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Estimating glomerular filtration rate: does the diabetic status influence the performances of current equations?

P. DELANAYE[1], J. BJÖRK[2], M. FLAMANT[3], N. EBERT[4], E. SCHAEFFNER[4], A. GRUBB[5], A. CHRISTENSSON[6], A. ÅKESSON[7], U. NYMAN[8], T. STEHLE[9], H. POTTEL[10] on behalf of the European Kidney Function Consortium

1 Department of Nephrology-Dialysis-Transplantation, University of Liège (ULiege), CHU Sart Tilman, Liège, Belgium, Department of Nephrology-Dialysis-Apheresis, 2 Division of Occupational and Environmental Medicine, Lund University, Lund, Sweden , 3 Assistance Publique-Hôpitaux de Paris, Bichat Hospital, and Université de Paris, UMR S1138, Cordeliers Research Center, Paris, France, 4 Charité Universitätsmedizin Berlin, Institute of Public Health, Berlin, Germany, 5 Department of Clinical Chemistry, Skåne University Hospital, Lund, Lund University, Sweden, 6 Department of Nephrology, Skåne University Hospital, Lund University, Lund, Sweden, 7 Division of Occupational and Environmental Medicine, Lund University, Lund, Sweden, 8 Department of Translational Medicine, Division of Medical Radiology, Lund University, Malmö, Sweden,, 9 Assistance Publique-Hôpitaux de Paris, Hôpitaux Universitaires Henri Mondor, Service de Néphrologie et Transplantation, Fédération Hospitalo-Universitaire «Innovative therapy for immune disorders », Créteil, France , 10 Department of Public Health and Primary Care, KU Leuven Campus Kulak Kortrijk, Kortrijk, Belgium

INTRODUCTION

Diabetes is the first cause of chronic kidney disease (CKD) worldwide. The estimation of glomerular filtration rate (GFR) is one main tool to detect CKD.
The most used biomarker remains serum creatinine and the European Kidney Function Consortium (EKFCcrea) equations is the most validated in Europe. More recently, another renal biomarker, cystatin C, has been proposed.

AIM

In the current analysis, we studied the performances of the EKFC equations in a large cohort of subjects according to their diabetic status.

METHOD

Four cohorts from the EKFC dataset were considered in which the diabetic status was available: Lund, Sweden (n=2,780), Berlin, Germany (n=654), Créteil, France (n=466), and Paris, France (n=2,258). Serum creatinine and cystatin C were measured with calibrated assays. GFR was measured by plasma clearances (mGFR) (iohexol in Lund, Berlin and Créteil and ^{51}Cr-EDTA in Paris). The performance of the equations was assessed by calculating bias, precision (IQR) and P30 (percentage of eGFR-values within ±30% of mGFR). As the characteristics of diabetic patients were different, we matched diabetic and non-diabetic patients using the following matching criteria: age (±3 years), sex (equal), mGFR (± 3 mL/min/1.73m²), and BMI (±2.5 kg/m²).

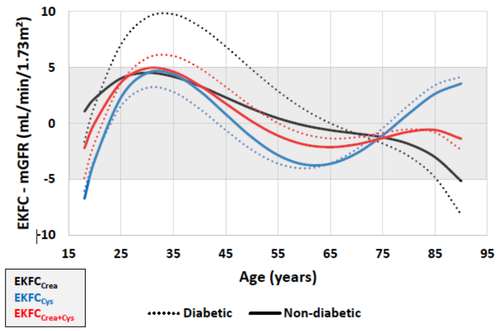
RESULTS

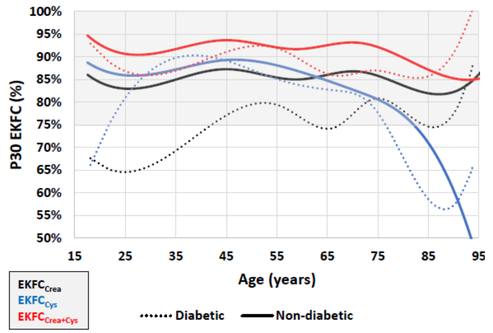
In the whole population (n=6,158), median [IQR] age was 61 [47;72] years, with 45.8% of women. Mean measured GFR (mGFR) was 60 [39;82] mL/min/1.73m². Compared to non-diabetic subjects (n=5,124), diabetic patients (n=1,034) were older, more frequently males, heavier, had lower mGFR (45 vs 64 mL/min/1.73m²), and higher creatinine (1.44 vs 1.06 mg/dL; p<0.0001) and cystatin C (1.67 vs 1.20 mg/L) concentrations.

The performance of the EKFCcys equation was similar to EKFCcrea, but the EKFCcrea+cys had better P30 than single-biomarker equations. Globally, P30 were substantially lower in diabetic patients than in non-diabetic patients (Table).

We could match data for 289 females and 546 males. The results in the matched cohorts were however quite similar between diabetics and non-diabetics subjects, and this is true for every equation.

	$EKFC_{crea}$	$EKFC_{cys}$	$EKFC_{crea+cys}$
Whole population, n=6,158			
Median bias (95% CI)	0.13 [-0.22; 0.43]	-0.86 [-1.17; -0.57]	0.07 [-0.21; 0.30]
IQR (Q1; Q3)	14.2 [-6.7; 7.5]	14.7 [-8.7; 6.0]	11.1 [-5.8; 5.3]
P30 (95% CI)	84.0 [83.1; 85.0]	83.7 [82.8; 84.7]	91.3 [90.6; 92.0]
Non-Diabetic, n=5,124			
Median bias (95% CI)	0.12 [-0.25; 0.44]	-0.77 [-1.10; -0.44]	0.12 [-0.20; 0.37]
IQR (Q1; Q3)	14.2 [-6.7; 7.5]	15.3 [-8.9; 6.3]	11.5 [-5.9; 5.6]
P30 (95% CI)	85.5 [84.5; 86.4]	84.4 [83.4; 85.4]	92.0 [91.2; 92.7]
Diabetic, n=1,034			
Median bias (95% CI)	0.21 [-0.51; 0.91]	-1.24 [-2.03; -0.58]	-0.12 [-0.74; 0.57]
IQR (Q1; Q3)	13.8 [-6.8; 7.0]	11.9 [-7.6; 4.3]	9.6 [-5.4; 4.2]
P30 (95% CI)	77.0 [74.4; 79.5]	80.4 [77.9; 82.8]	87.9 [85.9; 89.9]
MATCHED ANALYSIS			
Non-Diabetic, n=835			
Median bias (95% CI)	0.24 [-0.51; 0.96]	-0.59 [-1.01; 0.22]	0.38 [-0.22; 0.84]
IQR (Q1; Q3)	12.2 [-5.1; 7.1]	12.2 [-6.6; 5.6]	9.0 [-4.1; 4.9]
P30 (95% CI)	82.4 [79.8; 85.0]	82.5 [79.9; 85.1]	90.2 [88.2; 92.2]
Diabetic, n=835			
Median bias (95% CI)	0.66 [-0.31; 1.38]	-1.10 [-1.92; -0.30]	0.05 [-0.57; 0.68]
IQR (Q1; Q3)	13.7 [-6.3; 7.4]	11.7 [-7.5; 4.2]	9.3 [-5.0; 4.3]
P30 (95% CI)	78.2 [75.4; 81.0]	81.9 [79.3; 84.5]	89.2 [87.1; 91.3]





CONCLUSIONS

In a large dataset of patients including diabetics and non-diabetics, we showed that the EKFC equations are accurate in diabetic and non-diabetic patients.

Combining the creatinine and cystatin C-based equations presents an added value.

If accuracy of all equations seems better in non-diabetic than in diabetic subjects, it is probably more due to differences in age and (still more) in GFR levels than to the diabetic status.

REFERENCES

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CONTACT INFORMATION

Dr Pierre DELANAYE pdelanaye@chuliege.be