A prediction model of postdonation renal function using dynamic kidney computed tomography volumetry in living kidney donor

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Background: The risk of renal failure after live kidney donation can be predicted based on various clinical information. We tried to introduce a model to predict the risk of renal failure after live kidney donation using predonation variables including residual kidney volume proportion (RKP, remnant kidney volume/total kidney volume) measured by computed tomography (CT) volumetry.

Methods: Patients who had donor nephrectomy between May 2007 and December 2019 in two independent centers. Age, sex, body mass index (BMI), hypertension, smoking history, preoperative estimated glomerular filtration rate (eGFR) and RKP were investigated. Primary end point is eGFR less than 60 mL/min/m² 6 months after kidney donation. Univariable and multivariable analysis was performed using the Cox hazard regression model.

Results: A total of 1,628 and 690 live kidney donors were included in training and validation cohort, respectively. The eGFR was less than 60 mL/min/m² 6 months after kidney donation in 235 donors (14.4%) of the training cohort and 178 donors (25.8%) of the validation cohort. In univariable analysis, sex, age, BMI, hypertension, preoperative eGFR, and remnant kidney proportion were significantly associated with the primary end point. After multivariable analysis, the variables used in the score system of the prediction model were sex, age, eGFR, and remnant kidney proportion. The sum of score ranges from 0 to 10 (sex: male, 1; female, 0), (age at operation: <30, 0; 30–39, 1; 40–59, 2; ≥60, 3), (preoperative eGFR: ≥100, 0; 90–99, 2; 80–89, 4; <80, 5), (RKP: ≥52, 0; <52, 1). This prediction model for the primary end point showed good discrimination (training: AUC, 0.891; 95% confidence interval [CI], 0.868–0.913; validation: AUC, 0.865; 95% CI, 0.833–0.897) and calibration by Hosmer-Lemeshow goodness-of-fit test (training: $\chi^2=1.9912$, df=8, P=0.9813; validation: $\chi^2=47.335$, df=8, P=1.323e-07).

Conclusions: Our prediction model based on dynamic CT volumetry and clinical data may be useful to estimate the risk of significant renal dysfunction after kidney donation.

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