

Performance of traditional and novel formula-based estimates of glomerular filtration rate in living kidney transplant donors

Dr Richard Shemilt¹, Ms Julie Glen², Dr Siobhan McManus², Professor Patrick B Mark¹

¹University Of Glasgow, Glasgow, United Kingdom, ²NHS Greater Glasgow & Clyde, Glasgow, United Kingdom

Accurate determination of glomerular filtration rate (GFR) is an essential component of work-up for living donor kidney transplantation to ensure that both the function of the transplanted kidney and remaining donor kidney are adequate. The gold standard means of assessing GFR is to measure clearance of a radio-isotope such as ⁵¹Cr-EDTA or ^{99m}Tc-DPTA.¹ Age and gender adjusted thresholds of minimum measured GFR for donation are advised by the British Transplantation Society (BTS)¹. Whilst isotopic GFR is accurate and reproducible, it is also a costly and relatively invasive investigation. The aim of this study was to compare different formula-based estimates of GFR with measured GFR (mGFR) in living renal transplant donors to assess their utility in this population.

100 living kidney transplant donors were identified who underwent donor nephrectomy at Glasgow Renal and Transplant Unit between 2016 and 2018. Pre-donation isotopic measurements of GFR and serum creatinine were retrospectively recorded as well as measurements of age, height and weight required to calculate estimated GFR (eGFR) adjusted to a standard body surface area of 1.73m². We calculated eGFR based on the widely-used MDRD and CKD-EPI formulae, as well as a third estimating formula 'CamGFR' (recently developed for use in calculating chemotherapy dosing) and compared these with mGFR.²

MDRD, CKD-EPI and CamGFR eGFRs all showed significant correlation with mGFR by Spearman correlation (0.59, 0.47, 0.48 respectively; all p<0.0001). All three formulae tended to overestimate mGFR. Bias, measured by mean difference between mGFR and eGFR was lowest for the CamGFR formula (-2.86ml/min/1.73m² vs -7.26ml/min/1.73m² for MDRD-eGFR and -7.33ml/min/1.73m² for CKD-EPI-eGFR). CamGFR-eGFR was significantly less biased than MDRD-eGFR and CKD-EPI eGFR. Standard deviation of the differences was lowest for CamGFR-eGFR (11.04ml/min/1.73m²), followed by CKD-EPI-eGFR (11.29ml/min/1.73m²) and MDRD-eGFR (15.11ml/min/1.73m²) suggesting CamGFR-eGFR was the most precise. Root mean square error was lowest for CamGFR-eGFR at 11.35ml/min/1.73m² compared to 13.41ml/min/1.73m² for CKD-EPI-eGFR and 15.11ml/min/1.73m² for MDRD-eGFR, suggesting CamGFR-eGFR was the most accurate. 99% of patients' CamGFR-eGFR was within 30% of mGFR, compared to 96% for CKD-EPI-eGFR and 91% for MDRD-eGFR. 94 of 100 patients' mGFR was above the BTS-recommended threshold for donation. Of the six patients who were below the mGFR threshold, five patients were above the threshold by if GFR was estimated using the CamGFR formula. Three of the six patients were above the threshold by CKD-EPI-eGFR and MDRD-eGFR.

In living kidney transplant donors, the CamGFR formula provided the least biased, most accurate and most precise estimate of eGFR. There was still considerable discrepancy between eGFR and mGFR, with a tendency for formula-based estimates of GFR to over-estimate, which could result in patients with mGFR lower than the recommended threshold proceeding to donation. This suggests current practice of measuring GFR by isotopic clearance should continue, though use of the CamGFR formula may provide a better estimate of GFR than traditional formulae in this group of patients.