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Original Article

A Study of Glomerular Filtration and Kidney Volume in Patients with Alcohol Dependence

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Abstract:

Background: The purpose of this study is to evaluate serum creatinine as a marker of estimated glomerular filtration rate (eGFR) in excessive alcohol use people, and to determine correlation between total kidney volume (TKV) and other relevant factors.

Methods: In this study, 95 people were examined 2025. We measured serum creatinine based GFR using the MDRD formula. Biochemical analysis and serum creatinine were evaluated using a fully automatic analyzer. TKV was determined by ellipsoid method using 2D sonographic transducer.

Result: The mean subject age was 52±10, BMI 25±4 and male female ratio was 4:1. Mean arterial pressure was 108±14 mmHg, eGFR 90±19 ml/min/1.73m 2. Age, body mass index (BMI) and mean arterial pressure (MAP) were inversely correlated with eGFR ($P<0.01$) and no difference between male and female recipients. There is no statistically significant correlation between TKV and eGFR. BMI and arterial pressure was correlated with TKV ($P<0.01$). Mean eGFR and TKV was calculated into 4 groups of 10-year intervals, that eGFR was decreased significantly with age groups.

Conclusion: According to our research, one of the optimal methods for assessing kidney function is the creatinine-based calculation method, and long-term excessive alcohol consumption is a risk factor for chronic kidney disease (CKD).

Keywords: Glomerular Filtration Rate; Kidney Volume; Alcohol Dependence

Introduction

The World Health Organization (WHO) reports that more than 400 million people, or 7% of the world's population aged 15 years and older, lived with alcohol use disorders. Of this, 209 million people (3.7% of the adult world population) lived with alcohol dependence.1 More than 30 percent of Mongolia's population consumes alcohol excessively, and according to WHO statistics, the average person over the age of 15 consumes 7.4 liters of alcohol per year, which is higher than the global average.2,3 A study on the prevalence of alcohol use and alcohol dependence disorders in Mongolia found that more than 60% of the total population consumes alcohol in some form, 8.6% abuse alcohol, 9.9% are alcohol dependent, and 6.4% of the total population meets the criteria for alcohol dependence disorders upon clinical examination [3].

The main goal of treatment for alcohol dependence is to prevent addiction and other organ system disorders. Excessive alcohol consumption is a risk factor for chronic kidney disease and is a leading cause of death from complications of high blood pressure and cardiovascular disease [4].

There are many methods for assessing kidney function or renal glomerular filtration rate, including 24-hour urine collection and creatinine clearance, and many analytical methods for assessing glomerular filtration rate using radioisotopes Tc99m-DTPA and Cr51-EDTA, which are widely used in practice. These methods are highly toxic, expensive, and prone to errors during testing [5].

Currently, the most widely used methods in practice are the CKD-EPI and MDRD formulas, which use serum creatinine to estimate renal function and glomerular filtration rate.

Methods

The study included a total of 95 participants aged 30-70 who were admitted to the Addiction Center of Ulaanbaatar, Mongolia in 2025. The participants behavioral disorders were assessed using the Michigan Test. Biochemical tests and serum creatinine were assessed using a fully automated analyzer (GOLSITE, China).TKV was determined by using 2D sonographic transducer (Mindray Z50, China).

Creatinine-based glomerular filtration was calculated using the MDRD formula: (ml/min/1.73m2) = 175*(SCr)-1.54x Age-0.203x (0.742 if female)6, and each kidney volume was separately determined by ellipsoid formula TKV=length*width*depth*π/6, TKV was calculated TKV=VolumeR+VolumeL

MAP was calculated using the formula Mean Pressure = DD + 1/3 PD according to the guidelines for hypertension (high>90mmHg) in adults [7].

According to the survey, parpicipants are not diagnosed with diabetes or other chronic diseases.

Mental and behavioral disorders were assessed for using the Michigan Alcohol Dependence Test over 15 points (0-5 points – No alcohol dependence, 5-7 points – High probability of alcohol dependence, 7-15 points – Early stage of alcohol dependence, 15-25 points – Moderate stage of alcohol dependence, 25 or more points – Severe stage of alcohol dependence)

Statistical analysis of the results was performed using SPSS (IBM, version 30). Standard deviations of the mean were calculated using numerical values (age, serum creatinine, and MDRD formula), and statistical significance was considered when P value <0.05. The correlation between numerical values was assessed using Pearson's correlation coefficient [8].

The study was conducted in accordance with ethical guidelines and approved by the Ethics Committee of the Addiction Center of Ulaanbaatar.

Results

Table 1. General characteristics.

Indicators	N	Minimum	Maximum	Mean	Std. Deviation
Age	95	30	70	51.9	10.2
BMI	95	25	40	25.1	4.3
eGFR (mil/min/1.73m^2)	95	37	159	103.74	28.7
MAP (mmHg).	95	80	146	108.2	14.5
Total Kidney Volume	95	165	351	242.4	45.2
Michigan Score	95	8	49	30.7	9.2

eGFR and TKV was calculated using histograms and showed a normal distribution. (Figures 1 and 2)

There was inversely correlation between Age, BMI, MAP and eGFR in this study participants (P<0.01), and no difference was observed between genders.

Additionally, when classifying according to the International Classification of Chronic Kidney Disease (CKD stage 1-5) based on serum creatinine, no patients with CKD stages 4 and 5 (chronic renal failure and end-stage renal disease) were not identified.

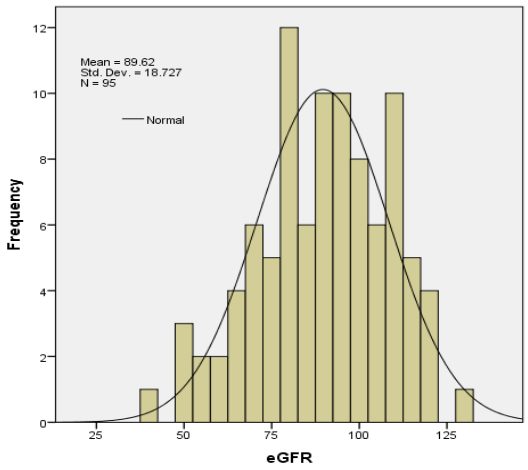

Figure 1. eGFR Frequency

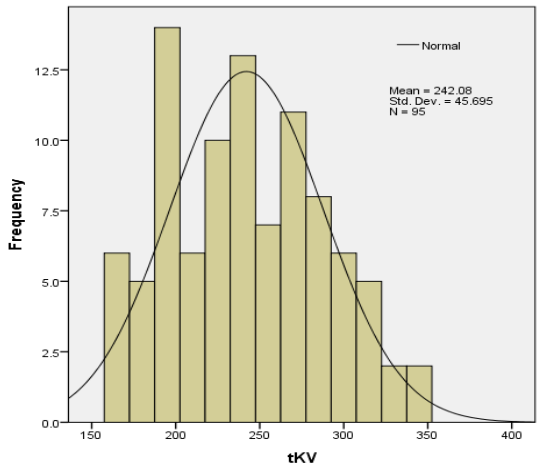

Figure 2. eGFR Frequency

When calculating the average eGFR in 3 CKD stage groups that mean eGFR decreases significantly (Figures 3)

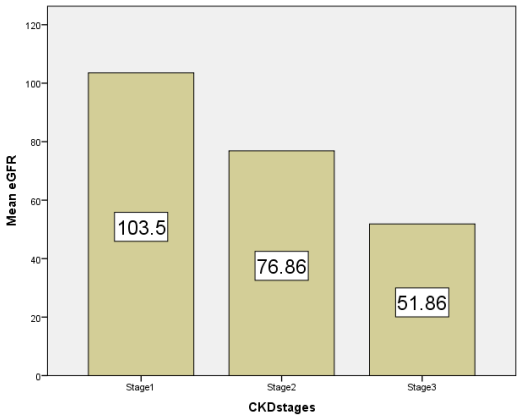

Figure 3. Mean eGFR in CKD stages

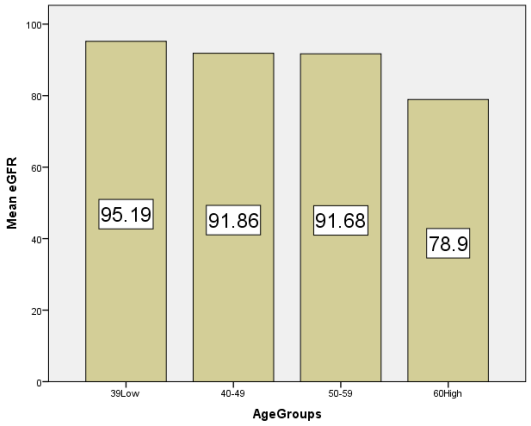

Figure 4. Mean eGFR in Age Groups

Mean eGFR was calculated into 4 groups of 10-year intervals, that eGFR was decreased more in elderly (age group that over 60).

There is no statistically significant correlation between eGFR and TKV but BMI and arterial pressure was correlated with eGFR and TKV (P<0.01).

Therefore, we calculated the average TKV during the stages of CKD and age groups there is no relation between them and no statistically significant correlation was observed between Michigan test scores and eGFR and TKV.

Discussion

Assessment of kidney function is essential for early detection of CKD and renal failure. MDRD and other creatinine based methods are considered to be the most suitable, cost-effective, rapid and reliable test for renal function [9].

Some studies have shown an inverse relationship between alcohol consumption and kidney function and with the increase in alcohol consumption being associated with elevated prevalence of CKD [12].

As people age, their glomerular filtration rate, an indicator of kidney function decreases (Over 40, eGFR decreases 1ml/min/1.732 per year)16 and one of the main factors contributing to this decline is excessive alcohol consumption [14].

Our study shows that eGFR was relatively stable under 59 years of age, but decreased more in elderly that over age 60. (Figure 4, Mean eGFR in Age Groups).

There was no statistically significant correlation between eGFR and TKV. Total study participants were in stages I-III of CKD stages, while about 20% had a eGFR between 90 to 120 ml/min/1.732 in normal filtration [11].

There was a statistically significant inversely correlation ($P<0.01$) between eGFR and MAP in the study participants, with 80% having high arterial pressure.

Mean eGFR decrease across the stages of CKD between alcohol dependence and is not directly related to each other. However, the decrease in eGFR with age suggests that long-term alcohol use is a risk factor for CKD [13].

There is no correlation between kidney size and glomerular filtration but the majority of this participants with alcohol dependence have high levels of hypertension (80% of the total) and high BMI with normal or decreased kidney function, which may be a one of the main cause of CKD [14,15].

Conclusion

Our study shows that one of the most effective methods for assessing kidney function is the creatinine-based GFR calculation method and excessive alcohol consumption does not directly affect kidney function, but in the long term it can lead to complications such as high blood pressure, to elevate prevalence of CKD.

References

1. World Health Organization. Alcohol. Available from: https://www.who.int/news-room/fact-sheets/detail/alcohol
2. Shao L, Chen Y, Zhao Z, Luo S. Association between alcohol consumption and all-cause mortality, cardiovascular disease, and chronic kidney disease. Medicine. 2024;40(2). https://doi.org/10.1097/MD.0000000000003xxxx
3. Насанжаргал Л, Даваалхам Д, Чимэдсүрэн Б, нар. Зонхилон тохиолддлох сэтгэцийн эмгэгийн тархалт. 2019.
4. Wakasugi M, Kazama JJ, Yamamoto S, et al. A combination of healthy lifestyle factors is associated with a decreased incidence of chronic kidney disease: a population-based cohort study. Hypertens Res. 2013;36:328–333. https://doi.org/10.1038/hr.2012.186
5. Dharnidharka VR, Kwon C, Stevens G. Serum cystatin C is superior to serum creatinine as a marker of kidney function: a meta-analysis. Am J Kidney Dis. 2002;40(2):221–226. https://doi.org/10.1053/ajkd.2002.34487
6. Levey AS, Bosch JP, Lewis JB, Greene T, Rogers N, Roth D. A more accurate method to estimate glomerular filtration rate from serum creatinine: a new prediction equation. Ann Intern Med. 1999;130(6):461–470. https://doi.org/10.7326/0003-4819-130-6-199903160-00002
7. Насанд хүрэгсдийн артерийн гипертензийн удирдамж. Эрүүл мэндийн яам; 2011.
8. Janse RJ, Hoekstra T, Jager KJ, Zoccali C, Tripepi G, Dekker FW, van Diepen M. Conducting correlation analysis: important limitations and pitfalls. Clin Kidney J. 2021;14(11):2332–2337. https://doi.org/10.1093/ckj/sfab085
9. Chen TK, Knicely DH, Grams ME. Chronic kidney disease diagnosis and management: a review. JAMA. 2019;322(13):1294–1304. https://doi.org/10.1001/jama.2019.14745
10. Wu J, Wang Y, Vlasschaert C, Lali R. Prognostic utility of total kidney volume for chronic kidney disease risk prediction: an observational and Mendelian randomization study. [Journal unknown]. DOI not available.
11. Perneger TV, Whelton PK, Puddey IB, Klag MJ. Risk of end-stage renal disease associated with alcohol consumption. Am J Epidemiol. 1999;150(12):1275–1281. https://doi.org/10.1093/oxfordjournals.aje.a009958
12. Koning SH, Gansevoort RT, Mukamal KJ, Rimm EB, Bakker SJ, Joosten MM. Alcohol consumption is inversely associated with the risk of developing chronic kidney disease. Kidney Int. 2015;87:1009–1016. https://doi.org/10.1038/ki.2014.414
13. Schaeffner ES, Kurth T, de Jong PE, et al. Alcohol consumption and the risk of renal

dysfunction in apparently healthy men. Arch Intern Med. 2005;165:1048–1053. https://doi.org/10.1001/archinte.165.9.1048

14. Yamagata K, Ishida K, Sairenchi T, et al. Risk factors for chronic kidney disease in a community-based population: a 10-year follow-up study. Kidney Int. 2007;71:159–166. https://doi.org/10.1038/sj.ki.5002017
15. Shield KD, Parry C, Rehm J. Chronic diseases and conditions related to alcohol use. Alcohol Res. 2013;35:155–173.
16. Weinstein JR, Anderson S. The aging kidney: physiological changes. Adv Chronic Kidney Dis. 2010;17(4):302–307. https://doi.org/10.1053/j.ackd.2010.05.002