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New priorities: Analysis of the New Kidney Allocation System on UCLA patients transplanted from the deceased donor waitlist

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ABSTRACT

UNOS implemented a new Kidney Allocation System (New KAS) on December 4, 2014 with a primary goal of increasing equity to organ transplant for patients that were immunologically or socially disadvantaged by the previous allocation system (Previous KAS) that prioritized long wait times. We examined the effects of the New KAS on patients transplanted from the UCLA deceased donor waitlist during the first year and compared to the last year of the Previous KAS. The total number of deceased donor kidney transplants was increased in the New KAS as compared to the Previous KAS (178 vs 148). Transplant of regraft patients and of highly sensitized patients with cPRA $\geqslant$ 99% was significantly increased in the New KAS (New KAS vs Previous KAS, 29.8% vs 11.5%, $p \leqslant 0.0001$, and 26.4% vs 2.7%, $p \leqslant 0.0001$, respectively). In the New KAS, the percentage of patient's receiving allografts imported from outside our local area was also significantly increased (34.8% vs 15.5%, $p < 0.0001$). In the New KAS, 59.7% and 48.3% of imported organs were allocated to very highly sensitized ($\geqslant$99% cPRA) or re-graft patients, respectively, as compared to 8.7% and 8.7% during the Previous KAS ($p < 0.001$). Recipients and donors with age differences exceeding 15 years were decreased in the New KAS as compared to the Previous KAS (36.5 vs 48.7%, $p \leqslant 0.032$). There was a 40.1% reduction in transplant to patients in the 65+ age group in the New KAS ($p \leqslant 0.025$). The percentage of patients transplanted with preformed donor specific antibody (DSA) was similar in the New as compared to the Previous KAS (19.7% vs 15.5%) and, patients were transplanted with a range of 1–3 preformed DSA of weak to moderate strength. Cold ischemic time was significantly increased over all organs, and in patients transplanted with preformed DSA during the New as compared to the Previous KAS (17.5 vs 19.1 h and 17.2 vs 22.2, $p < 0.04$ and $p < 0.03$, respectively). Episodes of delayed graft function and the number of biopsies for cause were similar between the New and the Previous KAS. However, there were more events of biopsy proven antibody mediated rejection in patients transplanted since the start of the New KAS. The data show that the New KAS is working at the center level as designed to better age match recipients and donors and to increase transplantation of very highly sensitized patients through broader sharing.

1. Introduction

In December 2014, UNOS initiated a new Kidney Allocation System (New KAS) to replace the previous allocation system (Previous KAS) established in 1987 [1,2]. The New KAS is designed to increase the median lifespan and allograft-year survival in transplant recipients and to improve transplant to patients who are

Abbreviations: ACR, acute cellular rejection; AMR, antibody mediated rejection; ATN, acute tubular necrosis; cPRA, calculated panel reactive antibody; DGF, delayed graft function; DSA, donor specific antibody; KAS, Kidney Allocation System; EPTS, estimated post transplant survival; KDPI, Kidney Donor Profile Index; MCS, median channel shift; OPTN, organ procurement and transplantation network; UNOS, united network for organ sharing.

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socially or immunologically disadvantaged by shortfalls of the Previous KAS that prioritized longer wait times [3,4]. The New KAS is predicted to improve access to transplants for patients who were disadvantaged by broad sensitization to HLA antigens or by delayed referral to transplant centers, and to limit age mismatch between expected recipient and donor kidney longevity thereby also reducing allograft discard rate.

Several core components have been built into the New KAS to achieve these goals [1]. First, patients and donors are risk stratified according to two new calculated parameters. The Estimated Post-Transplant Survival (EPTS) score ranks patients based on age, dialysis time, diabetes status and primary or regraft status. The Kidney Donor Profile Index (KDPI) ranks donors based on multiple parameters of age, size, clinical status and donation after circulatory death status. Lower percentage EPTS and KDPI are correlated with improved post-transplant survival. In the New KAS, "longevity matching" between patients and donors is achieved by prioritizing patients with EPTS $\leqslant$ 20% to receive kidneys from donors with KDPI $\leqslant$ 20%. The second component is the use of a sliding scale from which points are awarded based on calculated panel reactive antibody (cPRA) prioritizing candidates with high cPRA. A third component broadens sharing for patients with a cPRA $\geqslant$ 99%. Pediatric candidates in the New KAS maintain priority over adult candidates to receive local offers from donors with KDPI < 35%. To increase transplant of blood type B candidates, eligibility for transplant with A_2/A_2B donors is now implemented with the New KAS. Finally, wait time is awarded to recipients based on time spent on dialysis prior to being registered to the waitlist—a component that was piloted in our local area prior to the start of the New KAS.

Simulated projections of the New KAS indicated a potential for increase in transplant of candidates in the 18–49 age range, for those of blood type B, and those with a cPRA $\geqslant$ 99%, and fewer transplants for candidates > 50 years old and those of blood type A [1]. In addition, allocation to those hardest to transplant, that is, very highly sensitized patients, would be improved by allowing regional and national sharing for candidates with cPRA $\geqslant$ 99% and regional sharing of kidneys from donors with a KDPI $\geqslant$ 85% [1].

These projections have been largely substantiated at the national level in the monitoring reports presented by UNOS/OPTN [5–8]. Nationally, an increase in transplantation of African Americans is also reported. Lacking from the national data, however, is analysis of short term outcomes in patients transplanted with preformed donor specific antibody (DSA). Patients that are very highly sensitized with a cPRA > 99% make up ~6% of the UCLA active waitlist for deceased donor renal transplantation and represent those that are at highest risk for delayed graft function (DGF) and rejection. Evaluating the New KAS at the center level is also important to assure that the quality of a national system is met at the local level. In this report, we present the data from the first year of the New KAS in comparison to the Previous KAS at the center level.

2. Materials and methods

2.1. Demographics

Patients who underwent deceased donor kidney transplant at UCLA during the first year of the New KAS (12/4/2014 to 12/4/2015) were compared to those transplanted during the same time period in the previous year (Previous KAS, 12/4/2013 to 12/3/2014). For all patients, sex, age at time of transplant, blood group, cPRA, regraft status and EPTS scores were gathered from UNOS data. Additional demographic information was collected by reviewing the patient's medical records including race, induction therapy, immunosuppression, presence of DSA, DGF, biopsy results, donor/recipient HLA-A, B, DR, DQ mismatch and graft loss. Deceased donor KDPI, local or regional/national import status and cold ischemic time were also determined from UNOS data. This study was approved by the UCLA institutional review board.

2.2. Antibody screening

Pretransplant, patients were screened for antibodies to HLA Class I and II using Lifecodes Flow Luminex PRA (Life Codes, Norcross, GA). Negative sera were screened annually. Sera identified as positive were then tested by Single Antigen Bead assay using the One Lambda LABScreen kit (One Lambda, ThermoFisher, Waltham, MA) and antibody reactivity greater than or equal to 1000 MFI were considered positive [9]. HLA antibody strength and specificity were tested at least annually by single antigen in patients found to be sensitized to HLA antigens. Post transplant, patients are stratified into immune monitoring protocols based on the presence or absence of preformed DSA at the time of transplant. Post transplant single antigen bead testing is also performed at suspicion of rejection.

2.3. HLA typing and crossmatch

Patient and donor HLA typing was performed by molecular methods as previously described [9]. Complement dependent T and B cell cytotoxicity crossmatches and T and B cell flow cytometric crossmatches were performed on all patients prior to transplant. In some cases, prior to performing the CDC or flow crossmatches, sera were treated with DTT to remove IgM, or T and B cells were incubated with pronase to remove Fc receptors and CD20 [10,11]. The positive threshold for a T or B flow crossmatch with or without pronase treatment is 50 or 120 median channel shift (MCS), respectively [9].

2.4. Immunosuppression

Throughout the duration of the study, induction was primarily solumedrol and basiliximab or anti-thymocyte globulin. The use of IVIG to augment immunosuppression at the time of transplant is used in most patients with DSA that is identified within one year of transplant (current). For patients with historic DSA, the use of IVIG at the time of transplant is at the discretion of the attending nephrologist. Maintenance immunosuppression for patients transplanted during both the New and Previous KAS primarily consisted of triple therapy with tacrolimus, mycophenolate mofetil (MMF) and steroids.

2.5. Diagnosis of rejection

Renal biopsies are not performed by protocol, but for cause on suspicion of allograft rejection. Rejection was characterized by the Banff classification [12].

2.6. Statistical methods

Statistical analyses were performed using Stata software version 13 (StataCorp, College Station, TX). Comparisons for categorical variables such as age group, cPRA group, blood type and race were analyzed by Fisher's exact test. Continuous variables such as cold ischemia time and DSA strength were compared using the Wilcoxon rank sum test. All tests were two-sided. P-values $\leqslant$ 0.05 were considered significant.