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Serum Cystatin C
A new Marker of Glomerular Filtration Rate

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ABSTRACT

Background

Estimation of glomerular filtration rate is widely accepted as the best overall measure of kidney function. A standard for glomerular filtration rate assessment is ^{99m}Tc – diethylene diamine tetra acetic acid renal scan. Serum creatinine has traditionally been used as a marker of estimate the glomerular filtration rate, but it is often not enough accurate. Recently serum cystatin C has been proposed as a new endogenous marker of glomerular filtration rate.

Patients and Methods

A total of 182 patients (46 women and 136men), who performed ^{99M}Tc – DTPA renal scan were enrolled in the present study. In each patient serum creatinine and serum cystatin C were also determined. Average age of our patients was 51.7 (from 20 to 85 years). Written consent was obtained from the patients prior to the test.

Results

Average isotope GFR was 33.81 ml/min / 1.73m^2 (from 6 to 110 ml / min / 1.73m^2). Average serum creatinine concentration was 3.6 mg /dl (from 0.8 to10 mg /dl) and average serum cystatin C concentration was 3.01 mg /l (0.8 to 8 mg /l).The correlations between isotope GFR, serum creatinine and serum cystatin C were statistically significant. The correlations between isotope GFR and serum cystatin C was better (r=-0.8848) than correlation between isotope GFR and serum creatinine (r=-0.6066).

Conclusion

Isotope GFR, serum creatinine and serum cystatin C are comparable markers of renal function. Based on the present study, serum cystatin C is a more reliable measure of glomerular filtration rate than serum creatinine.

Key words: Glomerular filtration rate, Kidney function, serum cystatin C, serum creatinine,^{99m} Tc-DTPA renal scan

INTRODUCTION

Glomerular filtration takes part in 1.6 to 2.4 million glomerulus. It is determined by filtration pressure and hydraulic permeability of glomerular basal membrane (filtration coefficient).The glomerular filtration rate (GFR) is traditionally considered the best overall index of renal function in health and disease (1).Because GFR is difficult to measure in clinical practice, most clinicians estimate the GFR from serum creatinine concentration. However, the accuracy of this estimate is limited because the serum creatinine concentration is affected by factors other than creatinine filtration (2,3).

Basic method for the estimation of GFR is renal clearance. It is defined as the volume of plasma that can be completely cleared of a particular substance into urine within certain unite of time (4).GFR could be accurately defined by the substance which is continuously produced in the body and exclusively secreted by free filtration, not being processed, synthesized nor secreted and reabsorbed in renal tubules (5).An endogenous substance to satisfy all these conditions has not

been found yet. Cystatin C was proposed some years ago as an alternative endogenous substance, because it has many properties of an ideal marker for GFR (6).However, it had not been used in the past because of its technically demanding application (7).

The aim of the present study was to find out if serum cystatin c concentration is a good marker of GFR and if it can be compared with isotope GFR [^{99m}Tc-DTPA renal scan]. We also aimed to find out if cystatin C could be a better indicates of GFR than serum creatinine concentration.

Patients and Methods

There were 182 patients included in the study, 136 were male (74.7%) and 46 female (25.3 %).Patients average age was 51.7 years, ranged from 20 to 85 years. Their average BMI was 22.6 (ranged from 14.5 to 29.8) and their average BSA was 1.68 (ranged from 1.2 to 2.07).

In all patients included in the study isotope GFR was estimated using 99mTc-DTPA renal scan by gamma camera (Gates method) at the same time serum creatinine and serum cystatin C were measured. Serum creatinine was measured by the kinetic method according to Jaffe, serum cystatin C was measured by particle-enhanced immuno nephelometric method (Dade Behring, Germany).

In statistical analysis medcalc statistical software was used. Mean values, range and standard deviation (SD) were calculated. Pearson's correlation coefficient (r) was used for finding out correlation between isotope GFR and serum creatinine and cystatin C.

RESULTS

Average isotope GFR in our patients was 32.4 ml/min/1.73m^2 ranged from 6.2 to 110 ml/min/ 1.73m^2 (33.81 ± 21.42). Serum creatinine concentration values were from 0.8 to 10mg/dl, average value was 3.60 mg/dl (3.60 ± 2.20). Serum cystatin C concentration values were from 0.8 to 8 mg/l, average value was 3.01 mg/l (3.01 ± 1.29).Correlation was better between isotope GFR and serum cystatin C (r = -0.8848) than between isotope GFR and serum creatinine (r = -0.6066) (Table1).

Table 1: Correlation between isotope GFR, serum creatinine and serum cystatin C

Parameters	Isotope GFR (ml/min/1.73 m^2)	P <
Creatinine (mg/dl)	r = -0.6066	0.001
Cystatin C (mg/l)	r = -0.8848	0.0001

r = Pearson's correlation coefficients.

DISCUSSION

Serum creatinine is the most often used method for GFR estimation in clinical practice. Creatinine is freely filtered it is not reabsorbed nor metabolized in kidneys, but partially secreted into proximal tubule. Tubular secretion causes increase and creatinine clearance for 10-20% (8).As plasma concentration increase, tubular secretion of creatinine increases, leading to an overestimation of GFR in patients with moderate to severe decreases of GFR (3). Serum creatinine concentration depends on muscle mass and food intake (meat in diet).A number of drugs used in clinical practice affect this tubular secretion of creatinine and thus rise the plasma creatinine and reduce the calculated creatinine clearance (eg., trimethoprim cimetidine etc).

Because of all mentioned facts, there is a need for a new maker of GFR, which can be easily measured and which would not depend on age, gender, weight, height, food intake and without possibility to be influenced by the concentration of other substances in the serum. Recently, cystatin C has been proven as on of such markers. It is protease inhibitor, produced by nucleated cells at a constant rate and is freely filtered through glomerular membrane[9].

There have been some studies published on the role of cystatin C is in estimation of GFR. Their results show that cystatin C serum concentration is better indicator of GFR than serum creatinine concentration (10,11,12,13,14). Results of our study confirm good correlation of Cystatin C

concentration and isotope GFR. Findings show that serum cystatin C is better marker of GFR than creatinine.

Results of our study bring us to conclusion that serum cystatin C concentration is a good marker of GFR. Besides, estimation of serum cystatin C is not technically difficult any more, but it is still more expensive than estimation of serum cretainine.

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