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Editorials and Perspectives: Overview

HTLV-1 in Solid-Organ Transplantation

Current Challenges and Future Management Strategies

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Abstract

Human T-cell lymphotrophic virus (HTLV)-1 has been reported after solid-organ transplantation, with a related fatal outcome in less than five cases. The natural history of HTLV-1 transmission from donor to recipient is unknown in this setting, because available screening platforms are suboptimal in low-prevalence areas and there is a lack of long-term follow-up. Minimizing organ wastage due to false-positive screening and avoiding donor-derived HTLV-associated diseases remain the goal. To date, only six HTLV-naive organ recipients from four donors (only one had confirmed HTLV) have developed HTLV-associated disease after transplantation. All of these cases were described in countries or from donors from HTLV-endemic regions. To the best of our knowledge, there have been no reported cases of donor-derived HTLV-1–associated death after organ transplantation in the world. Based on data from low-prevalence countries (Europe and the United States) and the current shortage of donor organs, it appears plausible to authorize the decision to transplant an organ without the prior knowledge of the donor's HTLV-1 status. Currently, it is not possible to exclude such transmission and recipients should be informed of the possible inadvertent transmission of this (and other) infections at the time of consent. In those cases where HTLV-1 transmission does occur, there may be a therapeutic window in which use of antiviral agents (i.e., zidovudine and raltegravir) may be of benefit. The development of national/international registries should allow a greater understanding of the extent and consequences of transmission risk and so allow a more evidence-based approach to management.

Transmission of infection from donor to recipient is one of the many risks associated with organ transplantation. Such risks can be reduced by careful donor assessment, but they cannot be abolished. The widening gap between the need for organs and the availability of organs donated by deceased individuals means that the transplant community has to manage such risks. One area of focus has been the risk associated with the procurement of organs from donors positive for human T-cell lymphotrophic virus (HTLV) infection. This review provides an overview of HTLV infection and the risks associated with transmission and addresses the challenges that surround HTLV in the transplant community.

OVERVIEW OF HUMAN T-CELL LYMPHOTROPHIC VIRUS INFECTION

HTLVs are enveloped, double-stranded RNA viruses, also known as delta retroviruses. Gallo et al. first described type 1 (HTLV-1) in 1980 and type 2 (HTLV-2) after 2 years ([1, 2]).

Epidemiology

HTLV-1 infects an estimated 15 to 20 million individuals worldwide ([3]) and is primarily transmitted from mother to child (usually through breast feeding), although transmission via blood products, intravenous drug use, sexual intercourse, and organ transplantation can occur ([4]). HTLV infection is endemic in southern Japan (seroprevalence up to 10%) ([5]), the Caribbean (3%–6%) ([6, 7]), sub-Saharan Africa (1%–5%) ([8]), and South America and in pockets of the Middle East and the Pacific Oceania islands. In contrast, only 0.0006% ([9]) to 0.046% ([10]) of healthy blood donors are infected with HTLV-1 or HTLV-2 in Europe and the United States, respectively. Romania is the exception in Europe, with reported rates of HTLV-1 alone as high as 0.053% in first-time blood donors ([11, 12]). The majority of HTLV-1 infections in low-risk countries are found in the ethnic minorities that have emigrated from endemic areas ([13]), whereas intravenous drug users together with their sexual contacts account for a large proportion of HTLV-2 infection ([14]). Seroprevalence increases with age and is female predominant in those over 30 years of age, as sexual transmission occurs more easily from males to females ([15]).

Natural History

HTLV-1 and HTLV-2 are lifelong infections, but the vast majority will not develop any clinical manifestations throughout their lifetime. The two main diseases associated with HTLV-1 are adult T-cell leukemia/lymphoma (ATLL) and HTLV-1–associated myelopathy (HAM), also known as tropical spastic paraparesis. The lifetime risk of HTLV-1–infected individuals developing ATLL is 2% to 5% ([16, 17]) and HAM is 1% to 2% ([15, 18]). The pathogenicity of HTLV-2 in humans remains uncertain, although isolated cases of neurologic disease, inflammatory arthritis, and lymphocytic leukemia have been reported ([19]). The major clinical manifestations and reported associations of HTLV-1 infection are summarized in Figure 1 ([20–26]).


FIGURE 1:
HTLV-1–associated minor/major disease manifestations. HTLV, human T-cell lymphotrophic virus.

The risk factors for progressing to ATLL or HAM are not well understood, but HTLV-1 proviral (HTLV-1 DNA within the host cell genome) loads have been previously linked with both HAM and other neurologic abnormalities ([27]). With the exception of ATLL-associated mortality, there are very few reports worldwide on the mortality rate of asymptomatic and/or symptomatic HTLV-1 infection. The largest cohort study performed in Japan between 1985 and 1995 highlighted that HTLV-1 carrier status (in the absence of ATLL) was associated with a significantly increased risk of age/sex-adjusted mortality (risk ratio=1.4). This study was limited, however, by a lack of confounding data on blood transfusion and the transmission of other bloodborne viruses, including hepatitis B and C viruses ([28]).

Screening and Diagnostic Methods

Over the last two decades, laboratory testing for HTLV-1/2 infections has become routine in blood transfusion, solid-organ/tissue transplantation, and clinical diagnoses in many countries in the world ([29]). Screening is based on the detection of HTLV antibodies, which develop 1 to 3 months after exposure to HTLV infection and persist for life ([4]). Enzyme-linked immunosorbent assays (ELISA) are the most widely used method for serologic screening; however, they remain limited for specifically screening HTLV-1 infection, as current available ELISAs cannot distinguish it from HTLV-2 infection ([4]). The reason for this is that current ELISAs only detect serologic antibody responses to the virus, which are indistinguishable between HTLV-1 and HTLV-2 strains ([4]). Those blood samples that are positive twice on ELISA testing are referred to as “repeat reactive”. ELISAs are sensitive (~100%) but lack specificity in populations of low HTLV prevalence (such as the United States and Europe) ([30, 31]). Confirmatory testing should be performed with immunoblotting (i.e., Western blotting or specific line immunoassay), which, unlike ELISAs, can differentiate between HTLV-1 and HTLV-2 infection by identification of specific viral protein products ([4]). Polymerase chain reaction (PCR) nucleic acid sequence–based amplification testing (NAT) may also be used to diagnose infection and at the same time provide quantification of HTLV-1 proviral loads ([32]).

HUMAN T-CELL LYMPHOTROPHIC VIRUS INFECTION IN SOLID-ORGAN TRANSPLANTATION

Transmission of HTLV-1 through solid-organ transplantation has been reported for a variety of solid organs. The exact route of HTLV-1 infection, however, has been difficult to establish in several of these cases due to coexisting risk factors (e.g., blood transfusions and hemodialysis ([33]) and high rates of preexisting HTLV-1 carrier status in recipients from endemic areas. Because of a lack of

prospective studies with long-term follow-up, the risks of HTLV-1 transmission from solid-organ transplantation and development of HTLV-1–associated disease after transplantation remain unknown. Isolated reports have suggested that immunosuppression and HTLV-1 proviral load are key determinants in disease development after transplantation ([33–36]), but these associations have not been confirmed in larger follow-up studies ([37, 38]).

Prevalence of Human T-Cell Lymphotrophic Virus Seropositivity in Organ Transplantation

Human T-Cell Lymphotrophic Virus–Positive Donors

European ([39, 40]) and American ([30, 41]) studies highlight very low rates of HTLV-1/2 infection in deceased donors, ranging from 0.047% to 1.6%, respectively. Of the 22 of 1408 (1.6%) positive ELISA HTLV-1/2 donors reported by Nowicki et al. in the United States ([30]), only 5 cases of HTLV-2 and a solitary case of HTLV-1 were proven with Western blotting. Their study population largely consisted of Afro-Caribbean or Hispanic donors; thus, the higher rate of HTLV-2 is likely attributed to a greater influx of immigrants from countries with a high incidence of HTLV-2 carriers ([30]).

Between 2004 and 2011 years, 5984 deceased donors had solid organs procured for transplantation in the United Kingdom, of which only 30.8% (1844 of 5984) had a definitive HTLV-1/2 antibody result captured by the UK NHS Blood and Transplant database. Only 0.2% (4 of 1844) of deceased donors with recorded test results were found to be repeat reactive for HTLV-1/2 antibodies (Table 1). Of the eight recipients (six kidney, one liver, and one pancreas), no cases/symptoms of posttransplantation HAM/ATLL have been reported, but the duration of follow-up is limited to only 2 to 6 years in these cases. Similarly, American data from the Organ Procurement Transplantation Network (OPTN)/United Network of Organ Sharing (UNOS) identified no cases of HTLV-1–associated disease among 162 recipients of 134 repeat reactive HTLV-1/2-positive donors between 1999 and 2008 ([42]). These two data sets are somewhat limited, however, as they only include donors whose organs were procured and lack confirmatory testing (such as Western blotting or PCR), pretransplanatation/posttransplantation recipient test results, records of neurologic symptoms, and long-term follow-up.

T1-1

TABLE 1:

Number of HTLV-positive deceased donors transplanted in United Kingdom 2004–2011: NHS Blood and Transplant database

To give a more accurate reflection of all potential organ donors in the United States, and not just those used, Kaul et al. reviewed data on 14,432 screened donors and found that 1.04% screened positive on repeat ELISA testing for HTLV-1/2 ([42]). However, in keeping with previous blood donor data, the only laboratory from the UNOS data set that attempted to distinguish HTLV-1 from HTLV-2 revealed that only 0.03% (1 of 3490) of all individuals screened were actually positive for HTLV-1 on confirmatory testing with immunoblotting [42]).

In contrast to the United States study, which has screened solid-organ donors since 1994, there remains a paucity of data on the prevalence of seropositive donors in HTLV endemic countries.

Human T-Cell Lymphotrophic Virus–Positive Recipients

There are few studies on the prevalence of HTLV-1/2 positivity in individuals awaiting organ transplantation, but rates appear to parallel that of general population studies. In high HTLV-endemic regions, such as Japan and Brazil, reported rates range from 7.1% to 11.1% ([37, 43–45]). In contrast, a solitary American study by Perez et al. reported that 6 of 224 (2.7%) renal transplant

recipients tested positive with ELISA and only 2 of which were confirmed positive for HTLV-1 on Western blotting ([46]). These rates, however, are unlikely to be a true representation of all organ recipients, as the majority of the kidney recipients had a prior history of long-term hemodialysis and/or blood transfusion, both well-recognized routes of viral transmission.

Posttransplantation Human T-Cell Lymphotrophic Virus–Associated Morbidity and Mortality

On review of the literature, only six HTLV-naive organ recipients from four donors (of which only one had proven HTLV) have developed HTLV-associated disease after organ transplantation ([33, 34, 47, 48]) (Table 2). All of these cases were described in countries or from donors from HTLV-endemic regions. In low-prevalence populations, such as the United States, recipients of HTLV-1/2 reactive organs have been shown to carry no significant risk of graft failure (hazard ratio, 1.2) or decreased survival (hazard ratio, 1.06) in comparison with recipients of HTLV-negative grafts ([49]). Furthermore, we are unaware of any reported deaths directly related to HTLV-positive organ donation. Whilst the Marvin et al. ([49]) analysis of the UNOS registry and the lack of reported donor-derived HTLV-associated deaths offer a degree of reassurance in low-prevalence countries, the true magnitude of the long-term risks of potential HTLV transmission in the transplant setting remains unknown. This is largely as a result of the lack of long-term follow-up, incomplete analyses (i.e., 49% of the donors [>40,000] in the UNOS were excluded due to unknown HTLV status), and the incidence of false-positive testing with current serologic screening tools.

T2-1
TABLE 2:
Published cases of HTLV-associated disease after solid-organ transplantation

Kidney Transplantation

Between 1989 and 2000, 10 cases of HTLV-related ATLL ([33, 35, 50–53]) and 2 cases of HAM ([48, 54]) after cadaveric kidney transplant were reported. In the absence of donor HTLV status, the majority of these cases (if not all) are likely to have been due to other routes of transmission (such as mother-to-child, infected blood transfusion, and sexual intercourse), as only 2 cases were seronegative before transplantation. Of note, 11 of 12 cases were reported from known endemic areas in Japan in which blood screening was not introduced until 1989, whereas the one UK patient originated from the Caribbean ([50]). Subsequently, researchers hypothesized that immunosuppression may accelerate the progression of HTLV-1–associated disease in infected renal recipients ([34]). In contrast to these isolated cases, combining data from retrospective cohort studies by Tanabe et al. (n=16; case series only) ([38]), Nakamura et al. (6 of 120) ([43]), and Perez et al. (2 of 224) ([46]) revealed that none of the 24 renal recipients that had positive HTLV serology pretransplant progressed to ATLL or HAM 3 to 13 years after organ transplantation. These studies therefore question the causative association between immunosuppression and HTLV disease development but, at the same time, should be interpreted with caution until longer follow-up data are available.

The first confirmed case of donor-derived HTLV infection was reported from Argentina in 2000 when a terminally ill child received a kidney graft from her seropositive mother ([55]). Despite undergoing seroconversion within 3 months of transplant, the child remained disease-free 4 years on. The first and only definitive cases of solid-organ donor-derived HTLV-1–associated disease emerged from Spain shortly after ([34, 36]). All three recipients (two kidney and one liver) were seronegative at transplantation, received cyclosporine, and developed HAM within 2 years of transplantation. The single donor who died of brain injury was previously infected by vertical transmission from his Venezuelan mother but was an asymptomatic unknown carrier at the time of donation. These three recipients are unique, in that they are the only reported cases of HAM after

transplantation with homologous DNA sequencing to the infections origin to the donor's mother ([34]). Ten years later, Inose et al. reported the first case of HAM after live-related kidney donation ([47]). The spastic paraparesis presented within 10 months of transplantation, but the HTLV-1 status of the donor was not measured ([47]).

Liver Transplantation

To date, there have only been five cases of HTLV-1–associated disease reported after liver transplantation worldwide: two cases of HAM ([34, 56]) and three of ATLL ([57, 58]). It is noteworthy that all three cases of ATLL originated from the recipients' viral strain and not the living donor and that two of three of subsequent deaths were due to chronic rejection ([57]). Indeed, the only confirmed liver donor-derived HTLV-1 who subsequently developed HAM is from the same Spanish donor who infected the two renal recipients described above ([34]). A recent study from Japan has suggested that recipient HTLV-1 infection has significant effects on 5-year survival after live-related liver transplantation for hepatitis C virus (15% vs. 67% hepatitis C virus monoinfection, P=0.04) ([45]). This study should, however, be interpreted with caution, as the study population consisted of only seven coinfected recipients, in which the commonest cause of death was chronic rejection and none died of HTLV-associated disease.

Heart Transplantation

The only reported case of HTLV-1–related disease after cardiac transplantation is from France ([59]). In this solitary case of HAM-associated death (<2 years), the recipient was infected by a blood transfusion at the time of transplant and not from the organ itself ([60]).

Lung Transplantation

There are currently no reported cases of HAM or ATLL after lung transplantation. Yara et al. described the first case of asymptomatic HTLV-1 transmission from a seropositive live-related lung donation ([61]). The decision to proceed in the prior knowledge of a donor-recipient HTLV mismatch in this case was clearly justified as the recipient's need was critical and 5 years after transplantation she remains asymptomatic.

Current Guidelines for Human T-Cell Lymphotrophic Virus Screening in Organ Transplantation

To date, no official recommendations exist in international transplant society guidelines with regards to HTLV organ donor screening and usage. There is, however, a general consensus among experts that local epidemiology, population migration, and availability of HTLV screening tests should all influence individual national screening policies.

Over the last two decades, it has been routine practice in parts of Europe and the United States to discard organs retrieved from deceased donors that are repeat reactive for HTLV-1/2 on ELISA. Exceptions to this include cases of urgent need in which the patient is willing to except the potential "risks" and in centers with long waiting lists (such as New York) ([49]). In October 2009, however, the OPTN/UNOS executive committee removed the requirement for prospective HTLV-1/2 screening of deceased donors in the United States. This decision was based on organ wastage due to false-positive screening tests ([42, 49]), the very low prevalence of HTLV-1 in the United States ([10]), and the paucity of Food and Drug Administration–approved HTLV-1 screening tests ([42]). However, to ensure long-term safety and to enhance our knowledge of HTLV-1 in the transplant community, the Ad Hoc Disease Transmission Advisory Committee recommended that retrospective HTLV-1/2 screening of deceased donors should be undertaken. Furthermore, in the event of screening positive, confirmatory testing for HTLV-1 with immunoblotting should be

mandatory to enable individualized follow-up and management ([42]). These recommendations were not intended to be universal, as they were specifically based on the epidemiology of HTLV-1/2 in the United States. To date, however, the OPTN/UNOS have not adopted the Ad Hoc Disease Transmission Advisory Committee proposal for retrospective screening and there remains no formal policy regarding confirmatory testing.

At present, the Council of Europe and the European Commission recommend that HTLV-1/2 screening should be undertaken in deceased donors who have lived in or have migrated from high-prevalence areas ([62]). This approach is somewhat limited, however, by the lack of definition of what constitutes "high prevalence". To overcome this, an ad hoc panel organized by the European Centre for Disease Prevention and Control in 2012 suggested that prevalence of more than 1% in the general population (or >0.01% first-time blood donors) could be considered as high ([63]).

Current Challenges of Human T-Cell Lymphotrophic Virus in Organ Transplantation

The lack of consensus guidelines addressing HTLV in organ transplantation highlights the pitfalls that exist in available screening/diagnostic modalities and in our knowledge of transmission risk and subsequent disease manifestation.

Limitations of Screening and Confirmatory Testing

Currently available ELISA tests lack specificity in low-prevalence populations (the United States and Europe) and are unable to distinguish between HTLV-1 and HTLV-2 ([31]). The resultant false-positive rate in these organ donor populations has huge implications on the wastage of appropriate organs in times when demand is at an all time high. Using sensitivity and specificity values provided by the manufacturers, Huang and Fishman highlighted that the Abbott PRISM HTLV-I/II ELISA would result in 40 false positives for every 1 true positive in a hypothetical low-prevalence (0.04%) population of 100,000 donors ([64]). Using the same model in a hypothetical population with a 15% prevalence such as Japan, the positive predictive value of the PRISM assay approaches ~1.0 ([64]) and thus most likely minimizes organ wastage in endemic regions. In contrast, Kaul et al. calculated that approximately 135 to 195 healthy organs (45–60 donors) are being wasted annually in the United States as a result of false-positive tests with existing screening tools ([42]). Other HTLV-1/2 assays are commercially available ([29]), including the Avioq HTLV-I/II Microelisa System (www.avioq.com), which as of March 2012 became the second Food and Drug Administration–licensed assay. The validity of both new and older assays is limited by the fact that they are designed for high-throughput blood screening and not single-sample analysis, which is essential to achieve the rapid turnaround times that are required in organ donation.

Due to the false-positive rate of ELISAs in low-prevalence areas and their lack of ability to differentiate the more clinical significant HTLV-1 infection from the HTLV-2 strain, mandatory confirmatory testing (immunoblotting or PCR NAT) is required to confirm true positives and more specifically identify HTLV-1. As with the ELISAs, the slow turnaround time of immunoblotting (or PCR NAT) would not be compatible with an acceptable cold ischemic time; thus, diagnostic confirmation would only be available after transplantation. The latter, however, may be sufficient in the advent of postexposure prophylactic strategies (discussed below). The ideal screening tool in organ transplantation needs to be both sensitive and specific for HTLV-1 in low-prevalence populations in addition to being compatible with the time constraints of organ utilization. One circumstance in which confirmatory HTLV-1 testing of the donor organ (immunoblotting or PCR NAT) would be feasible without an unacceptable delay to organ transplantation is live-related organ donation. In the advent of identifying a live-related HTLV-1–positive organ donor, another

donor may be sought or in cases of urgent need in which the recipient is willing to except the potential “risks” donation can proceed.

Lack of Clinical Data and Long-term Follow-up

The current lack of long-term follow-up, confirmatory testing (<70% in the United States ([65])), and recordings of neurologic/malignant sequelae, in both low-prevalence and high-prevalence populations, restricts our understanding of the true risk of donor-derived HTLV transmission and disease manifestation after transplantation. In the absence of large-scale evidence and only isolated posttransplantation cases of severe HTLV-associated disease in endemic areas, an evidence-based approach to advise whether organs from positive donors should be used is not possible. Certainly, the lack of significant effect on graft or patient survival, the inadequacies of current screening tools in low-prevalence countries, and the mortality of those awaiting a transplant support the active consideration of the use of infected organs for selected recipients ([49, 66]). Examples of recipients whose benefits may far outweigh the risks include those with an urgent need of transplant, older recipients, and those with preexisting HTLV-1 infection. The decision not to use positive organs in recipients with preexisting infection, as outlined by the Japanese Transplant Organization, has much greater consequences in endemic countries, with an estimated 3% to 5% loss of potential donor availability ([4]).

Over the last 50 years, there have been marked shifts in migration to countries that offer transplantation services. For example, the Caribbean-born population in the United States has increased more than 17-fold over this time period ([67]). Subsequently, the characteristics of organ donor pools are likely to change with time and will likely consist of more asymptomatic HTLV carriers from endemic countries. These migration trends have implications for national screening policies and highlight the importance of maintaining up to date seroprevalence records, with specific emphasis on countries (such as Spain) that opt to screen donors from endemic areas only ([4]).

Future Directions

Striking the correct balance between minimizing organ wastage due to false-positive screening and avoiding inappropriate donor-derived HTLV-associated diseases remains the common goal. Due to the time constraints between organ retrieval and transplantation, one area of focus to prevent or minimize the severity of HTLV-1 infection is the use of postexposure prophylaxis.

HTLV-1 Postexposure Prophylaxis

Following exposure to HTLV-1, there may be a therapeutic window to prevent or reduce the severity of HTLV-1 infection using postexposure prophylaxis. Such a therapeutic window has not been previously investigated in patients exposed to HTLV-1 through organ transplantation because of a lack of data on transmission risk during this time frame. However, with increased disease awareness and improved PCR technology (with improved laboratory infrastructure and the possibility of proviral load readings within 48 hr of transplantation), this is now an option. We are not aware of any observational “proof of concept” studies for postexposure HTLV-1 prophylaxis. The choice of potential antiviral agents in this setting can, however, be guided by animal data ([68, 69]), in vitro data ([70, 71]), and clinical trials in established HTLV-associated diseases ([72]).

Two therapies, namely zidovudine (nucleoside analogue reverse transcriptase inhibitor) and raltegravir (integrase inhibitor), have been shown to inhibit HTLV-1 replication both in vitro ([70, 71, 73]) and in vivo ([68]). Both agents are currently licensed for the treatment of HIV-1 infection. Zidovudine is generally well tolerated in humans with early side effects (nausea, vomiting, and headache) self-limiting and the main long-term complications being reversible macrocytic anemia

and lipodystrophy. Raltegavir, the newer of the two compounds, is favored as an antiretroviral therapy in HIV-1–infected patients undergoing transplantation as it is well tolerated and has not been shown to interact with immunosuppression drugs (tacrolimus or cyclosporine) ([74, 75]).

In light of the safety profile of zidovudine and raltegravir and the severity of HTLV-1–associated diseases, we would recommend antiviral prophylaxis for any recipient of an organ from a HTLV-1–infected donor. A proposed algorithm for HTLV-1 prophylaxis/preemptive therapy in organ transplantation is summarized in Figure 2. Once HTLV-1 infection is established in the asymptomatic recipient as shown by detection of HTLV-1 DNA in peripheral blood mononuclear cells, it is likely too late to alter the course of the infection ([76]). Our proposed management strategy is based on expert opinion only (GJT) and is not an established approach. For this reason, it is essential that the efficacy of such is assessed at the earliest opportunity after implementation.


FIGURE 2:
Proposed algorithm for HTLV-1 prophylaxis/preemptive therapy in recipients of HTLV-1–positive donors. The decision of whether or not to initiate immediate prophylaxis is based on whether the donor HTLV-1 status is known within 48 hr of transplantation. HTLV, human T-cell lymphotrophic virus; BD, bidaily; Tx, therapy.

CONCLUSION

HTLV-1 infection rarely develops into clinically significant disease after transplantation; however, because of suboptimal screening platforms and a lack of long-term follow-up, the natural history of HTLV-1 transmission remains unknown in this setting. The marked regional differences in the prevalence of HTLV-1 and isolated cases of viral-associated disease highlight the importance of developing national guidelines based on local and current epidemiologic records. Based on the most recent data from low-prevalence countries and the current shortage of donor organs, it appears plausible to authorize the decision to transplant an organ without the prior knowledge of the donor's HTLV-1 status. To minimize the long-term risk of adopting such a strategy, however, recipient and donor status should still be confirmed immediately after transplantation and new prophylaxis regimens should be considered in the event of HTLV-1 donor exposure. Until there is ready availability of robust tests for HTLV-1 infections that are cheap and able to generate results for a single sample within a short time frame, clinicians will need to evaluate the risks and possible consequences of transmission of HTLV infection from donor to recipient. Because, at the present time, it is not possible to exclude such transmission, recipients should be warned of the possible inadvertent transmission of HTLV (and other) infections. In those cases where transmission does occur, use of antiviral agents may be of benefit. The development of national or international registries should allow a greater understanding of the extent and consequences of this risk and so allow a more rational approach to management.

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Keywords:

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