RESEARCH LETTER

Donor Estimated Glomerular Filtration Rate With or Without Body Surface Area Indexing and Kidney Transplant Graft Survival

To the Editor:

Assessing predonation glomerular filtration rate (GFR) is a key aspect in the evaluation of living kidney donor candidates. To determine eligibility for donation, international guidelines recommend determining estimated GFR (eGFR) and confirming adequate GFR using a second method, indexing all assessments for body surface area (BSA) because this indexing takes into account variations in donor size and, therefore, metabolic need—similar to the value of using BSA-adjusted eGFR in kidney disease staging.[1,2] However, when predicting recipient outcomes, limited data suggest that donor GFR that is not BSA-indexed provides a better estimate of the total clearance that will be provided by the allograft and therefore is a better indicator of living kidney donor quality.[3] We compared the association of donor eGFR with versus without BSA indexing with post-transplant death-censored graft failure.

We identified adult US living donor kidney transplants 2000-2019 using Scientific Registry of Transplant Recipients data (n = 115,277) (see Acknowledgements). We excluded those missing donor predonation creatinine levels (n = 2,487) or with extremes of creatinine (≤0.4 mg/dL, n = 306; ≥2.0 mg/dL, n = 197). We then excluded those missing donor or recipient height or weight (n = 9,412). Finally, we excluded those with extremes of donor/recipient height (<120 cm, n = 142; >210 cm, n = 113) or weight (<40 kg, n = 515; >150 kg, n = 200) because most were suspected to be erroneous (eg, 20 donors with height < 61 cm [2 feet]). We calculated donor and recipient BSA using the DuBois formula.[4] We calculated eGFR using the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI 2021) formula[5] and then removed the BSA indexing to determine deindexed eGFR as "dGFR" = [eGFR × BSA_{donor}/1.73 m^2]. We then recalculated eGFR after indexing for recipient BSA as "rGFR" = [dGFR × 1.73 m^2/$BSA_{recipient}$]. We computed Cox proportional hazards models for death-censored graft failure separately with dGFR, eGFR, or rGFR as the independent variable, and calculated Harrell's C-index for each model. We then recalculated multivariable models adjusting for donor age, donor sex, recipient age, and recipient sex and calculated Harrell's C-index for each adjusted model. Finally, we calculated the subhazard of graft failure for each GFR estimated in Fine-Grey competing risk models treating death as a competing risk and then calculated the Akaike information criterion for each model. End of follow-up for each patient was last reported follow-up date or March 2, 2023 (end of file follow-up). Analyses used Stata/MP17 (StataCorp, TX). This study was approved by the institutional review board of Columbia University Medical Center.

Among 101,905 donors included, the median BSA was 1.86 m^2 (interquartile range [IQR] 1.71-2.02, range 1.25-2.85). The median difference between donor and recipient BSA was –0.05 m^2 (IQR 0.26 to 0.16), including 0.02 m^2 (–0.14 to 0.17) for pairs of the same sex (Figure 1A) and –0.15 m^2 (–0.35 to 0.14) for pairs of opposite sex (Figure 1B). The median predonation dGFR was 111 mL/min (IQR 95-127) with a median eGFR of 104 mL/min/1.73 m^2 (89-119), corresponding to a median difference of 7 (IQR –0.9 to 17) (Figure 1C and 1D). The median rGFR was 100 mL/min/1.73 m^2 (IQR 84-118), with a median difference between eGFR and rGFR of 3 (–9 to 13).

When assessing the association of each GFR estimate with death-censored graft failure, 16,874 failures were observed. The Harrell's C-index was 0.525 for the model using dGFR (hazard ratio [HR] = 0.968 per 10 mL/min/1.73 m^2, 95% confidence interval [CI] 0.961-0.976, $P < 0.001$), 0.522 using eGFR (HR = 0.972 per 10 mL/min, 95% CI 0.967-0.979, $P < 0.001$), and 0.522 (HR = 0.974 per 10 mL/min/1.73 m^2, 95% CI 0.968-0.980, $P < 0.001$) using rGFR. Results were similar when adjusting for donor and recipient age and sex (dGFR: Harrell's C-index = 0.604; eGFR: 0.605; rGFR: 0.608). Results were also similar when analyzing only transplants with donor BSA in the lowest or highest deciles of the group (dGFR: Harrell's C-index = 0.517; eGFR: 0.516; rGFR: 0.517). Finally, results were also similar in the full cohort when using a competing risk model with death as a competing risk (dGFR: AIC = 367,678; eGFR: 367,680; rGFR: 367,700).

These results suggest that despite differences in BSA-indexed and -deindexed predonation GFR estimates, removing living kidney donor BSA indexing from eGFR or re-indexing eGFR for recipient BSA did not strengthen the association between donor GFR and graft longevity. This finding may result from the low absolute difference in GFR estimates with versus without BSA indexing or may suggest that minor differences in living donor GFR do not have a large influence on post-transplant allograft survival. Additional limitations include that the impact of BSA indexing on allograft outcomes may be obscured by the fact that most transplant centers would be reluctant to use kidneys from donors that were much smaller than the intended recipient, thereby reducing potentially consequential instances of large BSA mismatches from appearing in transplant registries.

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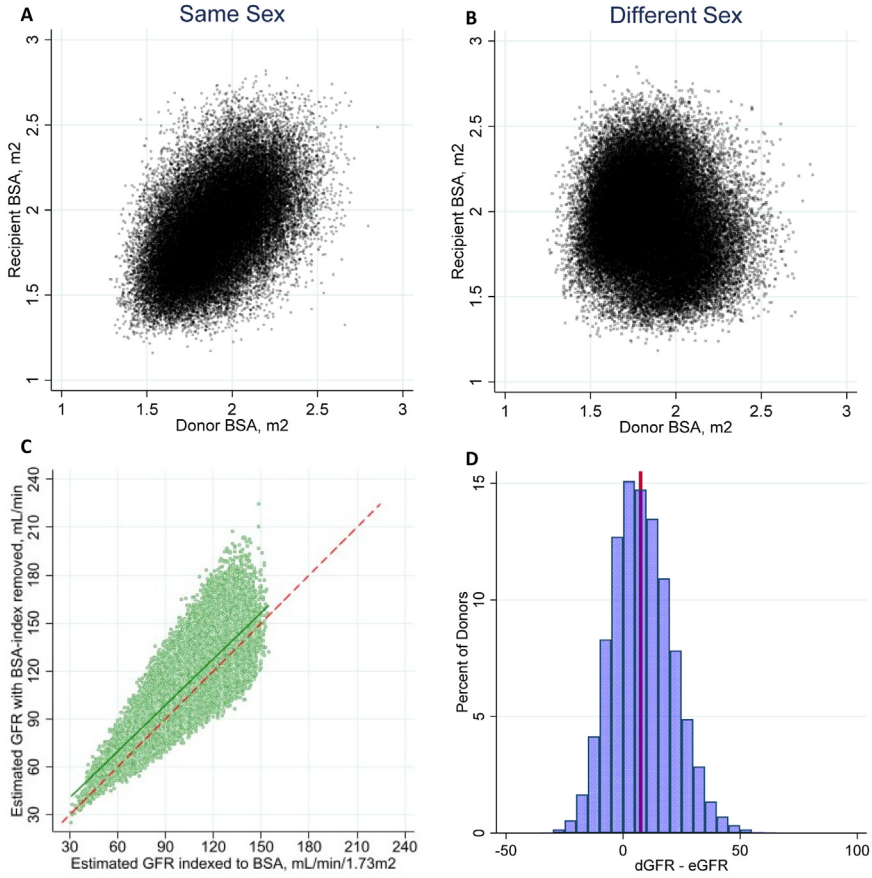

Figure 1. Body surface area (BSA) and predonation estimates of glomerular filtration rate (GFR) among living donor kidney transplants. (A, B) Recipient BSA versus donor BSA, where median difference between donor and recipient BSA was 0.02m^2 (IQR −0.14 to 0.17) for donor-recipient pairs of the same sex and −0.15 m^2 (IQR −0.35 to 0.14) for pairs of opposite sex. (C) Estimated GFR with BSA-indexing removed ("dGFR") versus estimated GFR with BSA-indexing ("eGFR"); the solid line shows the line of best fit, and the scored red line is the line of concordance. (D) The distribution of difference between dGFR and eGFR, where the median difference, as indicated by the vertical red line, was 7 (IQR −0.9 to 17).

ARTICLE INFORMATION

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