

Estimation of Creatinine Clearance in Detection of Kidney Disease

N.JEEVAN YADAV {REG NO.-17006092}- FINAL YEAR MBBS
DR.NAGESHWARAO [DM,NEPHROLOGY]
DR.K.INDIRA PRIYA[PG IN GENERAL MEDICINE]

ABSTRACT:

AIM : To measure creatinine clearance to evaluate kidney filtration

OBJECTIVE: the main purpose is to assess kidney function.

Creatinine clearance is the theoretical volume of blood which is wholly cleared of creatinine following one passage through kidney.

It is a measure of glomerular function test- to determine estimated glomerular filtration rate

To provide information about how well the kidneys are filtering blood and is important for detecting and monitoring kidney problems

Date of Submission: 12-10-2022

Date of Acceptance: 27-10-2022

I. INTRODUCTION:

The measurement of accurate renal function is vital for the routine care of patients.

[1] Determining the renal function status can predict kidney disease progression.

[2] The glomerular filtration rate (GFR) describes the flow rate of filtered fluid through the kidneys. The biochemical marker creatinine found in serum and urine is commonly used in the estimation of GFR.

[3] Both CrCl and GFR can be measured using the comparative values of creatinine in blood and urine.



$GFR = [UrineX \text{ (mg/mL)}] * \text{urine flow (mL/min)} / [PlasmaX \text{ (mg/mL)}]$, where X is a substance that is completely excreted.

GFR APPROXIMATION USING CREATININE CLEARANCE:

The CrCl rate approximates the calculation of GFR since the glomerulus freely filters creatinine. However, it is also secreted by the peritubular capillaries, causing CrCl to overestimate the GFR by approximately 10%. Despite the marginal error, it is an accepted method for measuring GFR due to the ease of measurement of CrCl.

$$eCCr = (140 - \text{Age}) \times \text{Mass (kg)} \times [0.85 \text{ if female}] / 72 \times [\text{Serum Creatinine (mg/dL)}]$$

Cockcroft-Gault formula: Estimated creatinine clearance rate (eCCR)

Serum and urine samples are required. The serum collection must be within 24 hours of urine collection.

II. METHODS:

APPARATUS: BECKMAN COULTER ANALYZER USING CHEMISTRY CALIBRATION, CREATININE REAGENT OSR6678

REAGENT USED: SODIUM HYDROXIDE AND PICRIC ACID IN THE PRESENCE OF ALKALINE PH GIVES YELLOW ORANGE COMPLEX.

SPECIMEN COLLECTED- SERUM

INTERFERING SUBSTANCES- BILIRUBIN,HEMOLYSIS,LIPEMIA.

RANDOMISED CONTROL TRAIL:

Nearly 50% of all the approached patients aren't diagnosed with CKD or any glomerular disease.

Blood specimen: RFT- SERUM CREATININE.

A blood sample of 2mL (minimum 0.5 mL) in a labeled tube, preferably stored in refrigerated or frozen temperature.

USG-ABDOMEN : cortico-medullary differentiation.

MATERIAL:

study was conducted on around 773 number of patients [MEN-498,WOMEN-275] suffering from prior renal disease and their creatinine clearance levels and GFR values are estimated in relation to the severity of the disease.

TIME: 17-19 DAYS

VERBAL CONSENT TAKEN

UNBIASED TESTING WAS DONE

Diagnostic Tests:

Elevated serum creatinine levels and a decreased CrCl rate are usually indications for abnormal renal function. For these patients, it is recommended to perform a thorough history, physical exam, renal ultrasound, and urinalysis. Relevant patient history includes medications, history of edema, gross hematuria, diabetes, and polyuria. A urinalysis positive for proteinuria or urinary sediment indicates the presence of glomerular disease.

Testing Procedures:

The normal range of CrCl is 110 to 150mL/min in males and 100 to 130mL/min in females. Serum creatinine level for men with normal kidney function is approximately 0.6 to 1.2mg/dL and between 0.5 to 1.1 mg/dL for women. Creatine levels above the normal range correlate with a reduction of GFR and indicate renal dysfunction.

Alteration of serum creatinine values can occur as its generation is subject to influence by muscle function, activity, diet, and health status of the patient. Increased tubular secretion of creatinine in certain patients with dysfunctional kidneys could provide a false negative value.

Interfering Factors:

A significant limitation of CrCl measurement is an age-related increase in the tubular secretion of creatinine that results in an overestimation of GFR. Creatinine clearance is affected by sex and race. Women have less muscle mass and a lower rate of creatinine production in comparison to men. Latinos produce lower clearance values while blacks produce higher values, indicating greater muscle mass in blacks. Patients with a unique dietary intake (e.g., vegetarian, creatine supplements) or have muscle wasting (e.g., malnutrition, amputation) can produce levels of creatinine that deviate from the general population. Drugs such as trimethoprim-sulfamethoxazole can increase serum creatinine level by approximately 0.4 to 0.5 mg/dL

Results, Reporting, Critical Findings:

Normal clearance values

Male - 1.65 to 2.33 ml/s

Female- 1.496 to 2.18 ml/s

BECKMAN COULTER REFERANCE- 0.6-1.3

Estimation of Creatinine Clearance in Detection of Kidney Disease

Serum creatinine level	N (Number of patients)	Percent
Normal level	386	49.3
High level	212	27.42
Not done	175	22.6
Total	773	100

It is essential to determine CrCl and serum creatine levels when there is suspicion of renal dysfunction. A common complication that results in increased serum creatine levels is acute kidney injury (AKI). A sudden decrease in GFR and oliguria are signs of AKI. this type of injury is common in 20% of hospitalised patients and leads to volume overload, electrolyte imbalances and drug toxicity. Management for patients with AKI is to persevere kidney function and prevent further complications.

CKD category	GFR (mL/min/1.73 m ²)	Description
G1	≥90	Normal or High
G2	60-89	Mildly decreased*
G3a	45-59	Mildly to moderately decreased
G3b	30-44	Moderately to severely decreased
G4	15-29	Severely decreased
G5	<15	Kidney failure

NOTE: PREFERENTIALLY ITS A CKD CATEGORY

Persistently elevated levels of serum creatinine and severely reduced GFR are indicative of chronic kidney disease. CKD occurs through multiple pathologic mechanisms of injury and affects several compartments of the kidney. The loss of micro-vasculature and increased fibrosis leads to hypoxia within the kidney, making patients more susceptible to acute kidney injuries with poor healing. The continued loss of tubular cells becomes replaced with collagen scars and macrophage infiltration. These chronic changes are associated with further loss of renal function and progression towards end-stage renal failure.

CKD- elevated levels of serum creatinine and severely reduced GFR for more than 3 months.

Clinical Significance:

Routine blood tests for serum creatinine levels among other substances can prevent future complications of renal disease. Patients with a chronic conditions like uncontrolled diabetes and hypertension are especially vulnerable to kidney disease.

Informed Consent form:

I hereby give consent to participate in study conducted by N.JEEVAN YADAV[FINAL YEAR, MBBS],SIDDHARTHA MEDICAL COLLEGE,VIJAYAWADA and to use my personal clinical data and results of investigation for the purpose of analysis and to study the nature of disease disease. I also give consent for further investigations.

References:

- [1]. Kumar BV, Mohan T. Retrospective Comparison of Estimated GFR using 2006 MDRD, 2009 CKD-EPI and Cockcroft-Gault with 24 Hour Urine Creatinine Clearance. Res. 2017 May
- [2]. Jalalomuhali M, Lim SK, Md Shah MN, Ng KP. MDRD vs. CKD-EPI in comparison to ⁵¹Chromium EDTA; BMC Nephrol. 2017 Dec

N.JEEVAN YADAV, et. al. "Estimation of Creatinine Clearance in Detection of Kidney Disease."
IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), 21(10), 2022, pp. 01-04.