



Association of Liver Enzymes and Chronic Kidney Disease Patients with or without Hemodialysis

Sinan Zhang*, Hanwen Liu, Xiang Deng, Yue Yu

Abstract

The persistent shortage of donor kidneys has prompted increasing consideration of organs that might previously have been declined because of infection-related findings, positive microbiological tests, or relevant exposure histories. Infectious risk alone does not necessarily preclude kidney use. Acceptance decisions should instead integrate the likelihood and potential consequences of transmission, the extent to which donor infection is controlled, the availability of effective preventive or therapeutic measures, the risks associated with continued waiting for transplantation, and the transplant center's capacity for diagnosis, treatment, and post-transplant surveillance. Advances in nucleic acid testing, donor screening, antiviral and antimicrobial therapy, and peri-transplant management have enabled the selective use of kidneys from HCV RNA-positive donors, selected HBV-related donors, HIV-positive donors for appropriately selected HIV-positive recipients, donors with controlled bacterial infections, and kidneys associated with selected positive preservation fluid cultures. In contrast, uncontrolled invasive fungal infections and multidrug-resistant Gram-negative bacterial infections may result in severe donor-derived infection, graft-related complications, graft loss, or recipient death. Management of HEV, arboviruses, and pathogens associated with specific geographic or social exposures relies more heavily on epidemiologic context, targeted testing, and post-transplant surveillance. This review summarizes the assessment framework for kidneys from donors with infectious risk, the current evidence across major pathogen groups, the safety boundaries for kidney acceptance, and the key requirements for transplant-center management, with the aim of reducing unnecessary organ discard while minimizing donor-derived infection risk.

Keywords: Kidney transplantation; Donors with infectious risk; Donor-derived infection; Donor kidney acceptance; Risk stratification; Infection management

Abbreviations

ART: antiretroviral therapy

BKPyV: BK polyomavirus

CMV: cytomegalovirus

CRKP: carbapenem-resistant *Klebsiella pneumoniae*

DAA: direct-acting antiviral

HBIG: hepatitis B immunoglobulin

HBsAg: hepatitis B surface antigen

Affiliation:

Queen Mary College of Nanchang University,
Nanchang, Jiangxi, China

*Corresponding author:

Sinan Zhang, Queen Mary College of Nanchang
University, Nanchang, Jiangxi, China

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HBV: hepatitis B virus

HCV: hepatitis C virus

HEV: hepatitis E virus

HIV: human immunodeficiency virus

KSHV: Kaposi sarcoma-associated herpesvirus

MDR: multidrug-resistant

mNGS: metagenomic next-generation sequencing

NAT: Nucleic Acid Testing

SVR12: sustained virologic response 12 weeks after completion of therapy.

Introduction

Kidney transplantation is an important and preferred renal replacement therapy for patients with end-stage renal disease. Compared with long-term maintenance dialysis, successful transplantation is associated with better long-term survival, improved quality of life, and more favorable clinical outcomes [1,2]. However, the shortage of donor kidneys and prolonged waiting times remain major factors limiting the full realization of the benefits of kidney transplantation, and some patients continue to face risks of dialysis-related complications, cardiovascular events, infections, and death while on the waiting list [3,4]. Therefore, reasonably expanding the available sources of donor kidneys while ensuring recipient safety remains a key issue of ongoing concern in the field of kidney transplantation. With the progressive standardization of donor screening protocols and nucleic acid testing, together with the continued accumulation of evidence on pathogen diagnosis and anti-infective therapy in recent years, some donor kidneys that were previously used cautiously or even discarded are now being reconsidered for clinical evaluation; these include kidneys from donors with indicators of infection risk, positive test results for specific pathogens, or relevant exposure histories [5-8]. The 2020 U.S. Public Health Service Guidelines state that risk prevention and control for donor-associated transmission of HIV, HBV, and HCV should include the identification of donor risk factors, laboratory screening, and post-transplant monitoring of recipients [7]. The American Society for Transplantation's Infectious Diseases Practice Community guidelines state that appropriate measures to reduce the risk of transmission should be implemented for different types of infections, and that recipients with suspected donor-related infections should undergo systematic evaluation and management [8]. Therefore, infection-related risk in the donor does not necessarily preclude use of the kidney; acceptance should be considered on a case-by-case basis, taking into account the type of infection, the likelihood of transmission, and the availability of effective preventive or therapeutic measures.

Donor-derived infection should be assessed using standardized definitions of imputability and classification criteria, considering clinical information from both the donor and recipient together with confirmatory test results. A positive microbiological result alone is insufficient to establish transmission [9,10]. The decision to accept a kidney from a donor with infection-related risk should not be based solely on the potential for transmission but should also take into account the risks of remaining on the waiting list, the likelihood of receiving another suitable kidney offer, and whether the infection can be effectively managed. From a clinical decision-making perspective in kidney transplantation, this review clarifies the concepts of donor kidneys with infection-related risks and donor-derived infection transmission, synthesizes the available clinical evidence across pathogen types, and discusses preacceptance risk assessment, decision-making pathways, and the boundaries of safe use.

Clinical Definition of Donor Kidneys with Increased Infectious Risk

Donor kidneys with an increased risk of infection mainly include those from donors with known or suspected active infections, or from donors with relevant epidemiological exposures, behavioral history, travel history, or abnormal microbiological test results suggesting the possibility of pathogen transmission through organ transplantation. Common risk indicators include abnormal serological or nucleic acid test results, positive blood cultures or other microbiological tests, infection involving the kidney intended for transplantation or the urinary tract, and detection of clinically significant pathogens in the donor kidney or preservation fluid [6,11,12]. Some of these risks can be identified before organ procurement through medical history review and infectious disease screening, whereas others may only become evident after culture or other test results obtained during the procurement period become available. In some cases, such abnormalities may only receive attention after transplantation when the recipient develops corresponding manifestations of infection early in the post-transplant period. The transmission risks associated with different abnormal findings vary. A higher potential risk is generally associated with donor bacteremia caused by highly virulent or antimicrobial-resistant pathogens, infection directly involving the kidney intended for transplantation, bloodstream infection caused by multidrug-resistant Gram-negative organisms or involvement of the donor kidney by relevant resistant pathogens, active systemic or invasive fungal infection, inadequately treated candidemia, or situations in which the donor has not yet received adequate effective antimicrobial therapy or achieved clear clinical improvement [6,11]. The assessment of specific transmission risk should consider the site of infection, the type of pathogen, its virulence and antimicrobial resistance profile,

the donor's antimicrobial treatment regimen and duration, the clinical response, and the extent of involvement of the kidney intended for transplantation [6,11]. It should be emphasized that the abnormalities described above merely indicate a potential risk of transmission of donor-derived infection; they do not constitute evidence that transmission has occurred. A single positive microbiological test in the donor or a positive preservation fluid culture may reflect donor colonization, specimen contamination, or contamination during organ procurement, preservation, or processing, and therefore should not be used as the sole basis for confirming donor-derived infection [12,13]. Attribution of transmission should comprehensively consider the consistency of microbiological findings between the donor and recipient, whether the timing of disease onset and clinical manifestations in the recipient are consistent with the characteristics of the corresponding infection, whether recipients of other organs from the same donor have similar microbiological or clinical evidence, and the exclusion of other more plausible sources of infection [13-15].

Decision-Making Pathway Before Donor Kidney Acceptance

Decisions regarding the acceptance of donor kidneys with infection-related risks should be based on a thorough assessment of the donor's infection-related background. In addition to the donor's medical and social history, epidemiological exposures, and clinical manifestations, the condition of the kidney intended for transplantation and the results of infectious disease screening should also be considered, with attention to the potential impact of the diagnostic window period, false-positive and false-negative results, and delayed reporting on the interpretation of test findings. On this basis, transmission risk should be comprehensively stratified according to the type, virulence, and antimicrobial resistance profile of the pathogen, together with the site of infection, the presence or absence of bacteremia or systemic infection, involvement of the kidney intended for transplantation, and the donor's clinical response following antimicrobial therapy [6,11,16]. Further decisions regarding acceptance should also consider whether effective targeted therapy or peri-transplant prophylactic strategies are available, whether reliable microbiological monitoring can be implemented after transplantation, and the balance between the potential consequences of transmission and the risks associated with continued waiting for transplantation. When the risk can be identified, effective interventions are available, and close monitoring is feasible, acceptance may be considered after a prophylactic or therapeutic plan has been established for the recipient and fully informed consent has been obtained; when the donor infection is not controlled, the infection directly involves the donor kidney, or effective treatment and monitoring options are lacking for the relevant

pathogen, the donor kidney should be used with caution or declined [6,17].

Assessing the Reliability of Evidence for Infection

The assessment of infection risk in donors should integrate medical and social history, travel history, other epidemiological exposures, physical examination findings, and available microbiological data, and use this information to determine whether additional testing is necessary [18,19]. Positive microbiological findings that may reflect colonization or contamination should not be directly equated with active infection; in particular, mNGS results alone cannot fully distinguish between active infection, colonization, and contamination and therefore require further evaluation in conjunction with conventional microbiological testing [19,20]. The clinical significance of positive preservation of fluid cultures from donor kidneys varies according to the pathogen identified. Available evidence indicates that ESKAPE pathogens are associated with an increased risk of probable donor-derived infection, whereas detection of low-virulence contaminants should not prompt unnecessary antimicrobial therapy [21].

mNGS can complement conventional microbiological methods in pathogen detection; however, its results still need to be interpreted together with the clinical context and conventional microbiological findings, and detection of a microorganism alone should not be equated with active infection [20]. Rao et al. showed that combining donor mNGS results with conventional microbiological testing and clinical features can provide a basis for developing perioperative antimicrobial regimens in deceased-donor kidney transplantation [20]. In a prospective study, Tan et al. further showed that, in the evaluation of potential kidney donors, mNGS achieved a higher pathogen detection rate and a shorter turnaround time than conventional laboratory testing [22].

Determining Whether an Infection Is Treatable

Whether effective preventive or therapeutic measures are available is an important consideration when deciding whether to accept kidneys from donors with infection-related risks. For confirmed infections, appropriate treatment should be given, with additional testing and/or preventive measures as needed [23]. For certain bacterial infections and HBV- or HCV-related infections, relatively well-established preventive and therapeutic measures are available, and organ utilization may be considered after appropriate management [6]. Organs from donors with syphilis may also be considered after treatment. Donor-derived syphilis transmission after kidney transplantation is generally rare, although the risk may be higher when the donor has active syphilis [24]. In contrast, donor-derived infections caused by multidrug-resistant Gram-negative bacteria and fungi can lead to bloodstream

infection, deep abscesses, vascular complications, graft loss, and even recipient death [6,25-27]. A study involving DCD donors showed that recipients with proven or probable donor-derived bacterial or fungal infections had significantly higher mortality and graft loss rates than those without donor-derived infections [26].

Assessing Recipient Benefits and the Risks of Waiting

When considering whether to accept a kidney from a donor with an infection-related risk, the risks associated with continued waiting should also be considered. For patients who are expected to face long waiting times, have limited chances of receiving another suitable kidney, or may experience clinical deterioration while waiting, declining such an organ may not necessarily result in a better outcome. Previous studies have shown that continuing to wait after declining a donor kidney with an increased risk of infection transmission is associated with a higher risk of death [28]. Therefore, the decision to accept such a kidney should balance the donor's risk of infection transmission against the recipient's risk of remaining on the waiting list and the likelihood of receiving another suitable kidney in the future.

Assessing the Transplant Center's Capacity to Manage Infection Risk

The use of donor kidneys with infection-related risks also depends on the transplant center's capacity for infection diagnosis, treatment, and monitoring. Donor culture results should be reported promptly, and antimicrobial regimens should be adjusted accordingly; for high-risk pathogens, timely communication among the transplant, infection, and microbiology teams is particularly important [6,23].

Ongoing monitoring after transplantation is equally important. Infections following kidney transplantation may result from newly acquired infections, donor-derived infections, or reactivation of latent infections. Clinical judgment should also consider the time since transplantation and the corresponding net state of immunosuppression,

previous exposure or infection history, and regional and seasonal epidemiological patterns [29]. Therefore, if microbiological results can be obtained promptly and appropriate treatment and post-transplant monitoring are available, some kidneys from donors with infection-related risks may be considered for use after careful evaluation; otherwise, greater caution is warranted. Overall, the pre-acceptance assessment of donor kidneys should consider four main aspects: the reliability of infection evidence, the controllability of infection risk, the potential benefit to the recipient, and the transplant center's capacity to manage infection risk (Table 1).

Pathogen Types and the Evidence Base

Infection risk in kidney donation is not a single clinical entity. Modes of transmission, diagnostic window periods, availability of treatment, and recipient outcomes vary substantially across pathogens. Therefore, the evidence should be evaluated separately according to pathogen type. Overall, HCV-related and some HBV-related donor kidneys are supported by a relatively large number of clinical studies. For CMV, BK virus, HEV, and vector-borne viruses, greater emphasis is placed on donor-recipient matching, regional epidemiology, and post-transplant monitoring. Preservation fluid contamination and multidrug-resistant (MDR) bacteria mainly affect early post-transplant infections and vascular complications. Fungal infections, geographically restricted pathogens, and infections related to social exposures are relatively uncommon, but when they do occur, the consequences are often severe.

HCV-Related Donor Kidneys

The use of direct-acting antivirals (DAAs) has expanded the use of HCV-positive donor kidneys in HCV-uninfected recipients. Provided that early initiation of DAA therapy can be ensured, transplantation of kidneys from HCV RNA-positive donors generally achieves high rates of sustained

Table 1: Key considerations in the pre-acceptance assessment of kidneys from donors with infection-related risks.

Assessment domain	Key question	Main considerations
Reliability of infection evidence	Do the available findings indicate a clinically meaningful infection or risk of transmission?	Specimen source and testing timing; repeat test results; clinical evidence of infection; possibility of contamination or colonization
Controllability of infection risk	Are the infection controlled, and are effective preventive or therapeutic measures available?	Pathogen characteristics; site of infection; involvement of the donor kidney; response to treatment; available preventive or therapeutic measures
Net benefit to the recipient	Is accepting the kidney preferable to continue waiting?	Expected waiting time and associated risks; dialysis-related risks; sensitization status; comorbidities; likelihood of receiving another suitable kidney
Transplant center capacity	Can the center promptly identify, manage, and monitor the infection risk?	Timely reporting of test results; adjustment of antimicrobial therapy; multidisciplinary communication; follow-up of delayed results; post-transplant monitoring

virologic response, with overall favorable short-term recipient and graft outcomes. However, existing studies are mostly non-comparative, and long-term safety requires further evaluation [30,31]. In the study by Elbeshbeshy et al., no recipient deaths or graft failures were observed during the first year after transplantation of organs from HCV-positive donors. Among viremic recipients who received initial DAA therapy, 14.3% experienced virologic relapses, but all achieved sustained virologic response after retreatment [32]. Papanikolla et al. showed that both 8 weeks of glecaprevir/pibrentasvir and 12 weeks of sofosbuvir/velpatasvir achieved high SVR12 rates, with no recipient deaths or graft losses observed [33]. The risk of HCV transmission from the donor should be assessed based on both anti-HCV and HCV RNA test results. Donor kidneys that are anti-HCV positive but HCV RNA negative generally do not increase the risk of HCV transmission [30]. However, donors with recent HCV exposure risk factors may still be within the window period, during which HCV RNA has not yet reached detectable levels [7]. HCV RNA positivity indicates donor viremia and a clear risk of HCV transmission [5,30]. A single-center retrospective study showed that recipients of kidneys from HCV RNA-positive donors who initiated a 3-month course of glecaprevir/pibrentasvir at the time of transplantation had no detectable HCV RNA during follow-up, and kidney allograft function remained generally stable at 1 year [34]. Dieter et al. further explored a prophylactic glecaprevir/pibrentasvir strategy initiated before transplantation with a prespecified 14-day treatment course, and all recipients ultimately achieved sustained virologic response [35]. Overall, kidneys from HCV RNA-positive donors may be used at transplant centers where informed consent, early DAA therapy, and virologic monitoring can be implemented. Clinical management should continue to address the risks of HCV transmission and treatment failure, drug-drug interactions between DAAs and immunosuppressive agents, and long-term recipient and graft outcomes.

HBV-Related Donor Kidneys

In the context of donor kidney shortage, the clinical use of kidneys from donors with positive HBV serologic or virologic markers has received increasing attention. The risk of HBV transmission is mainly influenced by the level of viral replication in the donor, the recipient's HBV immune status, and peri-transplant prophylactic measures [36-38]. Kidneys from HBsAg-negative, anti-HBc-positive donors are generally associated with a low risk of HBV transmission and may be considered for adult kidney transplant candidates after appropriate informed consent, individualized assessment of risks and benefits, and formulation of prophylactic and monitoring strategies according to the recipient's HBV immune status [36]. In contrast, kidneys from HBsAg-positive or HBV NAT-positive donors carry a higher risk of

transmission but are not absolutely contraindicated. Available studies have shown that qualitative HBV NAT positivity may correspond to a wide range of viral loads. In recipients with pretransplant HBV immunity who receive peri-transplant HBIG and antiviral therapy, transplantation of HBV NAT-positive non-hepatic organs has shown relatively favorable short-term safety outcomes [37]. In addition, the risk of HBV transmission from HBsAg-positive donor kidneys is influenced by the donor HBV DNA level, the recipient's anti-HBs immunity acquired through prior infection or vaccination, and the prophylactic regimen [38]. Therefore, evaluation of HBV-related donor kidneys should not rely on a single serologic or virologic marker, but should consider the donor's level of viral replication, the recipient's anti-HBs and anti-HBc status, the availability of antiviral prophylaxis, and the capacity for post-transplant follow-up. For recipients of kidneys from HBsAg-positive or HBV NAT-positive donors, an individualized prophylactic regimen should be developed, with serial monitoring of HBsAg and HBV DNA to allow timely identification of donor-derived HBV infection.

HIV-Infected Recipients and Issues Related to HIV-Positive Donors

For HIV-infected kidney transplant recipients, the focus of peri-transplant management is on maintaining HIV viral suppression, reducing the risk of rejection, and managing drug interactions between antiretroviral therapy (ART) and immunosuppressants. The 2025 European AIDS Clinical Society guidelines further noted that, with the increasing use of organs from HIV-positive donors, antiretroviral regimens before and after transplantation in people living with HIV should be selected to minimize drug-drug interactions, with therapeutic drug monitoring used to optimize post-transplant management [39]. The HOPE in Action observational study showed that, compared with HIV-infected recipients of kidneys from HIV-negative donors, those who received kidneys from HIV-positive donors met the prespecified noninferiority criterion for the primary composite safety outcome, with generally similar patient survival, graft survival, and rejection rates between the two groups [40]. These findings suggest that, in recipients with well-controlled HIV infection who can maintain effective ART and undergo standardized virologic monitoring, HIV D+/R+ kidney transplantation may represent a feasible transplant option. HIV D+/R+ transplantation still carries specific risks of donor-derived HIV superinfection and transmission of concomitant pathogens. A U.S. multicenter study showed that KSHV seroprevalence was high among HIV-infected kidney transplant recipients and HIV-positive donors, but KSHV-associated disease after transplantation was uncommon, occurring in only 5 of 418 recipients, including one case of renal allograft Kaposi sarcoma that was considered highly likely to be donor-derived [41]. Viral sequence analysis of 18

HIV D+/R+ kidney transplant recipients identified only one confirmed case of donor-derived HIV superinfection, with no associated HIV virologic breakthrough or apparent adverse clinical outcomes [42]. Current evidence therefore suggests that such donor-derived infectious events are uncommon, but the risk is not zero. HIV drug resistance in both donors and recipients and the effectiveness of the recipient's ART regimen should still be assessed before transplantation, with continued monitoring of HIV RNA and relevant opportunistic infections after transplantation.

Other Viral Risks: CMV, BKPyV, HEV, and Arboviruses

The CMV D+/R- donor-recipient serostatus combination carries the highest risk of CMV infection and CMV disease after kidney transplantation and generally requires antiviral prophylaxis or preemptive therapy [43]. In these high-risk recipients, letermovir is noninferior to valganciclovir for the prevention of CMV disease and is associated with a lower incidence of leukopenia or neutropenia [44]. Nevertheless, late-onset CMV infection may still occur after prophylaxis is discontinued. Continued virologic monitoring after completion of prophylaxis may therefore be considered in high-risk recipients. If the virologic response remains inadequate after at least 2 weeks of appropriately dosed antiviral therapy and cumulative antiviral exposure reaches 4 weeks or longer, antiviral resistance should be further evaluated [43]. BK polyomavirus (BKPyV) replication occurs mainly in the setting of immunosuppression, but donor factors also influence post-transplant risk in recipients. Higher donor BKPyV antibody reactivity is associated with an increased risk of post-transplant BKPyV DNAemia and BKPyV-associated nephropathy; in particular, the combination of higher donor antibody reactivity and lower recipient antibody reactivity is associated with a significantly increased risk of BKPyV DNAemia [45]. However, current evidence is insufficient to support using donor-recipient BKPyV serologic results to guide acceptance of the donor kidney. Clinical management continues to rely primarily on regular monitoring of plasma BKPyV DNA after transplantation and reduction of immunosuppression in patients with persistent or high-level DNAemia [46]. Donor-derived HEV infection is relatively uncommon but may be underestimated. Immunosuppressed recipients may present only with mild elevations in liver enzymes, and antibody responses may be delayed or absent, leading to delayed diagnosis. Reported cases of transmission through kidney transplantation have shown that anti-HEV IgM and IgG may remain negative even when both the donor and recipient are HEV RNA-positive [47]. Therefore, HEV RNA testing should be performed in kidney transplant recipients with unexplained or persistent elevations in liver enzymes, together with an assessment of epidemiologic exposures, rather than relying on antibody testing alone [47]. Arboviral infections show distinct geographic and seasonal patterns.

West Nile virus is an arbovirus for which donor-derived transmission in solid organ transplantation is relatively well documented and can cause severe neuroinvasive disease in transplant recipients [48,49]. In endemic areas or during the West Nile virus transmission season, risk assessment should consider viral activity in the donor's location, local human and mosquito surveillance data, and the presence of unexplained fever or neurologic manifestations in the donor. For donors from endemic areas or during periods of increased viral activity, West Nile virus nucleic acid testing may be considered according to donor type and local testing capacity. Current evidence supports regional and seasonal screening rather than universal year-round screening [48,49].

Donor Bacterial Infection, Preservation Fluid Contamination, and MDR Organisms

Donor bacterial infection and preservation fluid contamination are important sources of donor-derived infection, but the clinical significance of a positive preservation fluid culture depends on the organism isolated. A single-center retrospective study found that kidney transplant recipients with positive preservation fluid cultures had higher rates of early postoperative infection and delayed graft function; recipients who developed possible donor-derived infection also had longer hospital stays and higher rates of graft loss and mortality [27]. Compared with other bacterial contaminants, ESKAPE pathogens in preservation fluid were more strongly associated with possible donor-derived infection, indicating that the clinical significance of preservation fluid culture results depends largely on the contaminating organism [50].

Among multidrug-resistant Gram-negative bacteria, carbapenem-resistant *Klebsiella pneumoniae* (CRKP) is of particular concern. Recipients with CRKP-positive preservation fluid may develop postoperative surgical-site, urinary tract, and bloodstream infections, and possible donor-derived CRKP infection may also lead to perigraft or retroperitoneal abscesses [25,51]. Observational studies suggest that timely targeted antimicrobial therapy guided by susceptibility testing, including regimens containing ceftazidime-avibactam, may improve recipient and graft outcomes; however, current evidence is insufficient to determine the optimal regimen and treatment duration [51]. For recipients in whom highly virulent or multidrug-resistant pathogens are detected in preservation fluid, antimicrobial therapy should be adjusted promptly based on donor culture results, antimicrobial susceptibility testing of preservation fluid isolates, and early microbiologic monitoring of the recipient.

Donor-Derived Fungal Infections

Donor-derived fungal infections are uncommon but may progress rapidly early after transplantation and can result in

graft loss or recipient death. Reports have shown that liver and kidney transplant recipients from the same donor may develop cryptococcosis within the first month after transplantation; when similar infections occur in multiple recipients from the same donor, donor-derived transmission should be considered [52]. Donor-derived mucormycosis may affect both kidney transplant recipients from the same deceased donor and can cause vascular invasion, thrombosis, and graft infarction. In severe cases, graft nephrectomy may be required, and death may occur [53]. *Scedosporium aurianticum* infection has also been reported in both kidney transplant recipients from the same near-drowning donor. One recipient developed renal allograft artery thrombosis, whereas the other developed early postoperative fever and soft-tissue infection outside the allograft [54]. Therefore, donor-derived invasive fungal infection should be considered promptly when the donor has a history of near-drowning, aquatic environmental exposure, or an unrecognized fungal pulmonary infection, or when the recipient develops unexplained fever, graft vascular complications, or unusual local lesions early after transplantation. Other organ recipients from the same donor should be evaluated at the same time.

Infections Associated with Geographic and Social Exposures

Regional epidemiology and social exposure history provide important information beyond routine donor infection screening. A study of living-donor kidney transplantation in Brazil found anti-*Leishmania* antibodies in both donors and recipients. *Leishmania* DNA was detected in some recipients before transplantation or during post-transplant follow-up, but none developed clinical manifestations of leishmaniasis [55]. These findings suggest that, in areas where leishmaniasis is endemic, infection risk assessment should not rely on a single serologic result alone but should also consider residence or travel history, molecular testing, and post-transplant follow-up. Social exposure history may also indicate infection risks that are not readily identified by routine screening. Donor-derived transmission of *Bartonella quintana* from a deceased donor with a history of homelessness to two kidney transplant recipients has been reported [56]. Overall, regional epidemiologic characteristics and social exposure history can provide important information beyond routine screening when assessing donor infection risk. For donors with exposure to specific endemic areas, a history of homelessness, or limited sanitary conditions, the potential risk of donor-derived infection should be assessed in conjunction with pathogen-specific testing and the recipient's post-transplant clinical findings.

Safety Boundaries for the Use of Kidneys from Donors with Infectious Risk

Expanded use of kidneys from donors with infectious

risk should be based on the ability to identify transmission risk, intervene against infection, and provide appropriate post-transplant monitoring. Kidney acceptance should not be determined solely by a positive microbiologic result but should also consider whether the donor infection is controlled whether the kidney intended for transplantation is involved, the virulence and resistance profile of the pathogen, the availability of effective preventive or therapeutic measures, and the potential consequences of transmission. Kidneys associated with HCV, selected HBV-related risks, appropriately treated bacterial infections, and selected positive preservation fluid cultures may be used after risk stratification when established preventive or treatment strategies and post-transplant monitoring are available. In contrast, discarding kidneys solely because of the detection of low-virulence organisms or possible contamination may lead to unnecessary organ loss. The safety boundary is particularly important for infections with severe consequences of transmission and limited options for control. Donor-derived transmission of invasive fungal infections and multidrug-resistant Gram-negative bacteria can cause severe infection and graft-related complications and increase the risk of graft loss and even recipient death [11,25,51,54]. Therefore, a more stringent approach to kidney acceptance is warranted when donor infection remains uncontrolled, the infection involves the kidney intended for transplantation, or effective interventions are lacking and the consequences of transmission are severe [6,11]. The acceptability of kidneys from donors with infectious risk is therefore not determined solely by pathogen type, but by an integrated assessment of the probability of transmission, the consequences of infection, and the availability of effective intervention. Expanding the use of such kidneys requires reducing unnecessary exclusion of manageable infectious risks while avoiding acceptance of donor-derived infection risks that may lead to severe and difficult-to-control outcomes.

Future Research Directions

Future research should further improve the quantitative assessment of kidneys from donors with infectious risk and develop and validate risk-stratification models that can support kidney acceptance decisions based on pathogen characteristics and donor-recipient risk assessment. Because the epidemiology of endemic pathogens, arboviruses, and antimicrobial-resistant organisms varies substantially across regions, donor screening strategies should also be adjusted dynamically according to local epidemiology and antimicrobial resistance patterns [48,50,55]. Current evidence is still based largely on retrospective studies and case series. More prospective multicenter studies are needed to assess long-term safety across different risk settings and to compare the net clinical benefit of accepting a kidney from a donor with infectious risk with that of remaining on the transplant

waiting list. For donor-derived infections that are uncommon but may have severe consequences, future work should further standardize case definitions and reporting criteria, improve systems for communicating delayed test results and tracing recipients of other organs from the same donor, and use regional or national surveillance systems to accumulate real-world data.

Conclusion

Kidneys from donors with infectious risk should not be accepted or declined solely because of a single positive microbiologic test or the detection of a specific pathogen. Clinical decisions should consider the likelihood and consequences of transmission, whether the infection can be controlled, the availability of effective preventive and therapeutic measures and post-transplant monitoring, and the risks associated with continued waiting for transplantation. Kidneys for which the transmission risk can be identified, the infection can be managed, and close post-transplant monitoring can be provided may be selectively used after careful evaluation. Greater caution is warranted when donor infection remains uncontrolled, effective interventions are unavailable, or transmission could result in serious adverse outcomes for the graft or recipient. Expanded use of kidneys from donors with infectious risk should therefore be based on reliable evidence and individualized risk–benefit assessment, with the aim of reducing unnecessary organ discard while avoiding extrapolation of limited clinical experience to settings in which safety has not been established.

Ethics in Publishing

Human and Animal Rights: This review article does not involve human participants, animal subjects, or experiments involving humans or animals. Therefore, ethics approval and informed consent were not required.

Declaration of Interests

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References

1. Chadban SJ, Ahn C, Axelrod DA, et al. KDIGO Clinical

Practice Guideline on the Evaluation and Management of Candidates for Kidney Transplantation. *Transplantation* 104 (2020): S11-S103.

2. Wolfe RA, Ashby VB, Milford EL, et al. Comparison of mortality in all patients on dialysis, patients on dialysis awaiting transplantation, and recipients of a first cadaveric transplant. *N Engl J Med* 341 (1999): 1725-1730.
3. Len O, Garzoni C, Lumbreras C, et al. Recommendations for screening of donor and recipient prior to solid organ transplantation and to minimize transmission of donor-derived infections. *Clin Microbiol Infect* 20 Suppl 7 (2014): 10-18.
4. Shi B, Ying T, Chadban SJ. Survival after kidney transplantation compared with ongoing dialysis for people over 70 years of age: A matched-pair analysis. *Am J Transplant* 23 (2023): 1551-1560.
5. Bhattacharya D, Aronsohn A, Price J, et al. Hepatitis C Guidance 2023 Update: AASLD-IDSA Recommendations for Testing, Managing, and Treating Hepatitis C Virus Infection. *Clin Infect Dis* (2023).
6. Grossi PA, Wolfe C, Peghin M. Non-Standard Risk Donors and Risk of Donor-Derived Infections: From Evaluation to Therapeutic Management. *Transpl Int* 37 (2024): 12803.
7. Jones JM, Kracalik I, Levi ME, et al. Assessing Solid Organ Donors and Monitoring Transplant Recipients for Human Immunodeficiency Virus, Hepatitis B Virus, and Hepatitis C Virus Infection - U.S. Public Health Service Guideline, 2020. *MMWR Recomm Rep* 69 (2020): 1-16.
8. Wolfe CR, Ison MG. Donor-derived infections: Guidelines from the American Society of Transplantation Infectious Diseases Community of Practice. *Clin Transplant* 33 (2019): e13547.
9. Garzoni C, Ison MG. Uniform definitions for donor-derived infectious disease transmissions in solid organ transplantation. *Transplantation* 92 (2011): 1297-1300.
10. White SL, Rawlinson W, Boan P, et al. Infectious Disease Transmission in Solid Organ Transplantation: Donor Evaluation, Recipient Risk, and Outcomes of Transmission. *Transplant Direct* 5 (2019): e416.
11. Eldin C, Grossi PA, Manda V, et al. Updates on Donor-Derived Infection in Solid Organ Transplantation, Report from the 2024 GTI (Infection and Transplantation Group) Annual Meeting. *Transpl Int* 38 (2025): 14237.
12. Fischer SA, Lu K. Screening of donor and recipient in solid organ transplantation. *Am J Transplant* 13 Suppl 4 (2013): 9-21.
13. Ison MG, Grossi P. Donor-derived infections in solid

- organ transplantation. *Am J Transplant* 13 Suppl 4 (2013): 22-30.
14. Kaul DR, Vece G, Blumberg E, et al. Ten years of donor-derived disease: A report of the disease transmission advisory committee. *Am J Transplant* 21 (2021): 689-702.
 15. Phadke VK. Clinical approach to donor-derived infection in solid organ transplant recipients. *Transpl Infect Dis* 26 Suppl 1 (2024): e14344.
 16. Chong CH, Maung Myint T, Gately R, et al. Evaluating Infections in Solid Organ Donors Before Transplantation: A Systematic Review of Clinical Practice Guidelines. *Transplantation* 110 (2026): e1122-e1140.
 17. Peghin M, Grossi PA. Donor-derived infections in solid organ transplant recipients. *Curr Opin Organ Transplant* 28 (2023): 384-390.
 18. Fishman JA, Grossi PA. Donor-derived infection--the challenge for transplant safety. *Nat Rev Nephrol* 10 (2014): 663-672.
 19. McAteer J, Tamma PD. Diagnosing and Managing Urinary Tract Infections in Kidney Transplant Recipients. *Infect Dis Clin North Am* 38 (2024): 361-380.
 20. Rao Z, Wang Z, Tang M, et al. Optimal Perioperative Antimicrobial Management Strategies of Kidney Transplant Recipients Guided by Metagenomic Next-Generation Sequencing of Deceased Donors' Microbiology Samples. *Infect Drug Resist* 16 (2023): 6473-6486.
 21. Machado FP, Vicari AR, Bauer AC. Assessing the impact of positive cultures in preservation fluid on renal transplant outcomes: a scoping review. *J Nephrol* 38 (2025): 321-341.
 22. Tan L, Chen B, Xu Y, et al. Clinical value of metagenomic sequencing in system evaluation of potential donors and donor-derived infection in kidney transplantation. *Am J Transl Res* 16 (2024): 7707-7715.
 23. Malinis M, Boucher HW. Screening of donor and candidate prior to solid organ transplantation-Guidelines from the American Society of Transplantation Infectious Diseases Community of Practice. *Clin Transplant* 33 (2019): e13548.
 24. Yin S, Wu L, Liu C, et al. Risk for Donor-Derived Syphilis after Kidney Transplantation, China, 2007-2022. *Emerg Infect Dis* 30 (2024): 1420-1424.
 25. Gao X, Chen L, Yang S, et al. Donor-derived carbapenem-resistant *Klebsiella pneumoniae* infections leading to retroperitoneal abscesses in kidney transplant recipients: a report of two cases. *BMC Infect Dis* 24 (2024): 1459.
 26. Wan Q, Liu H, Ye S, et al. Confirmed Transmission of Bacterial or Fungal Infection to Kidney Transplant Recipients from Donated After Cardiac Death (DCD) Donors in China: A Single-Center Analysis. *Med Sci Monit* 23 (2017): 3770-3779.
 27. Zhang F, Wang W, Zhong J, et al. Effect of preservation fluid contamination and associated possible donor-derived infections on early postoperative prognosis in kidney transplant recipients. *BMC Microbiol* 24 (2024): 189.
 28. Bowring MG, Holscher CM, Zhou S, et al. Turn down for what? Patient outcomes associated with declining increased infectious risk kidneys. *Am J Transplant* 18 (2018): 617-624.
 29. Bharati J, Anandh U, Kotton CN, et al. Diagnosis, Prevention, and Treatment of Infections in Kidney Transplantation. *Semin Nephrol* 43 (2023): 151486.
 30. KDIGO 2022 Clinical Practice Guideline for the Prevention, Diagnosis, Evaluation, and Treatment of Hepatitis C in Chronic Kidney Disease. *Kidney Int* 102 (2022): S129-S205.
 31. Gordon CE, Adam GP, Jadoul M, et al. Kidney Transplantation From Hepatitis C Virus-Infected Donors to Uninfected Recipients: A Systematic Review for the KDIGO 2022 Hepatitis C Clinical Practice Guideline Update. *Am J Kidney Dis* 82 (2023): 410-418.
 32. Elbeshbeshy H, Modi N, Patel T, et al. Outcomes of kidney, liver, and simultaneous liver and kidney transplants from hepatitis C infected donors to hepatitis C naïve recipients: A large single center experience. *Clin Transplant* 38 (2024): e15161.
 33. Papanikolla J, McGowan M, Chunduru M, et al. Real-world experience in treatment of donor-derived Hepatitis C virus in kidney transplant recipients with delayed initiation, shortened course glecaprevir/pibrentasvir versus standard of care. *Transpl Infect Dis* 26 (2024): e14366.
 34. Ploeger L, Elshoff PL, Kortus-Goetze B, et al. Utilization of Organs from Hepatitis C-Antibody-Positive or RNA-Positive Donors in Kidney Transplantation: A Single-Center Retrospective Analysis of Outcomes and Safety. *J Clin Med* 14 (2025).
 35. Dieter RA, Mattoo A, Hotchkis P, et al. Prophylactic 2-week glecaprevir/pibrentasvir in hepatitis C positive-to-negative kidney transplantation. *Nephrol Dial Transplant* 40 (2025): 1322-1331.
 36. Huprikar S, Danziger-Isakov L, Ahn J, et al. Solid organ transplantation from hepatitis B virus-positive donors: consensus guidelines for recipient management. *Am J Transplant* 15 (2015): 1162-1172.

37. Tam PCK, Katz-Greenberg G, Wolfe CR, et al. Hepatitis B Virus NAT Positive Donors in Non-Hepatic Organ Transplant: Quantifying Viral Loads to Optimize Recipient Risk Stratification and Management in the Prevention of Donor-Derived Infection. *Clin Transplant* 39 (2025): e70236.
38. Terrault NA. Transplanting Kidneys From Donors With Chronic Hepatitis B: Bringing Transmission Risk Closer to Zero. *Clin Infect Dis* 72 (2021): 1024-1025.
39. Ambrosioni J, Levi LI, Alagaratnam J, et al. Major revision version 13.0 of the European AIDS Clinical Society guidelines 2025. *HIV Med* 27 (2026): 18-32.
40. Durand CM, Massie A, Florman S, et al. Safety of Kidney Transplantation from Donors with HIV. *N Engl J Med* 391 (2024): 1390-1401.
41. Nambiar PH, Liang T, Labo N, et al. Kaposi Sarcoma-Associated Herpesvirus Risk and Disease in Kidney Donors and Transplant Recipients With HIV in the United States. *Clin Infect Dis* 82 (2026): 709-719.
42. Rozek GM, Yang P, Eby Y, et al. HIV Superinfection in Kidney Transplant Recipients With HIV Who Received Organs From Donors With HIV. *J Infect Dis* 232 (2025): 359-363.
43. Kotton CN, Kumar D, Manuel O, et al. The Fourth International Consensus Guidelines on the Management of Cytomegalovirus in Solid Organ Transplantation. *Transplantation* 109 (2025): 1066-1110.
44. Limaye AP, Budde K, Humar A, et al. Letermovir vs Valganciclovir for Prophylaxis of Cytomegalovirus in High-Risk Kidney Transplant Recipients: A Randomized Clinical Trial. *JAMA* 330 (2023): 33-42.
45. Wunderink HF, van der Meijden E, van der Blij-de Brouwer CS, et al. Pretransplantation Donor-Recipient Pair Seroreactivity Against BK Polyomavirus Predicts Viremia and Nephropathy After Kidney Transplantation. *Am J Transplant* 17 (2017): 161-172.
46. Kotton CN, Kamar N, Wojciechowski D, et al. The Second International Consensus Guidelines on the Management of BK Polyomavirus in Kidney Transplantation. *Transplantation* 108 (2024): 1834-1866.
47. Solignac J, Boschi C, Pernin V, et al. The question of screening organ donors for hepatitis E virus: a case report of transmission by kidney transplantation in France and a review of the literature. *Virol J* 21 (2024): 136.
48. Anesi JA, Silveira FP. Arenaviruses and West Nile Virus in solid organ transplant recipients: Guidelines from the American Society of Transplantation Infectious Diseases Community of Practice. *Clin Transplant* 33 (2019): e13576.
49. Soto RA, McDonald E, Annambhotla P, et al. West Nile Virus Transmission by Solid Organ Transplantation and Considerations for Organ Donor Screening Practices, United States. *Emerg Infect Dis* 28 (2022): 403-406.
50. Yu X, Wang R, Peng W, et al. Incidence, distribution and clinical relevance of microbial contamination of preservation solution in deceased kidney transplant recipients: a retrospective cohort study from China. *Clin Microbiol Infect* 25 (2019): 595-600.
51. Zhang F, Zhong J, Ding H, et al. Effects of preservative fluid associated possible donor-derived carbapenem-resistant *Klebsiella pneumoniae* infection on kidney transplantation recipients. *BMC Nephrol* 23 (2022): 101.
52. Sha M, Shen C, Tong Y, et al. Cluster of Donor-Derived Cryptococcosis after Liver and Kidney Transplantation. *Emerg Infect Dis* 28 (2022): 2112-2114.
53. Farkouh EK, Michel IM, Harrison DJ, et al. Dual Donor-Derived Renal Allograft Mucormycosis From a Single Deceased Donor. *Mayo Clin Proc* 99 (2024): 1341-1342.
54. Choudhary D, Kaur H, Subramani VN, et al. Scedosporium Infection in Recipients of Kidney Transplants from Deceased Near-Drowning Donor. *Emerg Infect Dis* 29 (2023): 2406-2408.
55. Johanson GH, Sanchez MCA, Souza RM, et al. Screening for anti-Leishmania antibodies and Leishmania infections in kidney transplant recipients and donors from Brazil. *Rev Inst Med Trop Sao Paulo* 67 (2025): e67.
56. Beeson AM, Rich SN, Russo ME, et al. Bartonella quintana Infection in Kidney Transplant Recipients from Donor Experiencing Homelessness, United States, 2022. *Emerg Infect Dis* 30 (2024): 2467-2475.



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