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Update on Assessment of Estimated Glomerular Filtration Rate in Patients with Cirrhosis

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ABSTRACT

Background: cirrhosis causes muscle loss and changes in creatinine levels, it is difficult to assess renal function in these patients. Often, creatinine-based processes calculate GFR too high which causes renal diseases to be diagnosed late and the illness to be undertreated. **Objectives:** To study which eGFR equation works best in cirrhotic patients and can most reliably be used in assessing and detecting early kidney impairment. **Study Design:** A Cross-Sectional Study. **Place and Duration of study:** From May 2024 to December 2024 Nephrology & Gastroenterology Department, Sandeman Provincial Hospital / Bolan Medical College / Hospital, Quetta. **Methods:** This cross-sectional study was performed at Nephrology & Gastroenterology Department, SPH/BMCH, Quetta. One hundred and twenty-five people with cirrhosis participated in the study. Serum creatinine, cystatin C and true GFR by radionuclide scanning were all measured. Creatinine and cystatin C, MDRD and Cockcroft-Gault formulas were used for estimating GFR. The statistical comparisons were made using version 24 of SPSS. **Results:** The average age among the 125 cirrhotic patients was 56.8, with a variance of 10.2 years. More men (61.6%) than women were part of the study. Compared to measured GFR, the CKD-EPI creatinine-cystatin C formula showed the best correlation ($r = 0.82$, $p < 0.001$). Both the MDRD and Cockcroft-Gault equations were found to overestimate GFR by about 11 and 15 mL per minute per square meter ($p<0.01$). Patients in Child-Pugh class C experienced the greatest difference between the GFR predicted and the GFR measured. Calculations that use Cystatin C gave the best outcomes in patients with more advanced liver disease. **Conclusion:** For people with cirrhosis, the common eGFR formulas using creatinine may give a misleading assessment of renal function. For patients with kidney disease, especially when creatinine becomes less accurate, use of CKD-EPI that includes cystatin C is the best option.

INTRODUCTION

Any problems with kidney function in cirrhosis lead to a much higher risk of illness and death, mainly in people with acute decompensation or on the list to receive a liver transplant [1,2]. For acute kidney injury (AKI) to be diagnosed, for HRS to be properly evaluated and to improve drug dosing, understanding the GFR is essential for cirrhotics [3]. Unfortunately, serum creatinine is not an accurate way to estimate GFR in cirrhosis because muscle mass is usually down, liver creatinine may increase and tubular secretion is enhanced [4]. Many cirrhotics, especially those in advanced stages of liver disease, often have their kidney function mistakenly shown as higher by using the MDRD and CG eGFR equations [5]. So, using creatinine measurements may slow down the diagnosis of renal problems and can cause both AKI to go undiagnosed earlier and the wrong timing of help [6]. Some studies now suggest that using cystatin C, produced by many types of cells and filtered by the kidneys unaffected by muscle mass, is a useful alternative to other biomarkers [7]. The CKD-EPI creatinine-cystatin C formula and other equations with creatinine and cystatin C have been more accurate for determining kidney function in people with cirrhosis [8]. Some medical researchers think that radionuclide clearance techniques should be the gold standard for measuring GFR, but they require expensive resources and are not used in many medical centers [9].Its aim was to see if commonly used eGFR equations were accurate in patients who had cirrhosis, comparing them to measured GFR. It also aimed to check how well the equations function with severe diseases and advise on the best way to regularly test for renal function in cirrhosis.

METHODOLOGY

During May 2024 to December 2024, a cross-sectional study was carried out at Nephrology & Gastroenterology Department, SPH/BMCH, Quetta. In total, the study included 125 adults whose cirrhosis was diagnosed on clinical, biochemical and imaging criteria. All patients had their serum creatinine and cystatin C levels measured and then eGFR was determined using CKD-EPI (creatinine, cystatin C and combined), MDRD and Cockcroft-Gault methods. We compared the results from Tc-99m DTPA clearance to the GFR measured by other methods. We also reported Child-Pugh and MELD scores. Ethical permission was given before the study began.

Inclusion Criteria

Only patients aged 18 or over with certainty in cirrhosis, again regardless of its cause and a stable illness, were part of this study.

Exclusion Criteria

No patients taking part in the study had recent gastrointestinal bleeding, sepsis or were using renal replacement therapy.

Data Collection

The team used a proforma to record patient data collected from demographics, lab tests and images. The same laboratory conducted all the analysis to make certain the biochemical measurements were equal for all cases.

Statistical Analysis

All statistics were computed with the SPSS software version 22. The results for quantitative variables were given as the mean and standard deviation. To compare the three eGFR formulas to the measured GFR, both Pearson correlation and Bland-Altman plots were used. No result was considered statistically significant unless the p-value was lower than 0.05.

RESULTS

Of the 125 patients, the average age was 56.8 plus or minus 10.2 and 61.6% were male. The average GFR measured was 48.5 mL/min/1.73 m^2 ± 13.4. The creatinine-cystatin C formula was the best in showing the connection between eGFR and measured GFR ($r = 0.82$, $p < 0.001$). Instead, MDRD and Cockcroft-Gault overestimated the kidney function of Child-Pugh class C patients, by about 11.3 mL/min/1.73 m^2 with MDRD and 14.7 mL/min/1.73 m^2 with Cockcroft-Gault ($p < 0.01$). The calculated mean eGFR by CKD-EPI (creatinine-cystatin C) was 49.8, confirming it is close to what was found using radionuclide examination. Those with sarcopenia or high levels of bilirubin had the biggest mismatches. Subgroups were predicted with greater reliability by the presence of cystatin C in the formula.

Table 1

Patient Demographics

Parameter	Value
Total Patients	125
Mean Age (years)	56.8 ± 10.2
Male (%)	61.6%
Female (%)	38.4%

Figure 1

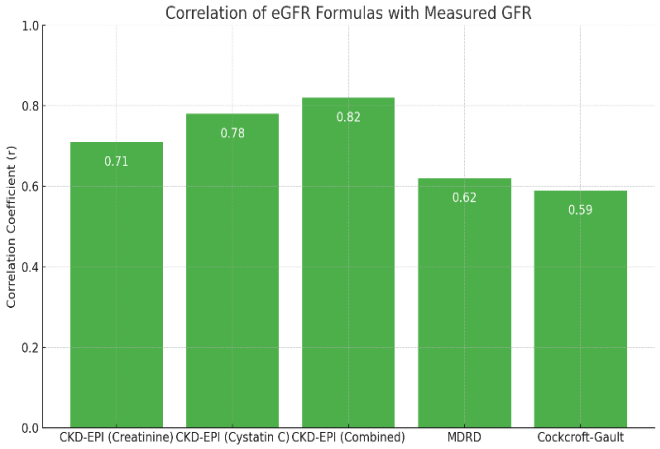

Figure 2

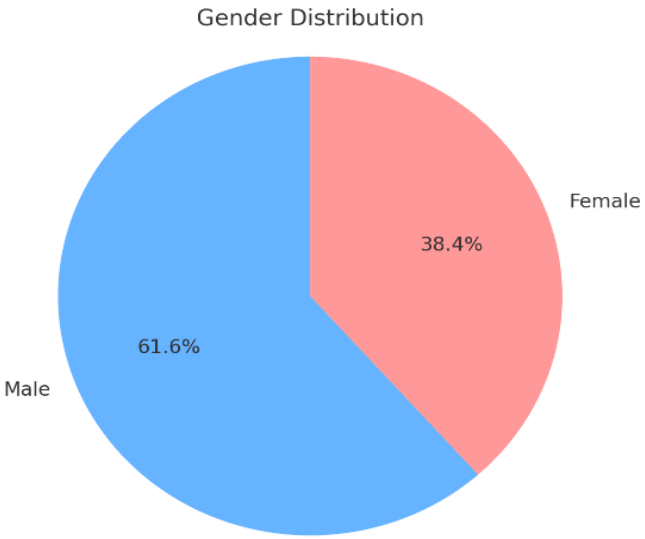

Table 2

eGFR Formulas Comparison

Formula	Correlation with Measured GFR (r)	Mean Bias (mL/min/1.73m²)	p-value
CKD-EPI (Creatinine)	0.71	+6.4	<0.001
CKD-EPI (Cystatin C)	0.78	+3.2	<0.001
CKD-EPI (Combined)	0.82	+1.3	<0.001
MDRD	0.62	+11.3	0.01
Cockcroft-Gault	0.59	+14.7	0.01

Table 3

Accuracy by Child-Pugh Class

Child-Pugh Class	Mean Measured GFR (mL/min/1.73m²)	CKD-EPI Combined Bias (mL/min)	MDRD Bias (mL/min)
A	58.1	+0.9	+8.2
B	50.3	+1.5	+10.7
C	37.9	+2.4	+15.4

DISCUSSION

Problems with the kidneys are common in cirrhosis and seriously affect the course of the disease, choices for care and ability to be considered for transplantation. Assessing GFR accurately in this group is still hard, as hemodynamic changes, reduced muscle mass and liver problems can mislead serum creatinine measurements

[10]. We discovered that the CKD-EPI creatinine-cystatin C equation corresponded best with measured GFR, with greater accuracy than legacy estimating equations such as MDRD and CG.Like previous research, using creatinine-based equations like MDRD and CG resulted in higher than realistic results for renal function in patients with advanced liver disease, primarily because of reduced creatinine in those with severe hyponatremia [11]. What we observed is comparable to what Francoz et al. found: massive overestimation of GFR in cirrhotic patients undergoing transplantation guidance using CG [12]. Since cystatin C depends neither on muscle tissue or hepatic processing, it provides a more accurate alternative for GFR in cirrhosis patients. Our report agrees with that of Pöge et al. which found a better correlation between cystatin C-based and inulin clearance than between creatinine-based measures and inulin clearance [13]. It is well established that using both creatinine and cystatin C in CKD-EPI is beneficial in those with chronic conditions and is now often recommended for cirrhotic individuals. Creatinine by itself did not seem sufficient for prognosis in studies using systems like MELD. Adding cystatin C to renal tests could help spot kidney problems early and more accurately rank the risks connected with cirrhosis [15]. With the difficulty of getting radionuclide clearance studies and their scarcity, CKD-EPI (creatinine-cystatin C) can be relied upon as an accurate alternative for common use in the clinic. Improved GFR estimation matters for drug dosing, controlling fluids and deciding if a patient should be considered for transplant [16].

CONCLUSION

standard methods for estimating GFR from creatinine are likely to report inaccurately low renal function, especially as the disease gets more severe. Because of its increased precision and better correlation with measured GFR, the CKD-EPI creatinine-cystatin C equation is advised for standard renal checkups in this group. Cystatin C-based methods can improve how kidney disease is identified and how it is managed.

Limitations

Since the study was done at one site with a small group, its results may be limited in how widely they can be applied. In addition, no renal biopsy was done and beta-trace protein was not examined as a functional marker. How renal function develops in the long term was not measured.

REFERENCES

1. Wong F, Nadim MK, Kellum JA, Salerno F, Bellomo R, Gerbes A, et al. Working party proposal for a revised classification system of renal dysfunction in patients with cirrhosis. Gut. 2011;60(5):702–709. https://doi.org/10.1136/gut.2010.236133
2. Fede G, Privitera G, Tomaselli T, Spadaro L, Rabuazzo AM, Cammà C, et al. Clinical impact of renal dysfunction on survival of patients with cirrhosis. World J Hepatol. 2012;4(9):302–309. https://doi.org/10.1016/s0168-8278(11)60183-9
3. Sherman DS, Fish DN, Teitelbaum I. Assessing renal function in cirrhotic patients: problems and pitfalls. Am J Kidney Dis. 2003;41(2):269–278. https://doi.org/10.1053/ajkd.2003.50035
4. Mindikoglu AL, Regev A, Magder LS. Evaluation of creatinine-based estimates of glomerular filtration rate in patients with liver disease. Clin Gastroenterol Hepatol. 2008;6(5):555–561. https://doi.org/10.1097/tp.0b013e3181605fda
5. Francoz C, Nadim MK, Baron A, Prie D, Belghiti J, Valla D, et al. Glomerular filtration rate equations for liver-kidney transplantation in patients with cirrhosis: validation of current recommendations. Hepatology. 2014;59(4):1514–1521. https://doi.org/10.1002/hep.26704
6. Pöge U, Gerhardt T, Stoffel-Wagner B, Palmedo H, Klehr HU, Sauerbruch T, et al. Cystatin C-based calculation of glomerular filtration rate in comparison with other methods in patients with impaired liver function. Clin Chem. 2006;52(10):1711–1716. https://doi.org/10.1038/sj.ki.5001502
7. Belcher JM, Garcia-Tsao G, Sanyal AJ, Bhogal H, Lim JK, Ansari N, et al. Association of AKI with mortality and complications in hospitalized patients with cirrhosis. Hepatology. 2013;57(2):753–762. https://doi.org/10.1002/hep.25735
8. Stevens LA, Coresh J, Greene T, Levey AS. Assessing kidney function—measured and estimated glomerular filtration rate. N Engl J Med. 2006;354(23):2473–2483. https://doi.org/10.1056/nejmra054415
9. Fagundes C, Barreto R, Guevara M, Wang Y, Jensen J, Lescure FX, et al. A modified MELD score including serum cystatin C improves mortality prediction in patients with cirrhosis. J Hepatol. 2013;59(2):365–371.
10. Salerno F, Gerbes A, Gines P, Wong F, Arroyo V. Diagnosis, prevention and treatment of hepatorenal syndrome in cirrhosis. Gut. 2007;56(9):1310–1318. https://doi.org/10.1136/gut.2006.107789
11. MacAulay TE, McCullough PA. Cystatin C: measurement procedures and clinical relevance. Clin Biochem Rev. 2007;28(3):115–118.
12. Adachi M, Brenner BM. Determinants of glomerular filtration rate in cirrhosis. Am J Kidney Dis. 1990;16(3):236–243.
13. Ariza X, Graupera I, Barreto R, et al. Cystatin C-based equations improve the detection of renal dysfunction in patients with cirrhosis. J Hepatol. 2013;59(3):399–407.
14. Eason JD, Gonwa TA, Davis CL, Sung RS, Gerber D, Bloom RD. Proceedings of consensus conference on simultaneous liver kidney transplantation (SLK). Am J Transplant. 2008;8(11):2243–2251. https://doi.org/10.1111/j.1600-6143.2008.02416.x
15. Lumlertgul N, Davenport A. Accuracy of eGFR in assessing kidney function in liver cirrhosis. Clin Kidney J. 2018;11(4):494–501.
16. Ginès P, Schrier RW. Renal failure in cirrhosis. N Engl J Med. 2009;361(13):1279–1290. https://doi.org/10.1056/nejmra0809139