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Selected Kidney Function Tests for Screening of Kidney Disease among Hypertensive Patients: A Cross Sectional Study

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ABSTRACT

Introduction: Renal disease is a disorder when the kidneys are damaged and unable to filter blood properly. Nephropathy, renal disease, or kidney disease are all terms used to describe conditions that affect the kidneys. Nephritis, an inflammatory kidney disease, can present in a variety of ways depending on where the inflammation is located. Nephrosis is a kidney condition that isn't brought on by inflammation. Nephrotic syndrome may develop as a result of nephrosis or nephritis. Renal failure increases a person's risk of developing kidney disease, which can be treated with dialysis or a kidney transplant. Acute renal injury, kidney cysts, kidney stones, and infections are a few other kidney conditions.

Materials and methods: The investigation makes use of analytical approach. Cross-sectional study design was used. The population of the study included all patients with hypertension at several hospitals in the Wardha district. The method of choosing the study's sample was purposive sampling. The study sample consisted of 85 hypertension patients from a particular Wardha hospital.

Results: The correlation between serum creatinine levels and food habits among hypertension patients at particular institutions. The calculated't' value was 2.16 at the 5% level of significance, however the tabulated 't' values were 1.98 (df=83), which is less. The relationship between Uric acid levels and a history of hypertension in the family. The calculated't' value was 2.31 at the 5% level of significance, but the tabulated't' value was 1.98 (df=83), which is less.

Conclusion: Elevated blood urea nitrogen, uric acid, and serum creatinine levels can cause renal dysfunction in hypertension patients. According to statistics, the uric acid score of hypertensive patients is statistically correlated with their diet, and the serum creatinine score is statistically correlated with their family history of hypertension.

Key words: Estimation, Selected kidney function tests, Screening

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INTRODUCTION

Globally, hypertension is a major contributor to cardiovascular disease and death, particularly in low-income countries. Due to a lack of awareness, inadequate care, and poor hypertension management, target organ damage (TOD), in particular chronic kidney disease (CKD), is more common in Africa [1]. Decreased renal function and signs of kidney injury, such as imaging or proteinuria (often measured by the albumin to creatinine ratio, or ACR), are used to identify CKD (below thresholds of GFR estimated from serum creatinine concentration). Serum creatinine concentration should be used to estimate GFR (eGFR), which should then be transformed using the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equation, according to the Kidney Outcomes Quality Initiative (KDOQI) and National Institute for Health Excellence (NICE) current recommendations. The Modification of Diet in Renal Disease (MDRD) equation is replaced by the CKD-EPI equation as a more reliable predictor of clinical risk, and both of these equations account for a few non-renal factors (age, race, and gender) [2]. Important signs of kidney deterioration include albuminuria, high serum creatinine, and low estimated glomerular filtration rate (eGFR). However, it is unclear whether these and newly discovered biomarkers, such as uric

acid, are independent predictors of the development of kidney disease or subsequent outcomes in people with type 2 diabetes (T2DM) and hypertension [3]. Acute kidney injury (AKI) is characterized by a sudden drop in glomerular filtration rate (GFR) that can last for hours to weeks as well as the retention of nitrogen waste products including blood urea nitrogen (BUN) AKI is a condition brought on by numerous illnesses and biological processes. Albuminuria, hypertension, oedema, and oliguria (urine output 30 mL/h or 400 mL/d) are among the clinical characteristics, while urine output can also be normal or increasing [4]. Both fatal and non-fatal cardio-vascular (CV) events have been linked to serum uric acid (SUA) levels in hypertensive individuals [5]. Up to 15% of adult populations worldwide are thought to have chronic kidney disease (CKD), which is independently linked to an increased risk of cardiovascular disease (CVD) on par with that of diabetes mellitus or coronary heart disease. As CKD progresses, this risk rises, and it is demonstrated by poor excretory function, which is typically expressed as lowering glomerular filtration rate and rising proteinuria. The total cost of CKD makes up 1.3% of healthcare budgets, of which 13% is attributable to the additional strokes and myocardial infarctions caused by CKD [6]. According to the United States Renal Data System's most recent annual report, the prevalence of ESRD grew globally from 6 to 135% between 2006 and 2012, placing further strain on many nations' health insurance systems. Numerous CKD risk factors have been identified and categorized as starting and perpetuating variables in earlier epidemiological research. Age, male sex, and diabetes are initiating factors that lead to nephron loss; maintaining factors include proteinuria, hypertension, and hyperuricemia that hasten the progression of the illness [7]. Adults with acute and chronic disorders frequently have their levels of serum creatinine and urine protein checked as part of routine medical exams. The basic metabolic panel commonly evaluates proteinuria, serum creatinine, blood urea nitrogen, and uric acid in addition to a routine urinalysis. However, until recently, there was confusion and disagreement over the categories of acute and chronic renal illnesses, the tests that should be carried out to identify them, and the reporting and interpretation requirements for those tests [8].

Objectives

To estimate the kidney function tests by estimating serum creatinine, blood urea nitrogen and uric acid level among hypertensive patients.

To associate the demographic variables with the selected kidney function tests among hypertensive patients.

MATERIAL AND METHODS

Study design

In the present study cross sectional research design was used for the study.

Study setting

The study was conducted in selected hospital of Wardha District.

Participants

Hypertensive patients in selected hospitals of Wardha were chosen for the study.

Variables

The demographic variables under the study were age, gender, family history and diet pattern.

Data sources/measurement

The researcher spoke with the hypertension patients in the Wardha district and discussed the goals of the study and how it would help them. They gathered a group of hypertension patients, gave them comfort, and gave them study instructions after learning about the study and its participants. Following that, blood samples were obtained for research purposes from hypertension individuals. The day after sample collection, investigation reports were gathered. The data collection was completed in the allotted time. The investigator thanked all of the study samples and the authorities for their cooperation after the data collection process.

Bias

There were no any bias was present in the study while collecting the data.

Study size

85 hypertensive individuals have been selected for the study who meets the inclusion criteria. These patients have been diagnosed with hypertension for between six months and three years, were willing to participate in the study, and are both male and female.

Statistical methods

Descriptive and inferential statistics method was used in the study.

Statistical analysis

Data was gathered using demographic characteristics that were also utilized to calculate the kidney function test score. Descriptive and inferential statistics were used in the analysis. Chi-square was used to analyze the associations between uric acid level and family history of hypertension and serum creatinine level and diet. If p0.05 at a 95% confidence level was reached, the level of statistical significance was attained.

Sample collection and laboratory analysis

Blood samples will be drawn via venipuncture, and the serum concentrations of urea nitrogen, creatinine, and uric acid will be determined using the urease with indicator dye, enzymatic creatinine amid hydrolase, and Uri case/peroxidase methods, respectively.

Ethical consideration

Study received approval from the institutional ethical review board, and was carried out in compliance with the moral standards for human research set forth by the ethical committee. DMIMS (DU)/IEC/ 2021/283 is the reference number for ethics committee consideration. Information was not utilized or disclosed in violation of the contract. Sample was safeguarded against all forms

of damage.

RESULTS

Participants

The researcher spoke with 85 hypertensive patients in a few hospitals in the Wardha district, explaining the goals of the study and how it might help them.

Descriptive data

Analyzing the demographic information from the study samples provides insight into the typical traits of hypertensive individuals. Age, gender, family history of disease, and food pattern are only a few of the characteristics of the sample that were described by the data that were collected.

In terms of the study samples' ages, it was discovered that 18.80% of the hypertensive patients fell into the 20–35 age range, 25.90% into the 36–50 age range, and 55.30% into the 51–65 age range. In terms of gender, it was shown that 49.40% of patients with hypertension were female and 50.60% were male.

Regarding the family history, it was discovered that each of the hypertensive patients had a history of hypertension (52.90%), a family history of kidney disease (34.10%), and a family history of both hypertension and kidney illness (16.50%). Regarding diet, 22.40 percent of hypertension patients were vegetarians, while 76.6 percent of them ate a mixed diet (Table 1).

Outcome data

Among hypertension patients, the serum creatinine, blood urea nitrogen, and uric acid levels were calculated to measure kidney function. The serum creatinine levels of 21.18% of hypertensive male patients and 12.94% of female patients were determined to be normal, whereas 29.41% of male and 36.47% of female patients had abnormal levels (Table 2) 10.59% of hypertensive male patients and 2.35% of hypertensive female patients had normal levels of blood urea nitrogen, 40% of male and 47.06% of female had abnormal levels (Table 3), and 24.71% of male and 3.53% of female hypertensive patients had normal levels of uric acid, while 25.88% of male and 45.88% of female hypertensive patients had abnormal levels (Table 4).

Main results

The association of Serum Creatinine score with dietary pattern of hypertensive patients was calculated from selected hospitals, the tabulated 't' values was 1.98(df=83) which is less than the calculated 't' i.e. 2.16 at 5% level of significance. Also the calculated 'p'=0.038. Which was less than the acceptable level of significance i.e. 'p'=0.05. Hence it was interpreted that dietary pattern of hypertensive patients is statistically associated with their serum creatinine score (Table 5) and in the association of Uric acid score with family history of disease of hypertension, the tabulated 't' value was 1.98(df=83) which is less than the calculated 't' i.e. 2.31 at 5% level of significance. Also the calculated 'p'=0.023 which was less than the acceptable level of significance i.e. 'p'=0.05. Hence it was interpreted that family history of hypertension of hypertensive patients is statistically associated with their uric acid score (Table 6). Because of this, statistical analysis indicates that the intended estimation of kidney function tests were successful in screening of kidney disease in hypertensive patients.

Other analyses

There were no significant association between age gender and other family history of history of hypertensive patients with kidney function tests has found in the study.

Table 1: Percentage wise distribution of hypertensive patients, according to their demographic characteristics.

Demographic Variables	No. of patients	Percentage (%)
Age(yrs)		
20-35 yrs.	16	18.8
36-50 yrs.	22	25.9
51-65 yrs.	47	55.3
>65 yrs.	0	0
Gender		
Male	43	50.6
Female	42	49.4
Family history of Hypertension		
Yes	45	52.9
No	40	47.1
Family History of kidney disease		
Yes	29	34.1
No	56	65.9
Family History of Hypertension and kidney disease		
Yes	14	16.5
No	71	83.5
Diet Pattern		
Vegetarian	19	22.4
Mixed Diet	66	77.6

Table 2: Assessment with level of serum creatinine among hypertensive patients.

Level of serum creatinine	Score Range	Level of Serum Creatinine	
		Male	Female
Normal	0.74-1.35 mg/dl-Male	18(21.18%)	11(12.94%)
	0.59-1.04 mg/dl-Female		
Abnormal	>1.35 mg/dl-Male	25(29.41%)	31(36.47%)
	>1.04-Female		
Total		43(50.59%)	42(49.41%)
Minimum score		0.6	0.6
Maximum score		2.6	2.6
Mean Serum Creatinine score		1.42 ± 0.58	1.50 ± 0.63

Table 3: Assessment with level of Blood Urea Nitrogen among hypertensive patients.

Level of blood urea nitrogen	Score Range	Level of Blood Urea Nitrogen	
		Male	Female
Normal	8-24 –Male	9(10.59%)	2(2.35%)
	6-21-Female		
Abnormal	>24-Male	34(40%)	40(47.06%)
	>21-Female		
Total		43(50.59%)	42(49.41%)
Minimum score		17	17
Maximum score		70	70
Mean BUN score		40.37 ± 16.85	44.47 ± 17.90

Table 4: Assessment with level of Uric Acid among hypertensive patients.

Level of uric acid	Score Range	Level of Uric Acid	
		Male	Female
Normal	3.4-7-Male	21(24.71%)	3(3.53%)
	2.4-6-Female		
Abnormal	>7-Male	22(25.88%)	39(45.88%)
	>6-Female		
Total		43(50.59%)	42(49.41%)
Minimum score		5.8	5.8
Maximum score		8.4	8.9
Mean Uric Acid score		7.27 ± 0.71	7.54 ± 0.92

Table 5: Association of Serum Creatinine Level in relation to dietary pattern.

Dietary Pattern	No. of patients	Mean serum creatinine score	t-value	p-value
Vegetarian	19	1.23 ± 0.51	2.16	0.038
Mixed Diet	66	1.53 ± 0.61		S,p<0.05

Table 6: Association of uric acid level in relation to family history of hypertension.

Family history of hypertension	No. of patients	Mean uric acid score	t-value	p-value
Yes	45	7.19 ± 0.86	2.31	0.023
No	40	7.60 ± 0.75		S,p,0.05

DISCUSSION

In present study 21.18% of hypertensive male patients and 12.94% female patients had normal level of serum creatinine and 29.41% of male and 36.47% of female had abnormal level of serum creatinine level.

Because mild to severe chronic renal disease is common in Spain, this study was supported by that data. An extensive, cross-sectional descriptive and politicized epidemiological investigation was conducted on the general population of Hortega. From 1997 to 2000, the study was in progress. The population was drawn from the western Valladolid health region, Spain, and ranged in age from 15 to 85. In four different techniques, they calculated creatinine clearance. According to the CG approach, CKD stage 3 was present in a third of men and nearly half of older women. There aren't many variations between the sexes in the measurement when the condensed MDRD research is applied. The prevalence of stage 2 CKD is greater (60%) than the CG equation predicts, although stage 3 CKD prevalence is similar (about 8%). Although stage 2 CKD affects adults over 65 more frequently than stage 3, stage 3 CKD measurements using the CG method and predicted creatininuria are generally close to those from the third National Health and Nutrition Examination Survey Study [9].

In the present study, the association of Serum Creatinine score with age in years of hypertensive patients from selected hospitals. The tabulated 'F' values was 3.07(df=2,82) which is higher than the calculated 'F' i.e. 1.49 at 5% level of significance. Hence it is interpreted that age in years of hypertensive patients is statistically not associated with their serum creatinine score.

The prevalence of impaired kidney function and related risk factors within the TAHES cohort were the focus of a cross-sectional investigation in a rural Benin population, which provided support for this study. 1360 of the 1583 cohort members had their creatinine levels checked in 2019, they found. The 95% CI for the percentage of patients with abnormal kidney function was [14.15-18.05], with an average age between 32 and 53.16. The probabilities of having abnormal kidney function rose significantly with age (adjusted OR (aOR)=2.75), female gender (aOR=2; 95 percent CI=[1.83-4.14]), aOR=1.54; 95% CI=[1.37-2.91], and hypertension, according to the results of the multivariate logistic regression analysis. High BMI, hyperglycemia (aOR=2.86; 95% CI=[1.12-2.17]), and (aOR=1.56; 95% CI=[1.12-2.13]) 95%CI=[1.68-4.88]) [10].

In the present study, table no. 6 shows the association of Uric acid score with family history of hypertensive patients from selected hospitals. The tabulated 't' values was 1.98 (df=83) which is higher than the calculated 't' i.e. 2.31 at 5% level of significance. Hence it is interpreted that family history of hypertensive patients is statistically associated with their uric acid score.

A cross-sectional study was undertaken on the higher prevalence of undiagnosed kidney illness in order to compare healthy persons living at high altitudes (HA) to healthy people living at sea level (SL) who had no known history of hypertension, diabetes, or chronic kidney disease. 293 persons between the ages of 40 and 60 were examined, including 168 HA (3640 m) and 125 SL (154 m) residents. SL patients' haemoglobin levels were lower, their serum creatinine levels were higher, and their estimated glomerular function rate (eGFR) was lower in HA residents (69.5 15.2 vs. 102.1 17.8 ml/min/1.73 m2, p 0.0001). In HA patients, the prevalence of metabolic syndrome were decreased. Hemoglobin concentrations in male and female HA residents were negatively linked with eGFR (p=0.001) and 0.03%, respectively. Logistic regression analysis showed that a lower eGFR was associated with female gender, high altitude (14.78 [6.46-33.79]; p=0.001), high haemoglobin (1.68 [1.16-2.43] haemoglobin; p=0.001), and uric acid (1.33-2.72); p=0.001 when subjects with an eGFR of 90 ml/min/1.73 m2 were compared to those with an eGFR [11].

LIMITATIONS

The study was taken in small geographical area in selected hospital.

Only hypertensive patients who were diagnosed from one to three years were chosen as participants of the study.

CONCLUSION

It was discovered that demographic factors and serum uric acid and creatinine levels are related. Our study's conclusion shows that hypertension people are more likely to develop renal disease because of elevated levels of serum creatinine, serum uric acid, and serum blood urea nitrogen. Other demographic factors, such as age and gender, did not significantly affect the results of kidney function tests in hypertension individuals. It is advised that a comparative research be carried out to standardize and validate the information guide sheet. Diabetes patients can be used in a similar study.

FUNDING

The funding was taken from the institution for data collection to conduct the study.

WHAT IS ALREADY KNOWN ON THIS TOPIC

The diet pattern and family history of hypertensive patients are the risk factors of kidney disease.

The elevated serum creatinine and serum uric acid levels can cause the kidney disease among hypertensive patients.

WHAT THIS STUDY ADDS

This study proves an estimation of selected kidney function tests in hypertensive patients aids in screening of kidney disease by associating the demographic variables such as diet pattern and family history of hypertension.

RECOMMENDATION

As decreasing the level of glomerular filtration rate is the triggering point of deciding a presence of kidney disease among hypertensive patient due to elevation of serum creatinine level, in this study two more tests were added to confirm the risk factors of kidney disease among hypertensive patients.

COMPETING INTERESTS

The authors don't having any competing interest.

AUTHOR'S CONTRIBUTION

Authors has given an equal contribution in the study to bring out the positive results.

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