

# Comparative Assessment of Glomerular Filtration Rate in Patients with Chronic Kidney Disease by the Cockcroft-Gault and MDRD Formulae in Conakry

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## **ABSTRACT**

**Introduction:** Epidemiological data show that the incidence of Chronic Kidney Disease (CKD) is increasing in all countries, developed or not. Our work was to estimate and compare the Glomerular Filtration Rate (GFR) calculated by the two formulae, CG (Cockcroft-Gault) and the MDRD (Modification of the Diet in the Renal Disease) in Chronic Kidney Disease patients in hospitals in Guinea.

**Materials and method:** The study was retrospective and descriptive from 2008 to 2010. The records examined were the number of 323 CKD cases out of 743 hospitalizations. The CKD was taken into account at stages 3, 4 and 5 i.e. moderate, severe and End-Stage Kidney Disease. Clearance calculations were made by the two formulae (CG and MDRD). Comparison parameters were patient's age, gender, and estimated glomerular filtration rate according to the stage of CKD.

**Results:** The prevalence of CKD was 43.5%. The average age of patients was 47 years [18-90]. The men were 174 (54%) in number and women 149 (46%) in number with a sex ratio of M / F = 1.2. The average serum creatinine was 672  $\mu\text{mol/l}$  [168-2854]. The estimated GFR was on average 16.2 ml / min by CG and 21.1 ml / min by MDRD. According to age, patients under 50 years were 202 (63%) in number by C-G and 210 (65%) in number by MDRD and

those of over 50 years were 121 (37%) in number by CG against 113 (35%) by MDRD. According to gender and stage of CKD, men and women were 11% and 12% by C-G, 5% and 8% by MDRD for the stage 3; 14% and 15% by -C-G against 11 % and 11% by MDRD for the stage 4. At the stage 5 of CKD men were 28%, women 27% by C-G against 29% and 27% by MDRD respectively.

**Conclusion:** The two formulae are comparable in the proportion of patients categorized into each of the CKD stages.

**Keywords:** *Chronic kidney disease, Cockcroft-Gault, MDRD*

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## **INTRODUCTION**

Epidemiological data show that the incidence of chronic kidney disease (CKD) is increasing in all countries, developed or not [1,2,3]. Impaired renal function results in the decrease in glomerular filtration rate (GFR). Renal physiological aging is responsible for a decrease in GFR, but it is normally greater than 60 ml/min/1.73m<sup>2</sup> in patients without kidney disease

<sup>1</sup>. The GFR has been evaluated for many years by the Cockcroft-Gault (CG), developed from a small cohort of hospitalized patients [4]. Thereafter, another formula of MDRD (Modification of Diet in Renal Disease) study, using the same method for the determination of creatinine, but derived from a larger cohort of patients with renal failure was proposed and validated in many people [5]. The Chronic Kidney Disease in our context is usually discovered at a late stage, the medical staff and the means for the care are also insufficient. Our work was to estimate and compare the glomerular filtration rates calculated by the two formulae, CG and MDRD in Chronic Kidney Disease patients seen in our hospitals in Conakry, Guinean.

**MATERIALS AND METHODS**

The study included 321 cases of patients with Chronic Kidney Disease. It was retrospective and descriptive,

$$Cl_{cr} \text{ MDRD (mL/min/1.73m}^2\text{)} = 186 \times (\text{creatinine})^{-1.154} \times \text{Age}^{-0.203} \times K$$

K= 0.742 if woman; and 1 if man of other races

K= (0.742 X 1.21) or 0.89782 if woman of black race

K=1.21 if man of black race

Each patient filled an informed consent form on enrolment.

**RESULTS**

The prevalence of CKD was 43.5% (323/743 cases). The average age of patients was 47 years (18-90). The men were 174 (54%) in number and women, 149 (46%) in number with a sex ratio of M / F = 1.2.

According to age, patients under 50 years were 202 (63%) in number by C-G and 210 (65%) in number by MDRD and those of over 50 years were

**Table 1:** Presentation of cases by age and stage of CKD

Age / Stage CKD	Formula	Stage 3	Stage 4	Stage 5	Total
< 50 years	C-G	34	50	118	202 (63%)
	MDRD	43	45	122	210 (65%)
> 50 years	C-G	22	32	67	121 (37%)
	MDRD	33	34	46	113 (35%)

extended over a three-year period (1<sup>st</sup> January 2008 – 31<sup>st</sup> December, 2010).

The parameters studied were age, gender, weight, and serum creatinine. Cases of dialysis and transplanted patients were excluded.

Blood samples for Serum creatinine were collected and analysed at the central laboratory of Donka Hospital using spectrophotometric technique.

GFR was estimated using the formulae of C-G and simplified MDRD.

$$Cl_{cr} \text{ C-G (mL/min)} = K \times [140 - \text{age (years)}] \times \text{weight (kg)} / \text{Creatinine}$$

K = 1.23 for men and 1.04 for women.

121 (37%) in number by C-G against 113 (35%) by MDRD (Table 1).

According to gender and stage of CKD, men and women were 11% and 12% by -C-G, 5% and 8% by MDRD for the stage 3; 14% and 15% by -C-G against 11 % and 11% by MDRD for the stage 4. At the stage 5 of CKD men were 28%, women 27% by -C-G against 29% and 27% by MDRD respectively (Table 2).

The average serum creatinine was 672 μmol / l [168-2854]. The estimated GFR was on average 16.2 ml / min by C-G and 21.1 ml / min by MDRD (Table 3).

**Table 2:** Presentation of cases by gender and stage of CKD

Sex / Stage CKD	Formula	Stage 3	Stage 4	Stage 5	Total
Male	C-G	36	45	90	171 (53%)
	MDRD	26	42	94	162 (50%)
Female	C-G	39	48	65	152 (47%)
	MDRD	32	42	87	161 (50%)

**Table 3:** Distribution of average clearances based on CG / MDRD formulae, gender and age

Age	C-G			MDRD		
	F	M	Average	F	M	Average
< 50 yrs	15.5	16.9	16.2	16.2	17.5	16.8
> 50 yrs	13.7	21.3	17.5	20.6	30.2	25.4
Average	14.6	19.1	16.8	18.4	23.8	21.1

### DISCUSSION

The prevalence of CKD was 38% in 2002 in Madagascar and 34% in Guinea [2, 3]. Several studies have been conducted in order to evaluate the performance of these two estimation formulae. They showed a superiority of MDRD in estimating renal function for a GFR less than 60 ml/min/1.73m<sup>2</sup> [6].

Both formulae give substantially the same results in young patients (<50 years) for both stage 5 and stages 3 and 4.

In elderly patients on the other hand and even more so in those over 60 years, at the stage 5, the C-G formula significantly overestimates the number of renal failure compared to MDRD. Lamb *et al.* in 200, found meanwhile greater accuracy for the MDRD and an underestimation of GFR by CG about 20% on average [7].

We found out, after application of the two formulae, whatever the stage of the disease, a predominance of male gender.

In our studies, the average GFR was according to C-G for the age 16.8 ml / min, and gender

14.6 ml/min in women, and 19.1 ml / min in men. It was, on the other hand, with MDRDs, 21.1 ml/min/1.73m<sup>2</sup> for the age; 18.4 ml/min/1.73m<sup>2</sup> for women and 23.8 ml/min/1.73m<sup>2</sup> for men.

Pedone *et al.* in 2006 found with the CG formula GFR an average of 51.2 ml / min against 64.7 ml/min/1.73m<sup>2</sup> with that of MDRDs [6]. This difference in average GFR allows us to see that according to the formula used in GFR, patients of both sexes are not always classified in the same stage renal failure. According to the CG formula, among the 321 patients with altered GFR, 185 patients (57.3%) had an end renal failure (GFR <15 ml / min). While they were 167 patients (54.2%) in number at the stage 5 with the MDRD formula.

Colas M. reported in France through a study in 1246 elderly patients, 1059 cases or 85% of patients with renal failure according to CG, and only 508 or 40% of the patients according to MDRD [8]. The juxtaposition of the results obtained using the two formulae revealed that 74% of patients were classified at the same stage of renal failure while 26% of patients were not.

Christnacht A. found in his work a discrepancy in the classification of patients with different stages of CKD by the application of both formulae [9]. Thus, contrary to the MDRD formula, the CG formula gives results of unindexed GFR to the body surface area.

### CONCLUSION

Chronic Kidney Disease is a common, costly disease, in complications and severe comorbidities. At present, its detection is based on the finding of an estimated lower glomerular filtration rate using serum creatinine.

We found through the two formulae for estimating GFR (CG / MDRD) a slight tendency of CG to overestimate the renal function in young patients, and a greater tendency to underestimate that of older patients. Using the MDRD formula would allow a better estimate of GFR and a better classification of patients at different stages of chronic kidney disease. The two formulae are comparable in the proportion of patients categorized into each of the CKD stages.

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