Evaluation of an Instrument for Screening Patients at Risk for Chronic Kidney Disease: Testing SCORED (Screening for Occult Renal Disease) in a Portuguese Population

Edgar A.F. de Almeida^{a–c} Carlota Lavinhas^b Catarina Teixeira^a
Mário Raimundo^a Cristina Nogueira^c Maria João Melo^a Martina Ferreira^c
António Sampaio^b Inês da Silva Henriques^b Cecília Teixeira^c Sofia Almeida^d
António Gomes da Costa^a Miguel Leal^c

^aServiço de Nefrologia e Transplantação Renal, Hospital de Santa Maria, ^bFaculdade de Medicina de Lisboa, Lisboa,

^cDiaverum Portugal, Unidade de Torres Vedras, Torres Vedras, and ^dFaculdade de Farmácia de Lisboa, Lisboa, Portugal

Key Words

Chronic kidney disease · Prescreening · SCORED

Abstract

Prevalence of chronic kidney disease (CKD) is increasing and CKD has a long asymptomatic phase suitable for screening. SCORED (Screening for Occult Renal Disease) is a prescreening test which has compared favorably with KEEP. We report the results of SCORED testing in subjects attending a World Kidney Day event. After SCORED, subjects were tested for creatinine, urinary albumin and creatinine, and renal ultrasound. Eighty-eight subjects participated (32 men; mean age 59.7 ± 14.8 years; 58% hypertensive and 15.9% diabetics) of which 60 had a high score for kidney disease. Thirty-eight of 47 (80.8%) subjects that were further evaluated had a high-risk score. All subjects with CKD had a high score (100% sensitivity). SCORED showed low specificity (24.3%), but a high negative predictive value (100%). Including albuminuria in the definition of CKD increased the positive predictive value to 43.6%. In conclusion, SCORED is good for

prescreening subjects for CKD in a European population as it captures all patients with CKD. Moreover, in subjects with low risk, the probability of CKD is low. SCORED is useful in alerting the general population and the medical community about the risk factors of CKD. Copyright © 2012 S. Karger AG, Basel

Introduction

Prevalence of chronic kidney disease (CKD) is increasing worldwide [1] and assuming epidemic proportions according to some authors [2]. Portugal has the second highest incidence of patients starting dialysis in Europe [3]. Moreover, prevalence of CKD stages 3–5 in Portugal is 6.1%, which compares to 8.04% in the National Health and Nutrition Examination Survey (NHANES) 1999–2004 [4]. Increasing age and increasing cardiovascular risk factors such as diabetes, hypertension and metabolic syndrome may contribute for this high incidence and prevalence of CKD [4]. As CKD remains symptomless for

most of its natural history, the majority of patients do not start any particular treatment until later stages of the disease. Late referral to nephrologists is a common problem in predialysis care and is related to poor outcomes. Therefore, efforts should be undertaken to screen patients for CKD, in order to start measures of renal protection earlier in the course of the disease.

Screening the whole population for CKD is questionable, but is indicated for high-risk patients. SCORED (Screening for Occult Renal Disease) is a validated tool for screening high-risk patients for CKD [5], with a high sensitivity and high negative predictive value [6]. Using SCORED is inexpensive and is a good tool to select a population at high risk for CKD to perform further analysis of kidney function and imaging, sparing useless exams and inappropriate referral to nephrologists. SCORED has been used in selected populations with high cardiovascular risk and in an unselected population [6, 7].

The main purpose of this study was to evaluate the performance of the SCORED questionnaire in a small sample of an unselected Portuguese population which attended a 2011 World Kidney Day event.

Population and Methods

Subjects attending a 2011 World Kidney Day event in Torres Vedras, Portugal, were invited to participate in this study. The screening was announced in the local media and those wishing to participate were registered and scheduled. The study protocol included collection of demographic data, measuring blood pressure after sitting for 5 min, measuring blood glucose and cholesterol, testing urine for proteins with a urine dipstick and taking the SCORED questionnaire (9 questions) [5]. Two additional questions were included regarding personal and family history of renal disease. Subjects were classified as having high risk for CKD if the SCORED score was 4 or higher, in accordance with the original study [5]. Urine samples were tested for albumin and creatinine and expressed as a urinary albumin-to-creatinine ratio (UACR). Subjects were invited to attend the nephrology outpatient clinic at Hospital de Santa Maria (Lisbon, Portugal) within 3 months to collect blood samples and perform a renal ultrasound. Estimated glomerular filtration rate (eGFR) was calculated using the CKD-EPI formula [8, 9]. CKD was stratified according to eGFR and microalbuminuria, as proposed [10].

All subjects were given indications to preserve renal function as well as a letter to their family practice physician. Subjects with a high score were invited to perform analysis and ultrasound even if they denied further participation in the study. Patients classified as CKD 3 or higher were scheduled for further evaluation at the nephrology department.

Comparisons were done with Student's *t* test and the χ^2 test for continuous and categorical variables, respectively. All statistical analysis was performed using SPSS 16 for Windows®.

Table 1. Demographics and clinical characteristics of the study participants

	n	%
<i>Demography</i>		
Total	88	100
Age (years)		
18–39	10	11.4
40–59	27	30.7
60–79	46	52.3
>79	5	5.7
Female gender	56	63.6
Black race	2	2.3
Basic or primary education	41	46.6
<i>Clinical condition</i>		
Smoking habits	6	6.8
Alcohol consumption	40	45.5
Hypertension	51	58.0
Diabetes	14	15.9
Dyslipidemia	54	61.4
Knowledge of high urea or creatinine	7	8
Previous renal ultrasound	54	61.4
Daily medication	71	80.7
Medical observation in the last 6 months	78	88.6
Serum chemistries in the last 6 months	58	65.9

The study was sponsored by several institutions, namely Diaverum Portugal, the University of Lisbon School of Medicine, the Nephrology and Renal Transplantation Department – Santa Maria Hospital in Lisbon, City Hall of Torres Vedras District and the Portuguese Society of Nephrology. The study protocol was approved by the Ethics Committee of University of Lisbon School of Medicine and by the Ethics Committee of Diaverum Portugal. All patients gave written informed consent before participating in the study.

Results

Eighty-eight subjects attended the event (mean age 59.7 ± 14.8 years), 56 were women (63.6%) and 2 were black (2.3%; table 1). Hypertension was previously diagnosed in 51 subjects (58%), diabetes mellitus in 14 (15.9%), and dyslipidemia in 54 (61.4%). Moreover, 7 subjects (8%) knew that they had increased serum creatinine and/or urea. Sixty subjects had SCORED scores of 4 or higher (68.2%), all but 1 being 50 or more years of age. All diabetics and all subjects with a previous cardiovascular event (cerebrovascular, cardiovascular or peripheral vascular disease) had high-risk scores. Moreover, 94.1% of subjects with hypertension were classified as high-risk for CKD (table 2).

Table 2. Comparison between subjects with and without high SCORED scores

		SCORED ≥ 4 (n = 60)			SCORED < 4 (n = 28)			Total (n = 88)		p
		% of total	% in the risk group	n	% of total	% in the risk group	n	%	n	
1	Female gender	46.6	68.3	41	17.0	53.6	15.0	63.6	56	NS
2	Age, years									0.0001
	50–59	12.5	18.3	11	8.0	25.0	7	20.5	18	
	60–69	27.3	40.0	24	3.4	10.7	3	30.7	27	
	≥ 70	27.3	40.0	24	0.0	0.0	0	27.3	24	
3	Anemia	3.4	5.0	3	3.4	10.7	3	6.8	6	NS
4	Hypertension	54.5	80.0	48	3.4	10.7	3	58.0	51	0.0000
5	Diabetes	14.8	21.7	13	0.0	0.0	0	14.8	13	0.007
6	Previous MI or stroke	8	11.7	7	0.0	0.0	0	8.0	7	0.06
7	Cardiac failure	1.1	1.7	1	0.0	0.0	0	1.1	1	NS
8	Peripheral vascular disease	11.4	16.7	10	1.1	3.6	1	12.5	11	0.08
9	Knowledge of proteinuria	22.7	33.3	20	8.0	25.0	7	30.7	27	NS

Table 3. Stratification of CKD according to low- or high-risk subjects

CKD stages	eGFR	Total (n = 47)		SCORED < 4 (n = 9)		SCORED ≥ 4 (n = 38)	
		%	n	%	n	%	n
0 or 1	≥ 90	22.0	10	8.5	4	12.7	6
2	60–89	56.1	27	10.6	5	46.8	22
3	30–59	22.0	10	0.0	0	21.2	10

Table 4. Cross-tabulation of subjects with high and low SCORED with CKD defined as eGFR < 60 ml/min

		CKD (eGFR < 60)				
		yes	no	total		
SCORED	high-risk	10	28	38	26.3%	PPV
	low-risk	0	9	9	100%	NPV
		10	37	47		
		100%	24.3%			
		sensitivity	specificity			

PPV = Positive predictive value; NPV = negative predictive value.

eGFR, Proteinuria and UACR

Forty-seven subjects (53.4%; mean age 62.4 ± 14.6 years; 33 women) had a further evaluation in the nephrology outpatient clinic that included testing for serum creatinine and UACR, and a renal ultrasound. Their mean eGFR was 75.4 ± 21.1 ml/min/1.73 m². Stratification of the subjects in eGFR stages revealed that none had stage 4 or stage 5 CKD, 10 (21.2%) had CKD stage 3, 27 (57.4%) had CKD stage 2, and 10 (21.2%) had CKD stage 1 or no disease. Thirty-three percent of the subjects stratified as CKD stage 3 were previously unaware of their condition. Overall, 38 of the subjects attending the follow-up study had a high-risk score (80.8%). All subjects with CKD stage 3 were correctly classified as ‘high-risk’ patients with the SCORED tool; in contrast, 6 of 10 subjects with minimal disease were misclassified as ‘high-risk’ patients (table 3). When defining CKD as an eGFR < 60 ml/min/1.73 m² (10/47; 21.2%), the SCORED questionnaire showed 100% sensitivity but a specificity of only 24.3%, with a positive predictive value of only 26.4% but a negative predictive value of 100% (table 4). After including UACR in the definition, more subjects were considered to have CKD (19/47; 40.4%). The sensitivity of the SCORED questionnaire lowered to 89.5% and the specificity to 21.4%, while the positive predictive value increased to 43.6% and the negative predictive value decreased to 75.0% (table 5). Two subjects with a SCORED of less than 4 were misclassified as not having CKD; they were included because of the presence of UACR and both had a

Table 5. Cross-tabulation of subjects with high and low SCORED with CKD defined as eGFR <60 ml/min or UACR >30 mg/g

		CKD (eGFR <60 or UACR >30)				
		yes	no	total		
SCORED	high-risk	17	22	39	43.50%	PPV
	low-risk	2	6	8	75%	NPV
		19	28	47		
		89.5%	21.4%			
		sensitivity	specificity			

PPV = Positive predictive value; NPV = negative predictive value.

family history of renal disease. Therefore, in our sample the probability of having CKD in a subject with a SCORED score <4 was 4.2%.

Discussion

Although the prevalence of CKD is high, screening the general population is not recommended. Despite the long preclinical phase and the potential serious consequences, screening for CKD in the general population is limited by the fact that stratification based on eGFR is associated with an overestimation of the prevalence of patients with CKD stage 3. Moreover, there is no evidence that patients with CKD stages 1 or 2 will progress to later stages and will eventually need dialysis or transplantation. In fact, in a 5.5-year longitudinal follow-up study only 3.1% of patients in stages 2–4 progressed to renal replacement therapy, while 24.9% died [11]. Therefore, screening for CKD in subjects with no risk factors may be associated with unnecessary anxiety and consumption of resources.

Bang et al. [5] proposed an instrument for selecting patients more suitable for screening for renal disease. The SCORED questionnaire is a simple checklist that subjects can apply themselves before submitting to the screening procedures. Its merits include alerting individuals, general practitioners and other clinicians to risk factors for CKD [5–7, 12]. The SCORED questionnaire was developed from the NHANES 1999–2002 and validated in a combined cohort of the Atherosclerosis Risks in Communities (ARIC) and Cardiovascular Heart Study (CHS), and NHANES 2003–2004 [12]. The performance of the

SCORED questionnaire was evaluated in selected patients, either community samples or clinical settings [6, 7, 11–13].

In the current study, unlike other evaluations that retrospectively applied the questionnaire to databases, we used the SCORED questionnaire prospectively in an unselected population attending a 2011 World Kidney Day event. The percentage of subjects with a high-risk score in our study population is higher than in the NHANES or ARIC studies (68.2% vs. 51% in ARIC/CHS and 40% in NHANES 2003–2004), which may reflect the fact that people attending the 2011 World Kidney Day event are more concerned about kidney disease [12]. Our results confirmed the high sensitivity of the SCORED questionnaire, which detected all subjects with CKD. Conversely, the specificity was low meaning that a substantial number of subjects will be tested for CKD despite not being affected. Nevertheless, the negative predictive value is high, which means that a low score will discard with high certainty the presence of CKD.

In early stages, the definition of CKD depends not only on eGFR evaluation, but also on findings that may anticipate progression of kidney disease, such as proteinuria or renal cysts in patients with a family history of Autosomal Dominant Polycystic Kidney Disease [1], and inclusion of UACR in CKD criteria has recently been proposed [10]. In our study population, it lowered the sensitivity of the SCORED questionnaire because 2 subjects with proteinuria may not be aware of this finding and answered ‘no’ in the question about proteinuria. Interestingly, both had a family history of kidney disease, but this question is not computed in SCORED. We speculate whether the inclusion of an additional question in the questionnaire will improve the performance of the SCORED score.

We acknowledge some limitations of our study. Firstly, the sample size is small, which could limit the interpretation of results. Nevertheless, to the best of our knowledge this is the first study that applied the SCORED score prospectively and our results are consistent with the larger studies that applied it retrospectively in other populations [6, 7, 11–13]. Another limitation, which is common to other studies, is the fact that the definition of CKD depends on the persistence of the findings during a 3-month period. We were unable to fulfill this criterion, which can lead to an overestimation of CKD prevalence. To reduce the overestimation of CKD in subjects with eGFR >60 ml/min/1.73 m², we used the CKD-EPI equation instead of the MDRD equation.

Screening is applicable if the disease is serious, if treatment given before symptoms is more beneficial than after

symptoms (e.g. dialysis) and if the disease is highly prevalent. All these conditions are fulfilled in CKD. The utility of a prescreening test is higher in situations in which the screening test is invasive or expensive. Screening tests for CKD involve determination of serum creatinine, urine dipstick examination and a renal ultrasound; serum creatinine and urine dipstick are routinely performed by most physicians in general practice. The costs of these exams, although relevant, are diluted in the costs of a general check-up. Therefore, in our view, the value of a prescreening test is to increase the awareness of the risk factors for CKD both by physicians (namely primary care physicians) and the general population. The SCORED questionnaire could be used by primary care physicians

to evaluate the need for testing for CKD before patients are referred to nephrologists.

In conclusion, our study evaluated SCORED questionnaire in a European population and the results suggest that it is a good tool as a prescreening test for CKD with a high sensitivity and high negative predictive value.

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