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Editorial

Ebola Virus Disease: Implications for Solid Organ Transplantation

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The current Ebola virus epidemic is unprecedented in scope, affecting 9178 individuals with transmission from individuals infected in West Africa to health-care workers (HCW) in the United States and Europe (1). Although transmission via organ transplantation has not occurred, it is important for the transplant community to recognize risk factors for Ebola virus disease (EVD) among potential donors to avoid this occurrence.

Symptomatic patients have virus disseminated in multiple organs and body fluids, and transmission occurs via contact with infected fluids (2). It is plausible, however, that organ donors might be infectious prior to the development of symptoms; donors with other asymptomatic infections (e.g. lymphocytic choriomeningitis virus) have transmitted infection to recipients (3). Donor-derived infection (DDI) could involve a donor who died of unrecognized EVD, or more likely an infected but not yet symptomatic donor. These potential donors could be residents of outbreak countries traveling to the United States, American workers/military personnel returning from areas of active EVD, or contacts of EVD patients in the United States.

The consequences of such a transmission, however unlikely, would be potentially grave. Not only would one expect Ebola virus transmitted to multiple immunosuppressed recipients to have a high mortality rate, but, in contrast to virtually all other instances of DDI, the implications for public health and exposed HCW would be significant. EVD would not be considered until multiple recipients developed disease, alerting those caring for the recipients to suspect DDI. An investigation would likely ensue, and could require significant time to make the correct diagnosis depending on when the donor's connection to EVD was suspected. Exposed individuals could include operating room personal and medical workers in the donor's hospital, as well as HCW, visitors, and perhaps other patients at recipient hospitals. While universal precautions are standard, recent events have demonstrated that these are not adequate to protect HCW. Adding to the potential impact, it is quite conceivable that heavily immunosuppressed recipients dying of unrecognized EVD would require intensive medical care in the setting of very high viral loads and be especially contagious.

An assessment of whether or not an organ from a donor at increased risk of transmitting an infection should be used relies on balancing the risk of transmittable disease combined with the consequences of transmission (e.g. is the transmitted disease treatable?) against the urgency of need for transplantation. For example, most surgeons would accept a Public Health Service increased risk donor whose risk factor was brief incarceration 9 months prior for a potential adult liver recipient with a high Model for End-Stage Liver Disease score. In most scenarios associated with an increased risk for transmission of DDI, the recipient participates in the decision through the informed consent process. In the case of Ebola, however, the willingness to accept this risk to gain the benefit of an organ is likely outweighed by the risk of spreading the virus to HCW and other contacts in the absence of a proven treatment and an almost certain transplant associated mortality. This risk to others cannot be resolved using informed consent.

Screening must be structured to minimize organ wastage. Given limited availability and poor sensitivity during the incubation period, laboratory testing is not likely to be useful as a screening tool to exclude transmissible infection. Rather, assessment of epidemiological risk factors is required. The European Union has taken a conservative approach, excluding from donation of blood or any ''substance of human origin'' for 60 days after returning from an area of EVD activity or other known exposure, with

an exception of 1 month in the case of ''urgent need for organ transplantation'' if negative Ebola virus nucleic-acid amplification testing is performed (2, p. 2). In the United States, the Organ Procurement and Transplantation Network/United Network for Organ Sharing Ad Hoc Disease Transmission Advisory Committee has provided some guidance regarding the risk of donor-derived EVD (4).

We believe that until the EVD outbreak ends, a simple assessment of all potential donors (living or deceased) for risk factors is appropriate. These risk factors include the following:

- Travel in the previous 21 days to an area of significant EVD activity
- HCW working *directly* with EVD patients in the past 21 days
- Others (e.g. family members) with *direct* exposure to a patient with proven EVD in the past 21 days.

Obtaining this information should not be a significant burden. Most organ procurement organizations are already obtaining travel history and the Uniform Donor Risk Assessment Interview includes a question regarding the specifics of travel. Notably, travel to other parts of Africa, foreign travel in general, or working in healthcare (without EVD exposure) does not create risk. Similarly, contacts of asymptomatic individuals exposed to EVD would not be considered at risk.

The approach suggested above may not identify all donors at risk for transmitting EVD. Asymptomatic infection with Ebola virus occurs, and those that recover from EVD may shed virus for prolonged periods of time (5,6). It is not known how long potential donors in either situation have infectious virus in organs. Thus, while we feel that a 21-day exclusion is a reasonable starting point, each offer should be evaluated individually assessing urgency of recipient need, obtaining recipient informed consent, and alerting centers to monitor for recipient clinical findings suggestive of EVD. Serial testing for EVD in the recipient could be considered as well. Further, potential donors (or their family members) may not be aware of specific exposures.

These concerns during the Ebola outbreak should not impede our ability to deliver vital organs to patients in need. With appropriate screening of donors, we can minimize risk for Ebola transmission with little impact on the donor pool.

Disclosure

The authors of this manuscript have no conflicts of interest to disclose as described by the *American Journal of Transplantation*.

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