WHICH CREATININE-BASED FORMULA IS USEFUL TO ESTIMATE GLOMERULAR FILTRATION RATE IN DECEASED KIDNEY DONORS OLDER THAN 70?

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BACKGROUND and AIM

The assessment of glomerular filtration rate (eGFR) in old deceased donors is crucial for allocation in renal transplantation, but the best estimating equation is still debated. Indeed none of the formulas used to estimate eGFR, i.e. Cockcroft-Gault (CG), Modification of Diet in Renal Disease Study (MDRD) and Chronic Kidney Disease-Epidemiology Collaboration (CKD-EPI) formula, was validated even in steady-state patients aged more than 70 years.

However the Berlin Initiative Study first developed the only GFR-estimating formula (BIS1) validated in elderly patients by iohexol clearance, but it is not usually adopted in the evaluation of the old deceased donor.

Aim of this study was to compare different GFR-estimating equations in deceased elderly kidney donors.

PATIENTS and METHODS

Study population

Deceased candidate donors older than 70 (n=82) evaluated in the Piedmont (North-West Italy, population of 4.4 million ppl) between August 2011 and August 2013.

All of them were Caucasian.

Baseline characteristics of the study population	
Male	42 (51.2%)
Age (yrs)	76.1 ± 4.3
Weight (Kg)	71.7 ± 13.1
Height (cm)	167 ± 7
BMI	25.5 ± 3.7
BSA (m^2)	1.82 ± 0.19
Creatinine (mg/dL)	0.84 ± 0.29

Creatinine based eGFR equations

BIS1 (BIS1-eGFR) : 3736 x (Creat (mg/dL))$^{-0,87}$ x (Age)$^{-0,95}$ x (0,82 if Female)

CG: (140-Age) x Weight (Kg)/(72 x (Creat (mg/dL)) x (0,85 if Female)

Body surface area (BSA): (Weight (Kg) x Height (cm) / 3600) ^{0,5}

CG adjusted by BSA (CG/BSA): CG x 1.73 / BSA

CKD-EPI: 141 x (Creat (mg/dL)/0,9)$^{-0,411}$ x 0,993$^{(Age)}$

MDRD: 175 x (Creat (mg/dL)$^{-1,154}$) x (Age)$^{-0,203}$ x (0,74 if Female)

RESULTS - 1

Mean BIS1-eGFR was not significantly lower than CG-eGFR or CG/BSA-eGFR, but was significantly lower than values estimated with CKD-EPI and MDRD (Table): these results are consistent with those of the original BIS cohort.

	Mean (SD)	Median (min-max)
Serum Creatinine (mg/dL)	0.84 (0.29)	0.78 (0.25-1.80)
BIS1 (mL/min/1.73m²)	70.4 (19.3)	67.9 (28.5-153.8)
CG (mL/min)	77.6 (27.2) *	71.3 (23.3-161.5)
CG/BSA (mL/min/1.73m²)	73.4 (23.8) **	70.2 (24.7-168.5)
CKD-EPI (mL/min/1.73m²)	78.8 (17.3) ***	83.3 (26.6-112.8)
MDRD (mL/min/1.73m²)	87.5 (32.9)****	81.7 (27.6-162.2)

**p = 0.054 CG vs BIS1; **p = 0.385 CG/BSA vs BIS1; *** p = 0.003 CKD-EPI vs BIS1; ****p = 0.0001 MDRD vs BIS1*

CKD classes of donors were assessed from BSA-adjusted formulas: a discordant CKD class due to different eGFR, if compared with BIS1-eGFR, was found in 17/82 patients (20.7%) using CG/BSA-eGFR, in 29/82 patients (35.4%) with MDRD-eGFR and in 23/82 patients (28.0%) with CKD-EPI, mainly due to lower BIS1-eGFR (12/17 vs CG/BSA, 29/29 vs MDRD, 23/23 vs CKD-EPI).

CKD-Classes as compared to BIS1-eGFR				
	CG/BSA cl1	CG/BSA cl2	CG/BSA cl3	total
BIS1 cl. 1	9	0	0	9
BIS1 cl. 2	10	38	5	53
BIS1 cl. 3	0	2	18	20
total	19	40	23	82

RESULTS – 2

CKD-Classes as compared to BIS1-eGFR				
	CKD-EPI cl1	CKD-EPI cl2	CKD-EPI cl3	total
BIS1 cl. 1	9	0	0	9
BIS1 cl. 2	15	38	0	53
BIS1 cl. 3	0	8	12	20
total	24	46	12	82

CKD-Classes as compared to BIS1-eGFR				
	MDRD cl1	MDRD cl2	MDRD cl3	total
BIS1 cl. 1	9	0	0	9
BIS1 cl. 2	22	31	0	53
BIS1 cl. 3	0	7	13	20
total	31	38	13	82

Both CKD-EPI and MDRD equations overestimate eGFR if compared with BIS-1 equation in a significant percentage of patients. BIS-1 never over estimates eGFR when compared to CKD-EPI and MDRD.

CONCLUSIONS

Taken together these data seem to suggest that the BIS1 formula, so far neglected in the setting of renal transplant, could be considered to estimate GFR in patients older than 70.

Limits of creatinine-based equations in deceased donors are well known to nephrologists: in the days before death a steady state can't be always assumed and all the formulas have been tested and validated in healthy cohorts rather than very sick patients, in which they are much less accurate. However, *an estimate of renal function is a crucial step in determining kidney retrieval and allocation* (single, dual or no transplant).

Further studies are needed to define the impact of the adoption of different eGFR estimating formulas on subsequent graft function and allocation, which was beyond the scope of our work. In the meantime, we think that *a better awareness of BIS1 formula peculiarity among transplant physicians may provide a useful tool to more accurately estimate renal function in older donors.*

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