Strategies to Expand the Deceased Donor Pool for Pediatric Kidney Transplant Recipients

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INTRODUCTION

Kidney transplantation is the treatment of choice for children with ESKD; however, access to transplantation is limited by the escalating gap between the organ supply and demand. In 2018, only 36% of the 756 pediatric kidney transplants were living donor transplants, indicating that pediatric candidates rely heavily on the deceased donor waiting list. The prevalence of pediatric candidates on the waiting list was 1585 in December 2018 (1). The increase in prevalence is due to a combination of longer waiting times and a decline in deceased donor transplant rates. According to the annual Scientific Registry of Transplant Recipients report, pediatric deceased donor transplant rates declined by 27% from 2009 to 2018 (52/100 versus 37.9/100 waitlist-years). Of the children waitlisted in 2015, 2% died on the waiting list and 15% were still waiting by 2018 (1).

Timely transplantation in children is critical for their growth and development. Compared with a functioning graft, dialysis is associated with six times lower patient survival, poorer physical growth, and inferior neurocognitive development (2). Considering the high morbidity and mortality on dialysis, we must explore strategies that would expand the deceased donor pool for children.

ORGAN DISCARD

Despite the severe organ shortage, 20% of kidneys are discarded annually in the United States. In 2019, kidneys from 4460 deceased donors were discarded (3). Of these, 50% were expanded criteria or high kidney donor profile index (KDPI) kidneys (KDPI is a numeric score denoting donor quality based on several donor characteristics), 26% were kidneys donated after cardiac death, and 23% were kidneys at risk of inadvertently transmitting HIV/hepatitis B/hepatitis C to the recipients (3). Other predictors of discard include pediatric donor age, cytomegalovirus seropositivity, hepatitis B/C seropositivity, cigarette use, diabetes, and AB blood type (4). In this article, we review pediatric kidney transplant outcomes associated with kidneys that are more likely to be discarded. The objective of this review is to assess whether any of the 20% of the kidneys that are annually discarded would be suitable for pediatric candidates.

INCREASED RISK DONOR TRANSPLANTS

Increased risk donors (IRDs) are donors who may inadvertently transmit hepatitis B and C and/or HIV to transplant recipients despite testing negative on ELISA or nucleic acid amplification testing due to their window period. IRDs are identified based on the Center for Disease Control and Prevention guidelines that were most recently updated in 2013 (Table 1).

Although the risk of virus transmission by an IRD is not zero, the risk is small: 0.027–32.4 per 10,000 IRDs for hepatitis C and 0.04–4.9 per 10,000 IRDs for HIV (5,6). Vaccination for hepatitis B and curative direct-acting antiviral therapy for hepatitis C have further decreased the risk. Barring the infection risk, IRDs are good-quality donors as reflected by their median KDPI of 19% (7).

In 2015, IRDs constituted 20% of the deceased donor pool but only 13% of pediatric deceased donor kidney transplants. To evaluate IRD transplant outcomes, we retrospectively compared 328 IRD with 4850 non-IRD pediatric transplants (performed during 2005–2015) and found similar patient and graft survival and no difference in deaths due to infections. We also found that IRD transplantation was associated with a survival benefit compared with remaining on the waiting list (7). Chow et al. (8) showed that candidates with high panel-reactive antibodies (>30%) and a wait time of >1–3 years were more likely to benefit from IRD transplantation versus remaining on the waiting list. Among pediatric candidates, 15%–20% wait >3 years and approximately 20% have panel-reactive antibodies of >80% (1). These children fulfill the criteria put forth by Chow et al. and would likely benefit from an IRD kidney.

In 2019, 1010 IRDs were discarded (3). Increased IRD utilization could mean nearly 1000 more transplants a year. Misconceptions and lack of awareness about IRDs contribute to the high discard rate. Emphasizing the small magnitude of infectious risk and increasing awareness about the survival benefits of IRD transplants through concerted educational efforts may decrease their discard.

We suggest that IRD kidneys be considered for pediatric candidates. The small infection risk and the survival benefit of an IRD transplant should be discussed with families at the time of listing so that an
Pediatric access to SPDs will shorten their waitlist time without compromising their long-term outcomes.

### Expanded Criteria or High KDPI Donors

Expanded criteria donors (ECDs) are donors who are >60 years, or age 50–59 years with at least two of the following: hypertension, terminal serum creatinine of >1.5 mg/dl, or cerebrovascular cause of death. In 2002, the Organ Procurement and Transplantation Network (OPTN) revised its allocation policies to promote the use of ECDs based on recipients’ suitability to combat the organ shortage and minimize discard. Compared with standard deceased donor transplants, ECD transplants in adults have similar short-term patient survival but lower long-term patient and graft survival (14). However, ECD transplants are associated with a survival benefit in select adults (>40 years) with longer waiting times on dialysis (14). Pediatric data on ECD or high KDPI kidney transplants are lacking. An analysis of the ANZDATA transplant registry showed lower patient and graft survival in young ECD recipients compared with age-related standard donor recipients (15). Results from the ANZDATA registry as well as extrapolation of adult data suggest that ECD transplantation for children is ill advised. Additional data are needed to inform the best pediatric practice regarding ECDs.

### Multiorgan Transplants

Current allocation policies prioritize multiorgan transplants (MOTS) above pediatric candidates. This decreases the number of low KDPI kidneys available for pediatric transplantation. In 2019, the OPTN ethics committee evaluated the inequities resulting from MOT prioritization. Although the policy did not change, the committee recommended that transplant centers should not proceed with MOTs if the expected recipient survival was low (16). A revision of this policy may be necessary to improve pediatric transplantation.

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**Table 1. Center for Disease Control and Prevention guidelines to identify increased risk donors**

| 2013 Guidelines |  |
|-----------------|---|
| Men having sex with men in the preceding 12 mo |  |
| Nonmedical injection drug use in the preceding 12 mo |  |
| Sex in exchange for money or drugs in the preceding 12 mo |  |
| Sex with someone with a known or suspected case of HIV, hepatitis B, or hepatitis C |  |
| Women who have had sex with a man who had had sex with men in the preceding 12 mo |  |
| Sex with a person who had sex in exchange for money or drugs in the preceding 12 mo |  |
| Sex with a person who injected nonmedical drugs in the preceding 12 mo |  |
| A child ≤18 mo born to a mother with a known history of or at high risk for HIV, hepatitis B, or hepatitis C |  |
| People in a correctional facility for >72 consecutive hours in the preceding 12 mo |  |
| People with a new diagnosis of, or who have been treated for, syphilis, gonorrhea, chlamydia, or genital ulcers in the preceding 12 mo |  |
| Hemodiluted deceased donor’s blood sample (can result in false negative testing for HIV, hepatitis B, and/or hepatitis C) |  |
| People on hemodialysis in the preceding 12 mo |  |
| When deceased donor’s medical or behavior history cannot be ascertained, donor should be considered increased risk donor |  |
access to low KDPI kidneys; however, further research is needed to examine the effect of MOT prioritization on pediatric transplantation. 

**Conclusion**

Organ discard must be minimized in the current era of severe organ shortage. We suggest considering IRDs and en bloc SPDs for all pediatric candidates. We also suggest considering DCDs for candidates with high morbidity on dialysis and/or long anticipated waitlist times. Accepting these kidneys for pediatric transplantation would add nearly 2500 more kidneys per year to the deceased donor pool for children. We do not advocate accepting ECDs for children given the lack of pediatric data.

**Author Contributions**

B. Chavers and S. Kizilbash reviewed and edited the manuscript.

**Disclosures**

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