Research Article

Assessment of Serum Cystatin C Marker in Patients of Chronic Kidney Disease

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ABSTRACT

Chronic kidney disease (CKD) is a globally significant public health problem. It is one of the serious conditions which decrease life expectancy. It may progresses to end-stage renal disease (ESRD) and then, only treatment option left will be kidney transplantation. The various markers are utilized for accurate diagnosis, assessing risk and for guiding clinical management. Various studies are done to validate serum cystatin C level, to be considered, as alternative to existing serum creatinine marker, as a filtration marker for CKD patients. This study was done to assess utility of cystatin C as diagnostic marker for CKD patients and compare results of cystatin C level with serum creatinine level for CKD cases and non- CKD cases. The prospective study was conducted in Clinical Pathology Laboratory of tertiary care hospital during the period August 2021 to July 2022 for the period of one year. The 50 cases were labeled as CKD cases, when the clinical presentation patients were classically of CKD patients along with increased levels of serum creatinine, abnormal ultrasonography findings of KUB and/or abnormal GFR in DTPA renogram. 50 control cases of non-CKD included in the study to compare with 50 CKD cases. The serum cystatin C level and the serum creatinine level were obtained from all study participated 100 cases. The serum cystatin C level showed the sensitivity (98.00 %), specificity (100.00 %) and accuracy (100.00 %) for detection of CKD cases. The serum creatinine level showed the sensitivity (92.00 %), specificity (96.00 %) and accuracy (94.00 %) for detection of CKD cases. The present study showed that serum cystatin C level is reliable, more accurate marker than commonly used serum creatinine level for early detection of CKD patients.

Keywords: Cystatin C level, serum creatinine, CKD.

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INTRODUCTION

The kidney disorders were listed on 12th position, for the most common causes of death in the report of Global Burden of Disease Study. They lead to approximately 1.1 million deaths per year.[1]The south Asian countries like India, Pakistan and Bangladesh has highest prevalence for CKD diseases which accounts for approximately 60 % of global population. The consumption of junk foods, medications abuse and associated disorders like diabetes mellitus, hypertension and renal stones are the majority reasons associated with CKD. [2, 3] The early diagnosis and prompt treatment may reduce the adverse effects outcomes of CKD.

CKD led to irreversible deterioration of kidney function and may progress to ESRD. The initial degradation of kidney functions can be detected with biochemical markers. In the later stage, patients of CKD present with clinical features of kidney failure and uremia. The markers like creatinine, urea, uric acid and electrolytes are utilized for routine assessment of kidney functions.[4]

Glomerular filtration rate (GFR) is still considered as gold standard marker for evaluation and management of CKD patients. The low GFR values are associated with the mortality. The serum creatinine commonly used to calculate GFR. However, serum creatinine value depends upon age, weight, gender, muscle mass.[5]The serum creatinine value decreases in diseases like cirrhosis and muscle wasting diseases and its value increases with high protein intake.[6] Thus, any diseases including malnutrition, inflammation which affecting muscle mass, will also affects creatinine value.

The cystatin C is low molecular weight non-glycosylated protein. Because of its small structure, it is easily filtered through the glomerulus and then totally reabsorbed and later degraded by proximal tubular cells.[6] The cystatin C has upper hand over creatinine, as cystatin C is not affected by inflammation, malignancy and muscle mass.[7]

There are many studies which showed that cystatin C has more accurate, valuable than the conventional marker-creatinine, in earlier prediction of CKD. [8, 9]The present study was undertaken to analyze diagnostic value of cystatin C, over serum creatinine in the diagnosis of CKD.

MATERIALS AND METHODS

The study was conducted in tertiary care hospital Clinical Pathology Laboratory for the period from August 2021 to July 2022.

The 50 CKD cases were included for study purpose. The inclusion criteria for the CKD cases were classical clinical presentation of CKD case, increased serum creatinine level, KUB abnormal findings of USG and/or abnormal GFR diagnosis in DTPA renogram. 50 non-CKD control cases used to compare with CKD cases. For all the cases the serum levels of cystatin C and creatinine were obtained. All other routine laboratory investigations like urine routine microscopy, blood urea, serum electrolytes, USG of KUB, DTPA renogram were also done for all cases.

The serum levels of cystatin C and creatinine were obtained on biochemistry analyzer. The serum creatinine level was obtained with enzymatic measurement method. The serum cystatin C level was obtained by turbido-metric immunoassay method, based on agglutination principle. The serum creatinine reference range was 0.5 to 1.2 mg % in females and 0.5 to 1.5 mg % in males. The serum cystatin C level reference range was 0.6 to 1.0 mg/ L. Renal dysfunction was labeled for cases where creatinine clearance was below 70 ml /min / 1.73 m square.[10]

The Statistical analysis were done with the SPSS software, for serum levels of cystatin C and creatinine for their respective accuracy, sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) for diagnosis of CKD cases.

RESULTS AND DISCUSSION

Out of 50 CKD cases, 29 cases were male and 21 were female and their age ranges from 39 to 64 years. The glomerulonephritis (9 cases), hypertension (13 cases), diabetes mellitus (18 cases), obstructive uropathy (10 cases) were included in 50 CKD cases.

Table 1: Serum creatinine level test evaluation for CKD cases

	CKD Cases	Non- CKD cases (Control)	Total	Predictive value (PV)
Creatinine Positive	46	02	48	**PPV (95.84 %)**
Creatinine Negative	04	48	52	**NPV (92.30 %)**
Total	50	50	100	
	Sensitivity (92.00 %)	**Specificity (96.00 %)**	**Accuracy (94.00 %)**	

Table 2: Serum cystatin C level test evaluation for CKD cases

	CKD Cases	Non- CKD cases (Control)	Total	Predictive value (PV)
Cystatin C Positive	49	00	49	**PPV (100.00 %)**
Cystatin C Negative	01	50	51	**NPV (98.03 %)**
Total	50	50	100	
	Sensitivity (98.00 %)	**Specificity (100.00 %)**	**Accuracy (100.00 %)**	

The Serum creatinine level showed Sensitivity, Specificity, Accuracy, Positive Predictive Value (PPV) and Negative Predictive Value (NPV) of 92.00 %, 96.00 %, 94.00 %, 95.84 % and 92.30 % respectively for detection of CKD cases. (Table 1) The serum cystatin C level showed Sensitivity, Specificity, Accuracy, Positive Predictive Value (PPV) and Negative Predictive Value (NPV) of 98.00 %, 100.00 %, 100 %, 100 % and 98.03 % respectively for detection of CKD cases. (Table 2)

In the present study, it was found that accuracy of serum Cystatin C was better than serum creatinine, for the detection of CKD diseases. Bukabau JB et al (2019) found similar findings in their study.[11] Stevens LA et al (2008) found that serum levels of cystatin C were closely correlated with GFR than serum creatinine in CKD cases.[12] Hojs R et al (2008) in their study showed that serum cystatin C is a more reliable marker than serum creatinine for GFR calculations in patients with CKD.[13] In the several studies done in the past by Grubb A et al (1985)[14], Simonsen O et al. (1985)[15], Harmoinen AP et al (1999)[16], Kyhse-Andersen J et al (1994)[17], Newman DJ et al (1995)[18], Coll E et al (2000)[19], Dharnidharka VR et al (2002)[20] proved the superiority of cystatin C in comparison to serum creatinine, for measurement of GFR in the diagnosis of CKD. There are occasional studies like Oddoze C et al (2001) which presented that cystatin C is not more sensitive than creatinine, for detecting early renal impairment diabetes CKD cases.[21]

The level of serum cystatin C is not affected by age, gender, race, protein intake and muscle mass, while serum creatinine level affected by all these factors and is the reason of superiority of serum cystatin C, as compared to, serum creatinine in detecting CKD cases. Also, as the GFR decreases, serum cystatin C level starts to rise proportionately, as compared to serum creatinine level. The serum cystatin C level can be used in clinical correlation with varying degrees of kidney function and it also detect decreases in GFR which are not evident with serum creatinine based measurements.[22] Thus, in the present study, it is concluded that serum cystatin C is a reliable marker of renal function over serum creatinine.

The limitation of the present study was about small sample size. More studies needed, with the application of present study objectives, to the large population, for better conclusions. Also studies required to be done, by evaluating different etiologies CKD patients (e.g. diabetes mellitus,

hypertension etc.) with their different treatment regimens like medications or dialysis and analyzing their effect on the levels of serum creatinine and serum cystatin C.

CONCLUSION

The serum cystatin C is a diagnostic and a sensitive marker for detection of CKD cases. The serum cystatin C can be included as screening test for diagnosis of CKD cases, in view of its promising simple measurement method, more accuracy and reasonable cost. For the clinicians, serum cystatin C is better alternative to commonly used serum creatinine marker, for better accurate detection of deranged kidney function and improved management of the patients.

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