examinations, uroflowmetry, and PVR monitoring, protect the graft from mechanical damage caused by high intravesical pressure and obstructive uropathy. Consequently, the effective management of bladder disorders and voiding dysfunction is not merely a supportive approach; it is a fundamental component that directly protects graft function and optimizes long-term survival by providing a low-pressure and safe reservoir.

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Chapter 22

UPPER AIRWAY AND OTORHINOLARYNGOLOGIC COMPLICATIONS IN RENAL TRANSPLANT RECIPIENTS

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Abstract

Renal transplantation significantly improves survival and quality of life in patients with end-stage renal disease. However, lifelong immunosuppressive therapy predisposes transplant recipients to a broad spectrum of infectious, inflammatory, and neoplastic complications involving the upper airway and otorhinolaryngologic system. Impairment of cellular immunity, disruption of mucosal barriers, and alterations in the sinonasal microbiome contribute to increased susceptibility to opportunistic infections and chronic inflammatory disorders. Chronic rhinosinusitis represents the most frequently encountered sinonasal complication, whereas invasive fungal rhinosinusitis, although less common, remains a life-threatening condition requiring urgent diagnosis and management. Oropharyngeal complications such as chronic pharyngitis, oral candidiasis, aphthous ulcers, and herpes simplex infections are frequently observed and may significantly impair nutritional status and quality of life. Otolgic manifestations, including otitis externa, otitis media, and drug-related ototoxicity, may also occur during the post-transplant period. In addition, prolonged immunosuppression increases the risk of head and neck malignancies and post-transplant lymphoproliferative disorders. Early recognition of symptoms, prompt endoscopic evaluation, radiologic imaging, and microbiological or histopathological confirmation are essential for accurate diagnosis. Management requires a multidisciplinary approach

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are indispensable tools in this process. Early biopsy is recommended for suspicious lesions. Management includes antimicrobial therapy, optimization of immunosuppression, and surgical intervention when necessary. Collaboration between nephrologists, ENT specialists, urologists and infectious disease experts is critical. Drug toxicity, interactions (e.g., calcineurin inhibitors with antifungals), and recurrence of infections are common challenges. Regular monitoring is required. Emerging approaches include personalized immunosuppression, microbiome-based therapies, and biomarker-driven diagnostics.

CONCLUSION

Renal transplant patients are prone to serious ENT conditions that can be life-threatening. Therefore, a routine ENT evaluation should be performed prior to transplantation. Sinonasal symptoms that develop in the post-transplant period should be evaluated promptly. Particular vigilance is required for acute complications such as epistaxis, especially during the first month. A multidisciplinary approach and early endoscopic evaluation are key to reducing morbidity and mortality.

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Chapter 23

THORACIC COMPLICATIONS AFTER KIDNEY TRANSPLANTATION

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Abstract

Thoracic complications after kidney transplantation constitute a heterogeneous clinical spectrum ranging from early postoperative respiratory impairment to late infectious, thromboembolic, pleural, malignant, and ventilation-related disorders. Their evaluation requires more than routine postoperative respiratory assessment because immunosuppression, graft function, renal-adjusted therapies, altered inflammatory responses, and competing diagnoses frequently obscure the clinical picture. This chapter reviews thoracic complications from a thoracic surgery-oriented perspective, emphasizing practical diagnostic pathways, indications for invasive evaluation, and situations in which surgical intervention becomes necessary. Particular attention is given to postoperative atelectasis and pneumonia, pleural effusion and pleural infection, pulmonary embolism, thoracic malignancies, pulmonary nodules, post-transplant lymphoproliferative disorder, diaphragmatic dysfunction, and complex pleural or pulmonary conditions requiring video-assisted thoracoscopic surgery. The chapter highlights the importance of differentiating reversible postoperative changes from complications requiring microbiologic diagnosis, pleural drainage, bronchoscopy, tissue biopsy, oncologic staging, or operative management. Because evidence specific to kidney transplant recipients remains limited for several thoracic conditions, general thoracic, pulmonary, and thromboembolic principles should be applied with transplant-specific caution. Early recognition, structured assessment, individualized risk evaluation, and coordinated multidisciplinary care are central to improving outcomes in this vulnerable patient population.

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Chapter 24

METABOLIC COMPLICATIONS AFTER KIDNEY TRANSPLANTATION

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Abstract

Various metabolic complications are common in the post-kidney transplant period and can negatively impact patient and graft survival. The most important complications include post-transplant diabetes mellitus (PTDM), dyslipidemia, metabolic syndrome, and electrolyte imbalances. PTDM is defined as diabetes that develops after transplantation and is evaluated regardless of the time of onset. The presence of PTDM is associated with an increased frequency of infections, increased cardiovascular morbidity and mortality, and an increased risk of graft loss. Dyslipidemia is characterized by elevated levels of low-density lipoprotein cholesterol and triglycerides, particularly in response to immunosuppressive therapies. This contributes to the development of atherosclerotic cardiovascular disease and facilitates the development of metabolic syndrome. Metabolic syndrome is a complex clinical condition characterized by abdominal obesity, hypertension, hyperglycemia, and dyslipidemia, and is a significant risk factor for cardiovascular mortality in kidney transplant recipients. Electrolyte imbalances are also commonly observed in the post-kidney transplant period. Hyperkalemia, particularly due to calcineurin inhibitors reducing distal tubular potassium secretion, can lead to serious cardiac arrhythmias. Hypomagnesemia, on the other hand, results from multifactorial mechanisms such as renal magnesium loss, gastrointestinal malabsorption, and immunosuppressive drug use. Low magnesium levels increase the risk of developing PTDM through decreased insulin secretion and increased insulin resistance, and can also potentiate the diabetogenic effects of calcineurin inhibitors. Hypophosphatemia is frequently

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graft function. Early detection of metabolic complications, regular metabolic monitoring, and the implementation of individualized treatment strategies are critically important both in reducing cardiovascular events and in extending graft survival. The current approach aims not only to preserve graft function but also to improve long-term patient and graft survival through early and effective management of metabolic risk factors.

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Chapter 25

COMPLICATIONS IN PEDIATRICS AFTER RENAL TRANSPLANTATION

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Abstract

This chapter examines the concept of childhood from social, legal, developmental, and ethical perspectives. It first discusses what it means to be a child and emphasizes that childhood should not be understood merely as a temporary stage before adulthood, but as a unique and valuable period of human life. The chapter highlights that children are rights-bearing individuals whose existence, development, and sense of self are shaped by the attitudes of families, society, and institutions. It explains how childhood has been defined in legal frameworks such as the Convention on the Rights of the Child, the Child Protection Law, the Turkish Penal Code, and the Turkish Civil Code. The chapter also addresses the importance of seeing the world through the eyes of children and draws attention to poverty, inequality, neglect, abuse, child labor, war, migration, and other social problems that threaten children's well-being. Furthermore, it compares the worlds of children and adults, underlining that children should not be treated as miniature adults or forced into adult responsibilities. Overall, the chapter argues that protecting childhood means protecting human dignity, children's rights, and the future of society.

Keywords: Childhood, child rights, child protection, child development, child welfare, childhood studies, social responsibility, neglect and abuse, child-centered approach

INTRODUCTION

Kidney transplantation is unquestionably the most appropriate treatment modality for many children with end-stage renal disease or those approaching this stage.

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Lymphocele, defined as an encapsulated collection of lymphatic fluid arising secondary to the surgical division of lymphatic vessels overlying the iliac vasculature, represents a well-recognized urological complication in the post-transplant period. By exerting extrinsic compression upon the urinary tract, lymphocele may precipitate post-obstructive uropathy, thereby jeopardizing allograft function and long-term graft survival. In a retrospective study examining the incidence and clinical implications of this complication, lymphocele was identified in approximately 3% of pediatric renal transplant recipients, underscoring its relevance even within this relatively low-prevalence surgical context. Risk factors independently associated with lymphocele development include age greater than 11 years, male sex, body mass index exceeding the 95th percentile, and a history of multiple transplantations, suggesting that older children with higher adiposity and complex surgical histories may constitute a particularly vulnerable subgroup. Notably, in the aforementioned series, the presence of lymphocele was associated with a clinically meaningful 10% reduction in one-year graft survival, highlighting the potential downstream consequences of this complication on allograft longevity and emphasizing the importance of early detection and timely intervention in the post-transplant surveillance protocol[27].

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