Value of Creatinine Based Equations for Assessment of Glomerular Filtration Rate in Relation to Renal Pathology

Thesis

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بسم الله الرحمن الرحيم

قالوا

سبحانك لا علم لنا إلا ما علمتنا إنك أنت العليم الحكيم

صدق الله العظيم

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Arabic Summary .... --

List of Abbreviations

AHA	**: American Heart Association**
AKI	**: Acute kidney injury**
AUC	**: Area under curve**
BMI	**: Body Mass Index**
BSA	**: Body surface area**
BTP	**: β-trace protein**
CHF	**: Congestive Heart Failure**
Cin	**: Clearance inulin**
CKD	**: Chronic kidney disease**
CKD-EPI	**: Chronic Kidney Disease Epidemiology Collaboration study**
Cl	**: Clearance**
Clp	**: Plasma clearances**
CRF	**: Chronic renal failure**
CVD	**: Cardiovascular disease**
DTPA	**: ^{99m}Tc–diethylenetriamine penta-acetic acid**
eGFR	**: estimated GFR**
$eGFR_{Cr}$	**: estimated GFR creatinine**

List of Abbreviations (Cont.)

$eGFR_{Cys}$	**: estimated GFR cystatin**
eGFREPI	**: estimated GFR Epidemiology**
eGFRMDRD	**: estimated GFR Modified Diet in Renal Disease**
eGFRmix	**: estimated GFR Epidemiology-cystatin**
ESRD	**: End stage renal disease**
F	**: Female**
GFR	**: Glomerular filtration rate**
GLN	**: Glomerulonephritis**
GN	**: Glomerulonephritis**
HBP	**: High blood pressure**
HCV	**: Hepatitis C viral**
Hgb	**: Hemoglobin**
HPLC	**: High-performance liquid chromatography**
HTN	**: Hypertension**
IDMS	**: Isotope dilution mass spectrometry**
K/DOQI	**: Kidney Disease Outcomes Quality Initiative**

List of Abbreviations (Cont.)

M	**: Male**
MDRD	**: Modified Diet in Renal Disease**
MELD	**: Model for End-Stage Liver Disease**
mGFR	**: measured GFR**
NIST	**: National Institute of Standards and Technology**
NKF	**: National Kidney Foundation**
PCR	**: Protein Creatinine Ratio**
POCT	**: Point-of-care testings**
RIV	**: Relative interstitial volume**
SD	**: Standard Deviation**
TP	**: Total protein**
UA	**: uric acid**

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Introduction

Kidney failure is a worldwide public health problem, with increasing incidence and prevalence, high costs, and poor outcomes. There is even a substantially higher prevalence of the earlier stages of chronic kidney disease (CKD), with adverse outcomes, including loss of kidney function, cardiovascular disease (CVD), and premature death. Strategies to improve outcomes will require a global effort directed at the earlier stages of CKD ***(EKNOYAN et al., 2004).***

Development, dissemination, and implementation of clinical practice guidelines are means to improve outcomes of CKD. Rigorously developed evidence-based clinical practice guidelines, when implemented, can reduce variability of care, improve patient outcomes, and ameliorate deficiencies in health care delivery ***(STEINBERG, 2003)***

The National Kidney Foundation's Kidney Disease Outcomes Quality Initiative (K/DOQI) Clinical Practice Guidelines on Chronic Kidney Disease: Evaluation, Classification and Stratification of Risk published in 2002 provided the first definition of CKD independent of cause, and classification of severity based on GFR level ***(NATIONAL KIDNEY FOUNDATION, 2003).***

Disease screening requires the use of a diagnostic tool with high sensitivity and specificity. Measuring both glomerular filtration rate (GFR) and proteinuria are key elements to estimate the global function of the kidneys ***(Levey et al., 2011).***

The generally accepted Gold standard technique for GFR assessment uses inulin infusion. This technique was found to be difficult and time consuming to perform and was therefore considered inappropriate for routine clinical use. The creatinine clearance is a widely used test to estimate the glomerular filtration rate (GFR) ***(Rose &Post, 2001).***

Creatinine is an amino acid derivative with a molecular mass of 113 D that is freely filtered by the glomerulus. Many studies support the similarity of creatinine clearance to GFR and its reciprocal relationship with the serum creatinine level **(Stevens & Levey, 2005).**

Decreased creatinine clearance indicates decreased Glomerular filtration rate (GFR). This can be due to conditions such as progressive renal disease, or result from adverse effect on renal hemodynamic that are often reversible, including drug effects or decreases in effective renal perfusion (eg, volume depletion, heart failure) ***(Kasiske & Keane, 2000).***

Increased creatinine clearance is often referred to as hyper filtration and is most commonly seen during pregnancy or in patients with diabetes mellitus, before diabetic nephropathy has occurred. It may also occur with large dietary protein intake. A major limitation of creatinine clearance is that its accuracy worsens in relation to the amount of tubular creatinine secretion. Often as GFR declines, the contribution of urine creatinine from tubular secretion increases, further increasing the discrepancy between true GFR and measured creatinine clearance ***(Kasiske & Keane, 2000).***

Several authors have proposed creatinine-based equations to improve GFR estimation. The Modified Diet in Renal Disease (MDRD) study and the Chronic Kidney Disease Epidemiology Collaboration study (CKD-EPI) equations are used to estimate CKD prevalence in epidemiological studies ***(Levey et al., 2006).*** However, there are several limitations to the use of serum creatinine-based equations. There are reasons to believe that both equations overestimate the real prevalence of CKD because they underestimate the measured GFR (mGFR) ***(Delanaye & Cohen, 2008).***