Journal of Gerontology & Geriatric Research

Tsimtsiou , et al., J Gerontol Geriatr Res 2017, 6:1
DOI: 10.4172/2167-7182.1000384

Research Article Open Access

Evaluating Kidney Function in Elderly Population: A Cross-Sectional Study in Primary Health Care

Zoi Tsimtsiou*, Konstantina Karakoula, Elpida Efthymiadou, Antonios Asimakopoulos, Basiliki Fardi, Sofia Birka and Foteini Dantsi

Urban Health Center Evosmos, Thessaloniki, Greece

***Corresponding author:** Zoi Tsimtsiou, Urban Health Center Evosmos, Tegopoulou 2 and Patron, Evosmos, 56224, Thessaloniki, Greece, Tel: 00302310387772; Fax: 00302310387778; E-mail: zoitsimtsiou@yahoo.gr

Rec date: Dec 20, 2016; **Acc date:** Jan 02, 2017; **Pub date:** Jan 04, 2017

Abstract

Background: Chronic kidney disease (CKD) is an important condition, with implications in morbidity and mortality that primary care physicians should early detect. The aim of this study was to identify the prevalence of CKD among the elderly population in primary care settings and to investigate the extent to which serum creatinine reflects kidney function.

Methods: All the patients aged 65 years old and over who came for laboratory tests in an urban primary health center for six months were invited to participated. Additional data on their age, gender, body weight (kg) and their medical history on chronic diseases were collected. The Cockcroft-Gault equation was used for the estimation of the participants' kidney function.

Results: 325 patients participated in the study with mean age 73.9 years old (±6.0, min 65-max 91), out of which 146 male (44.9%). According to the estimated creatinine clearance, which in turn estimates glomerular filtration rate (GFR) in ml/min, eGFR: 60-89 was found in 50.5% (164), eGFR: 30-59 in 26.2% (85) and eGFR: 15-29 in 2.2% (7). Spearman's correlation coefficient (rho0 between age and eGFR was -0.52, p<0.001. Serum creatinine (mg/dl) was ranging from 0.7 to 1.7 (mean 1.1) in patients with eGFR: 30 ml/min to 59 ml/min and 1.6 to 3.2 (mean 2.1) in the group with eGFR: 15 ml/min to 29 ml/min.

Conclusion: General practitioners should routinely estimate kidney function in their in the older patients. Since the normal serum creatinine reference interval does not necessarily reflect a normal kidney function, GFR equations may facilitate its estimation in every day practice. Early identification of CKD, dosage reduction of renally excreted drugs and timely referral to a nephrologist is feasible and should be pursued within primary care.

Keywords: Primary care; Kidney function; Chronic kidney disease (CKD); Cockcroft-Gault equation; Glomerular filtration rate (GFR)

Introduction

Chronic kidney disease (CKD) is an important condition, with implications in morbidity and mortality that every primary care physician should early detect. Ageing and a number of common chronic diseases like hypertension, diabetes mellitus, cardiovascular disease and their treatments are associated with significant modifications of kidney function [1-3]. Especially, ageing is frequently associated with loss of muscle mass, but also determines changes in kidney structure, since it is associated with a loss of renal mass by about one fourth from 30 to 80 years of age [4], and a decrease in kidneys' length by 15% from 17 to 85 years of age [5]. In the Framingham Offspring Study, it was shown that for an increase in age of ten years, the odds ratio for developing CKD was 2.56 [6]. Early identification of CKD, appropriate treatment of risk factors, alteration of medication that could be harmful and timely referral to a nephrologist may delay the progression of renal disease, decrease morbidity and mortality and lower costs [7,8].

The measurement of serum creatinine alone can be misleading in the detection of CKD, especially in elderly populations [9,10]. The estimation of creatinine clearance is essential, however a 24-hour urine collection for creatinine clearance is often biased in older patients due to inaccurate or incomplete urine collection [10]. For these reasons, some equations based on serum creatinine, age and sex are used to obtain an estimation of glomerular filtration rate (eGFR) [11,12]. Estimation of GFR is a very practical way for detecting and staging CKD, determining drug dosages, and stratifying risk.

Although estimation of GFR is a recognized necessity in every day practice, a UK study reported that 86% of general practitioners took only serum creatinine concentration into account when prescribing drugs for elderly patients [13]. There are a few published studies in primary care settings reporting on the identification of chronic kidney disease [1,13-18], while no study has been previously published on the prevalence of CKD in Greek primary care patients. The aim of this study was to identify the prevalence of CKD among the elderly population in primary care settings and the extent to which serum creatinine reflects kidney function.

Methods

Study population

All the patients aged 65 years old and over who came for laboratory tests in the primary health center of Evosmos in Thessaloniki were

invited to participated. The study was completed in six months, from May until October of 2015. The patients were informed by the general practitioner about the purpose of this study. Inclusion criteria were age (65 years old and over) and willingness and competence to provide their informed consent. Patients who declined to perform their blood tests in the health center's laboratory were excluded from the study, in order to ensure technical homogeneity and comparability of results.

Study variables

All patients underwent serum measurements of urea, creatinine, and uric acid (mg/dl). Moreover, they provided data on their age, gender, body weight (kg) and their medical history on chronic diseases.

Kidney function estimation

Creatinine Clearance (ml/min), which in turn estimates glomerular filtration rate (GFR) in ml/min was estimated by Cockcroft-Gault Equation {CreatClear=[(140-Age)*Weight/72*Serum Creat]*0.85 in female} [5]. According to the results, patients were distributed to the following five categories, according to the described stages of CKD: ≥90 ml/min, 60 ml/min to 89 ml/min, 30 ml/min to 59 ml/min, 15 ml/min to 29 ml/min and <15 ml/min [19].

Statistical Analysis

Data were entered independently by two researchers and were cross-checked by a third to avoid data entry errors. Continuous variables were summarized with means and standard deviations. Categorical variables were presented with frequencies and the corresponding percentages. For the evaluation of the correlation between age and eGFR, the Spearman correlation coefficient (rho) was used, since both variables were not normally distributed. Data were analyzed using the IBM/SPSS (version 21.0). All p values were two-tailed.

Results

Population of the study

325 patients participated in the study with mean age 73.9 years old (±6.0, min 65-max 91), out of which 146 male (44.9%). The description of population of the study in terms of their laboratory results and their medical history is described in Table 1.

	% (n) or mean (SD±, min-max)
Medical History	
No chronic disease	7% (24)
Hypertension	76.6% (249)
Diabetes Mellitus	25.8% (84)
Hyperlipidemia	54.2% (176)
Coronary Heart Disease	14.5% (47)
Osteoporosis	17.5% (57)
Hypothyroidism	6.2% (20)
Gastroesophageal reflux disease	28.9% (94)
Benign prostatic hyperplasia	6% (49)
Anemia	8% (26)
Hyperuricemia	8% (28)
Laboratory results	
Serum Creatinine (mg/dl)	1.0 (±0.3, 0.4-3.2)
Serum Urea (mg/dl)	38.8 (±14.8, 13-146)
Serum Uric Acid (mg/dl)	4.8 (±1.5, 1.2-10.2)

Table 1: Description of the study population (laboratory results and medical history).

Estimating kidney function

According to the estimated GFR (ml/min), GFR: ≥90 was found in 21.2% (69), GFR: 60-89 in 50.5% (164), GFR: 30-59 in 26.2% (85), and GFR: 15-29 in 2.2% (7). The mean of the serum creatinine, urea, uric acid, and age, as well as their range (minimum and maximum values) per group are presented in Table 2.

eGFR (ml/min)	Serum Creatinine (mg/dl) Mean (min-max)	Serum Urea (mg/dl) Mean (min-max)	Serum Uric Acid (mg/dl) Mean (min-max)	Age (mg/dl) Mean (min-max)
≥90	0.8 (0.4-1.4)	33.0 (14-64)	4.5 (1.9-7.5)	70.2 (65-82)
60-89	0.9 (0.5-1.5)**	36 (13-67)**	4.7 (1.2-9.6)	73.3 (65-86)**
30-59	1.1 (0.7-1.7)**	44.5 (17-101)**	5.1(2.0-10.2)*	77.5 (67-91)**
15-29	2.1 (1.6-3.2)**	99.0 (74-146)**	7.1 (4.1-8.7)**	81.1 (75-90)**
*p<0.05 compared to GFR ≥90 ml/min; **p<0.001 compared to GFR ≥90 ml/min				

Table 2: Descriptives of the serum creatinine, urea, uric acid, and age per group are presented.

Spearman's correlation coefficient rho between age and eGFR was -0.52, p<0.001.

The distribution of the study population in the different groups according to their estimated GFR and their medical history (no

previous history, hypertension, diabetes mellitus and coronary heart disease) is presented in Table 3.

eGFR (ml/min)	No current medications (N=24) % (v)	Hypertension (N=249) % (v)	Diabetes Mellitus (N=84) % (v)	Coronary Heart Disease (N=47) % (v)
≥90	25% (6)	18.5% (46)	27.4% (23)	21.3% (10)
60-89	62.5% (15)	49% (122)	46.4% (39)	44.7% (21)
30-59	12.5% (3)	29.7% (74)	21.4% (18)	27.7% (13)
15-29	-	2.8% (7)	4.8% (4)	6.4% (3)

Table 3: Groups according to eGFR and their medical history.

Discussion

This cross-sectional study in elderly Greek primary care patients provided further evidence on the necessity of the estimation of GFR for the evaluation of renal function in every day practice. Half of the patients visiting primary care settings were found to have impaired renal function (eGFR between 60 ml/min and 89 ml/min, while one out of three patients was found with eGFR below 60 ml/min. Age was negatively associated with the value of e-GFR, underlining the necessity to routinely estimate GFR in older patients, since kidney function estimate based on simple determination of serum creatinine level is hardly reliable.

Ageing was found significantly associated with CKD, being in line with previous findings [1,16] Since mild and moderate kidney disease is poorly described from serum creatinine alone, clinical laboratories could routinely estimate GFR and report the value when serum creatinine is measured. Such an initiative could significantly help health care providers to early detect CKD among patients with risk factors, but also monitor patients already diagnosed with CKD. In an effort to further facilitate primary care physicians, an interesting multifaceted intervention including the use of a software programme for the estimation of creatinine clearance and recommendation of individual dosage requirements has been used successfully in the setting of small primary care practices in Germany [20]. It was found to be effective in reducing inappropriately high doses of renally excreted medications in patients with CKD [20].

Some limitations of our work should be discussed. First of all, kidney function was estimated by an equation and not as a result of a 24-hour urine collection. However, equations have been proposed in order to provide the physician an easy way of calculation and an accurate estimation of kidney function [12]. However, all of them have their own limitations, and no equation proved to be better than the other ones [12]. Although the Cockcroft-Gault equation [11] may not take into account the variability of creatinine production, and may systematically overestimates the GFR in obese or edematous patients [21], it was the first published and still widely used in every day practice. Another limitation of the study could be that the population of the study was not a random sample from the community, but all the patients who were send for laboratory tests for six months. Since all the patients of the involved primary care setting are asked to undergo laboratory tests once a year, the population of the study can be considered representative of the people who use primary care services, providing useful conclusions for this population.

In conclusion, general practitioners should routinely estimate kidney function in their patients, especially in the older patients, since aging and their co-morbidities increase the possibilities of development of CKD. Since the normal serum creatinine reference interval does not necessarily reflect a normal kidney function, equations may facilitate its estimation in every day practice. Early identification of CKD, dosage reduction of renally excreted drugs and timely referral to a nephrologist is feasible and should be pursued within primary care.

References

1. van der Meer V, Wielders HP, Grootendorst DC, de Kanter JS, Sijpkens YW, et al. (2010) Chronic kidney disease in patients with diabetes mellitus type 2 or hypertension in general practice. Br J Gen Pract 60: 884-890.
2. Scott D, Davidson JA (2011) Managing chronic kidney disease in type 2 diabetes in family practice. J Natl Med Assoc 103: 952-959.
3. Vassalotti JA, Centor R, Turner BJ, Greer RC, Choi M, et al. (2016) Practical approach to detection and management of chronic kidney disease for the primary care clinician. Am J Med 129: 153-162.
4. Beck LH (1998) Changes in renal function with aging. Clin Geriatr Med 14: 199-209.
5. Miletic D, Fuckar Z, Sustic A, Mozetic V, Stimac D, et al. (1998) Sonographic measurement of absolute and relative renal length in adults. J Clin Ultrasound 26: 185-189.
6. Fox CS, Larson MG, Leip EP, Culleton B, Wilson PWF, et al. (2004) Predictors of new-onset kidney disease in a community-based population. JAMA 291: 844-850.
7. Black C, Sharma P, Scotland G, McCullough K, McGurn D, et al. (2010) Early referral strategies for management of people with markers of renal disease: A systematic review of the evidence of clinical effectiveness, cost-effectiveness and economic analysis. Health Technol Assess 14: 1-184.
8. Karsch-Völk M, Schmid E, Wagenpfeil S, Linde K, Heemann U, et al. (2013) Kidney function and clinical recommendations of drug dose adjustment in geriatric patients. BMC Geriatr 13: 92.
9. Swedko PJ, Clark HD, Paramsothy K, Akbari A (2003) Serum creatinine is an inadequate screening test for renal failure in elderly patients. Arch Intern Med 163: 356-360.
10. Duru OK, Vargas RB, Kermah D, Nissenson AR, Norris KC (2009) High prevalence of stage 3 chronic kidney disease in older adults despite normal serum creatinine. J Gen Intern Med 24: 86-92.
11. Cockcroft DW, Gault MH (1976) Prediction of creatinine clearance from serum creatinine. Nephron 16: 31-41.
12. Garasto S, Fusco S, Corica F, Rosignuolo M, Marino A, et al. (2014) Estimating glomerular filtration rate in older people. Biomed Res Int 2014: 916542.

13. Jonville-Bera AP, Paroux L, utret-Leca E (2008) Assessing general practitioners' prescribing behaviour in elderly patients with concealed renal failure. Br J Clin Pharmacol 65: 961-963.
14. Roderick PJ, Atkins RJ, Smeeth L, Nitsch DM, Hubbard RB, et al. (2008) Detecting chronic kidney disease in older people; what are the implications? Age Ageing 37: 179-186.
15. Anandarajah S, Tai T, de Lusignan S, Stevens P, O'Donoghue D, et al. (2005) The validity of searching routinely collected general practice computer data to identify patients with chronic kidney disease (CKD): A manual review of 500 medical records. Nephrol Dial Transplant 20: 2089-2096.
16. de Lusignan S, Chan T, Stevens P, O'Donoghue D, Hague N, et al. (2005) Identifying patients with chronic kidney disease from general practice computer records. Fam Pract 22: 234-241.
17. Glynn LG, Reddan D, Newell J, Hinde J, Buckley B, et al. (2007) Chronic kidney disease and mortality and morbidity among patients with established cardiovascular disease: A West of Ireland community-based cohort study. Nephrol Dial Transplant 22: 2586-2594.
18. Joshy G, Porter T, Le Lievre C, Lane J, Williams M, et al. (2010) Implication of using estimated glomerular filtration rate (GFR) in a multi ethnic population of diabetes patients in general practice. N Z Med J 123: 9-18.
19. National Kidney Foundation (2002) K/DOQI clinical practice guidelines for chronic kidney disease: evaluation, classification and stratification. Am J Kidney Dis 39: 1-266.
20. Erler A, Beyer M, Petersen JJ, Saal K, Rath T, et al. (2012) How to improve drug dosing for patients with renal impairment in primary care: A cluster-randomized controlled trial. BMC Fam Pract 13: 91.
21. Rolin HA, Hall PM, Wei R (1984) Inaccuracy of estimated creatinine clearance for prediction of iothalamate glomerular filtration rate. Am J Kidney Dis 4: 48-54.