



Contents lists available at ScienceDirect

European Journal of Internal Medicine

journal homepage: www.elsevier.com/locate/ejim

Original Article

Prognostic relevance of glomerular filtration rate estimation obtained through different equations in hospitalized elderly patients

Paolo Gallo^{a,*}, Antonio De Vincentis^a, Claudio Pedone^a, Alessandro Nobili^b, Mauro Tettamanti^b, Umberto Vespasiani Gentilucci^a, Antonio Picardi^a, Pier Mannuccio Mannucci^c, Raffaele Antonelli Incalzi^a, REPOSI Investigators^a Department of Medicine, University Campus Bio-Medico, Rome, Italy^b IRCCS - Istituto di Ricerche Farmacologiche "Mario Negri", Milan, Italy^c Bianchi Bonomi Hemophilia and Thrombosis Center, IRCCS Ca' Granda Maggiore Hospital Foundation, University of Milan, Italy

ARTICLE INFO

Keywords:

Glomerular filtration rate estimation
eGFR
Elderly in-patients
Prognosis

ABSTRACT

The estimated glomerular filtration rate (eGFR) is a predictor of important outcomes and its reduction has been associated with the risk of all-cause mortality in both general population and elderly patients. However while reduced renal function is common in older people, the best method for estimating GFR remains unclear, especially in an acute care setting. Most studies analyzing the accuracy of eGFR in the elderly were carried out in different heterogeneous settings. In this study, we compare the prognostic value of different formulas estimating GFR in predicting the risk of in-hospital morbidity and mortality within 3 months from discharge in elderly hospitalized patients. Data were extracted from "Registro Politerapia Società Italiana di Medicina Interna (REPOSI)". Patients with available creatinine values at hospital admission were selected and eGFR was calculated according to the different formulas: Cockcroft-Gault, Modification of Diet in Renal Disease equation, Chronic Kidney Disease Epidemiology Collaboration, Berlin Initiative Study and Full Age Spectrum. 4621 patients were included in the analysis. Among these, 4.2% and 14.2% died during hospitalization and within 3 months from discharge, respectively. eGFR > 60 ml/min/1.73 m² at admission was associated with a very low risk of mortality during the hospital stay and within 90 days from discharge, while an eGFR < 60 ml/min/1.73 m² was associated with unfavorable outcomes, although with a poor level of accuracy (AUC 0.60–0.66). No difference in predictive power between different equations was found. Physicians should be aware of the prognostic role of eGFR in a comprehensive assessment of elderly in-patients.

1. Introduction

Multimorbidity is a common problem in elderly populations as its prevalence rises with age [1]. As a result, an increasing number of patients with many chronic medical conditions are hospitalized in internal medicine and geriatric wards, with a subsequent increase of polypharmacy and its attendant risks. Among chronic diseases, chronic kidney diseases (CKD) affects more than one-third of people aged 70 years and often coexists with conditions that increase the risk of hospitalization and death [2–5]. Therefore, the evaluation of renal function, mainly for polypharmacy, represents an important topic.

Some studies have suggested that the age-related decline in estimated glomerular filtration rate (eGFR) is physiological and does not substantially increase the risk of death [6,7]. Conversely, it has been reported that reduced eGFR is independently associated with all-cause

mortality in the overall population, including the elderly populations [8–13]. La Higuera et al. [14] recently demonstrated that severely reduced eGFR in elderly in-patients is a strong predictor of the risk of dying during hospitalization and that eGFR at discharge helps to predict early death. Several formulas have been developed to estimate eGFR [15–17], because serum creatinine alone is not an adequate marker as its value is affected by several factors. Older and malnourished patients in the acute care hospital are at special risk of having a depressed eGFR with normal creatinine [18–20]. Anyhow, while reduced renal function is common in older people, the best method for estimating the GFR remains unclear and a reliable assessment for this population is a challenge, especially in an acute setting. The Cockcroft-Gault (CG) equation [21] was the first published formula and it is still widely used, being recommended for drug dosing and contraindication checking in the package leaflets of several medications. In the last years, new GFR

* Corresponding author at: Clinical Medicine and Hepatology Unit, Department of Medicine, Campus Bio-Medico University, Via Alvaro del Portillo 200, 00128 Rome, Italy.
E-mail address: paolo.gallo@unicampus.it (P. Gallo).

<https://doi.org/10.1016/j.ejim.2018.04.001>

Received 12 January 2018; Received in revised form 29 March 2018; Accepted 1 April 2018
0953-6205/ © 2018 European Federation of Internal Medicine. Published by Elsevier B.V. All rights reserved.

estimating equations (Modification of Diet in Renal Disease, MDRD; Chronic Kidney Disease Epidemiology Collaboration, CKD-EPI; Berlin Initiative Study, BIS) have been validated but only the BIS in persons aged 70 and older [16,22–25]. Finally, FAS (Full Age Spectrum) equation has been developed and validated across the entire age spectrum [26].

All these formulas have merits and drawbacks. For example, CG does not take into account the variability of creatinine production and calculates its clearance overestimating systematically the eGFR in obese or edematous patients [21,27]. MDRD has not been validated in patients with normal renal function and the elderly [28,29]; CKD-EPI is based on creatinine and has been validated in a population including relatively few people older than 70 years of age; FAS equation is somewhat new. Additionally many drugs may interfere with creatinine filtration and secretion, particularly in critical settings, and these variables are difficult to take into account.

Therefore, even though reduced eGFR has been reported to be independently associated with all-cause mortality, its prognostic significance is not universally defined, as it might vary with the formula used to estimate it, the outcome (i.e. functional decline, short or long term mortality) and the setting (community dwelling subjects, nursing home residents or hospitalized patients). Moreover, studies on the accuracy of different formulas for GFR estimation in older patients were carried out in ambulatory or outpatient settings [9,10,16,22,23] and the prognostic implication of eGFR in acute settings was not an object of research [30]. Therefore, to our knowledge, the role of different formulas estimating GFR as a marker of short-term mortality in older people in acute care wards has not been investigated. With this background and gaps of knowledge, the present study aims to compare the prognostic significance (in terms of risk stratification and predictive power) of GFR estimated with five different formulas (CG, MDRD, CKD-EPI, BIS and FAS) regarding short-term mortality (in-hospital and three months mortality) in elderly patients admitted to acute medical and geriatric wards.

2. Patients and methods

We extracted data from a validated database employed by internal and geriatric medical wards participating in the “Registro Politerapia SIMI (REPOSI)”, which is a registry including hospitalized patients aged 65 years or more and organized by the Italian Society of Internal Medicine (SIMI), and by the Istituto di Ricovero e Cura a Carattere Scientifico - IRCCS Istituto di Ricerche Farmacologiche “Mario Negri” and IRCCS Fondazione Ca’ Granda Ospedale Maggiore Policlinico, both in Milan. The collection of data occurred every 2 years in 2008, 2010, 2012, 2014 and since 2015, data collection has become annual. The design is described in details elsewhere [31].

All patients admitted to the participating wards during the four selected week windows separated by three months were consecutively recruited. Three months after discharge, ward physicians performed a telephone interview. All the data were revised and rechecked by a central monitor at the IRCCS-Mario Negri Institute. The study was approved by the Ethical Committee of the IRCCS Cà Granda Maggiore, Policlinico Hospital Foundations in Milan, as well as by the local Ethical Committees of the participating centers. All patients with available serum creatinine values at hospital admission were selected and the eGFR was calculated according to the CG (ml/min/1.73 m²), CKD-EPI, MDRD, BIS and FAS formulas.

From the full database of 4713 patients admitted to 107 Italian wards participating to the study in the 2010–2016 period, 35 patients were excluded because of unavailable data at hospital discharge and 57 for unavailable creatinine values. Of the remaining 4621 subjects analyzed, 1408 were lost at 3-month follow-up. The main study outcomes were in-hospital mortality and mortality three months after discharge. All the other clinical and demographic characteristics were retrieved.

The association between eGFR according to the different equations and in-hospital and 3-month mortality was estimated through log-binomial regression models and expressed as risk ratios (RRs) with 95% confidence intervals (95% CI). In order to find out the best model fit, eGFR was firstly modeled with a restricted cubic spline function and, as exposed afterward, the risk of short term mortality was expressed as RRs for eGFR greater or below 60 ml/min/1.73 m² and for every 10 units decrease of eGFR below this cut-off.

Nested multivariable models were used to study the effect of selected variables on the associations between eGFR equations and mortality. A first multivariable model was adjusted for demographical characteristics, such as age and sex. Then, since nutritional status and comorbidities may differently affect the eGFR estimates, and the related relationship between estimated eGFR and survival, a second multivariable model was fitted including also albumin levels, as a surrogate of nutritional status, and the Cumulative Illness Rating Scale Comorbidity Index, CIRS-CI, a comorbidity index.

Finally, the discriminatory performance of different eGFR equations were evaluated considering the under the receiver operating characteristic curve (AUC) of the above mentioned regression models for in-hospital and three months' mortality. Sensitivity, specificity and predictive values of eGFR < 60 ml/min/1.73 m² were also computed. All analyses were performed using R 3.3.3 software for Mac (R Foundation).

3. Results

3.1. Main characteristics of the study population

The general characteristics of the study population, overall and according to survival status, are reported in Table 1. Out of 4621 patients, 193 (4.2%) died during hospitalization, while 457 (14.2% of the initial 4621 minus the 1408 patients lost at follow-up) had died at 3 months after discharge. As expected, age, creatinine levels and CIRS were significantly higher in patients who died. In addition, these patients were physically and cognitively more compromised, had a lower BMI and the eGFR was significantly lower independent from the equation used to compute it.

3.2. eGFR and mortality

The relation between eGFR and the risk of mortality is reported in Fig. 1. While showing a positive trend for eGFR values above 100 ml/min/1.73 m² and below 60 ml/min/1.73 m², the mortality risk does not significantly increase for patients with eGFR above 100 ml/min/1.73 m² compared to those having eGFR between 60 and 100 ml/min/1.73 m² (RRs not shown). Conversely, mortality risk linearly and sharply increases for decreasing eGFR values below 60 ml/min/1.73 m². Accordingly, any further reduction in eGFR below this cut-off was significantly associated with both in-hospital and three-month mortality, as shown by the means of all estimating equations in Table 2. Concerning the strength of this association, all formulas showed comparable RR with the established outcomes.

When eGFR was also tested for its discriminative properties, the AUCs were poor and each formula showed a similar prediction of in-hospital and 3 months mortality with AUC of, respectively, 0.61 (95%CI 0.56–0.66) and 0.62 (95%CI 0.58–0.65) for CKD-EPI, 0.66 (95%CI 0.61–0.71) and 0.64 (95%CI 0.61–0.68) for CG, 0.60 (95%CI 0.55–0.65) and 0.60 (95%CI 0.57–0.64) for MDRD, 0.64 (95%CI 0.59–0.68) and 0.62 (95%CI 0.59–0.65) for BIS, 0.65 (95%CI 0.61–0.70) and 0.62 (95%CI 0.59–0.66) for FAS. The cut-off of 60 ml/min/1.73 m² had poor sensitivity and specificity, but showed a good negative predictive value (0.97–0.98 for in hospital mortality; 0.92–0.94 for 3-month mortality; Table 3).

After correction for factors potentially affecting GFR estimations, as well as for those affecting the relationship between eGFR and survival,

Download English Version:

<https://daneshyari.com/en/article/8945021>

Download Persian Version:

<https://daneshyari.com/article/8945021>

[Daneshyari.com](https://daneshyari.com)