Research Article

A comparative study of biochemical markers of renal function and creatinine clearance in hypertensive and normotensive males

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Abstract

Introduction: Hypertension is the most common cardiovascular disease all over the world. Hypertension and renal function are closely related. Glomerular filtration rate is the best estimate of number of functioning nephrons and functional renal mass. Accurate measure of GFR is time consuming and expensive, but a number of filtered substances (blood urea, serum creatinine, uric acid) may be measured to estimate GFR. The aim of the study is to compare the renal function tests and creatinine clearance in hypertensive and normotensive males. **Materials and Methods:** Study setting: a hospital based case control study done by Department of Physiology, Sri Manakula Vinayagar medical college hospital Madagadipet, Puducherry. Sample size for study was calculated to be 100 with case control ratio being 1:1. Biochemical markers of renal function were calculated to test the significance of renal function among hypertensive's and normotensives. Data was entered and analysed using SPSS version16. **Results:** Renal function tests were significantly elevated in hypertensive's when compared to normotensives whose $p<0.05$; urea 0.048, creatinine 0.000, uric acid 0.009, whereas creatinine clearance is not significantly elevated, p 0.362($p>0.05$) which implies creatinine clearance is not found to be a significant indicator of renal function among hypertensives. **Conclusion:** The present study shows that elevated urea, creatinine, uric acid are strong predictor of renal impairment among hypertensives. Creatinine clearance does not appear to be a significant indicator for renal impairment among hypertensives in the present study.
Keywords: creatinine clearance, glomerular filtration rate, hypertension

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INTRODUCTION

Among all cardiovascular diseases hypertension is the commonest in all over the world.[1]Theprevelance of hypertension in India is 23.10% in men and 26.60% in women.[2] In south India it is 20% according to CURES study.[3] Hypertension and renal dysfunction are closely related. Majorities of hypertensive patients are asymptomatic and left untreated. So complication develops and become fatal. Chronic kidney failure usually develops and becomes slowly with few signs or symptoms in early stages.[1] Glomerular filtration rate is the best estimate of number of functioning nephrons and functional renal mass. accurate measure of GFR is time consuming and expensive; but a number of filtered substances may be measured to estimate GFR including blood urea, serum creatinine.[4] The elevation of serum urea and creatinine may be relevant to the decreased GFR as a result of hypertension effect on renal function. Decrease in renal blood flow results in decrease in GFR this leads to decrease in distal tubular flow rate which leads to increase in urea reabsorption and decreased secretion which may be the reason for elevated serum urea concentration.[5] The elevation of serum creatinine concentration in hypertension may be attributed to the decrease in creatinine clearance due to decrease in GFR. Creatinine clearance rate determines how efficiently

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kidneys are clearing creatinine from the blood. Hence it serves as an estimate of kidney function.[1] The uric acid causes increased chemokine and cytokine expression induction of the rennin angiotensin system and to increased vascular c-reactive protein (CRP) expression. Experimental evidence suggests a complex but potentially direct casual role of uric acid in pathogenesis of hypertension.[4] According to Zainab et al, hyperuricemia in individuals with essential hypertension is associated with endothelial dysfunction. Uric Acid can stimulate the synthesis of CRP, and that might be one of the mechanisms underlying the endothelial dysfunction in hypertensives.[7] According to Francesca et al , Mild hyperuricemia is associated with early signs of renal damage in primary hypertension chronic hyperuricemia was shown to induce several potentially unfavourable effects, vascular smooth muscle cell hyperplasia, endothelial dysfunction and intrarenal activation of the renin-angiotensin-aldosterone system.[6] A number of studies were conducted on effect of hypertension on kidney functions, but little is known about rural population in India. This study was conducted to compare the renal function tests and creatinine clearance in hypertensive and normotensive males.

MATERIAL AND METHODS

This study was conducted in Sri Manakula Vinayagar medical college hospital Madagadipet, Puducherry.

Study design:

Hospital based case control study.

Sample and Sample size

1. 50 normal healthy male subjects of 35-55years of age.
2. 50 hypertensive male subjects of 35-55 years of age.

Sampling

A representative sample of local population comprising of 100subjects aged 35-55 years were selected from

1. Hypertensive patients attending medicine outpatient department in SMVMCH.
2. Normotensives are attendants of patients, workers in SMVMCH.

Study duration: 2012-2013.

Inclusion criteria

1. Male subjects 35 -55 years of age.
2. Hypertensive subjects having blood pressure >140/90 mmHg. (according to WHO criteria)
3. Normotensive subjects having blood pressure 120/80mmHg.

Exclusion criteria

H/o cardiovascular disease
H/o respiratory disease
H/o drug Medications (steroids, α methyl dopa) for past three months
H/o renal disease
H/o endocrine disease.

Methodology

Parameters

1. Blood pressure
2. Weight
3. Serum urea
4. Serum creatinine
5. Serum uric acid
6. Creatinine clearance

Procedure

Measuring Blood pressure

After giving half an hour rest to the person in the departmental laboratory, blood pressure was measured in supine position by mercury sphygmomanometer, between 10 am to 11 am. The pressure at which Korotkoff's sound first heard (Phase I) was taken as systolic blood pressure and the pressure at which these sounds disappeared (Phase V) was taken as diastolic blood pressure. Blood pressure was measured three times. The average of second and third readings will be taken as correct systolic and diastolic blood pressure.[8,9]

Normal BP:	<120/80 mmHg
Pre Hypertension:	120-139/ 80-89 mmHg
Stage I Hypertension:	140-159 / 90-99 mmHg
Stage II Hypertension:	> 160/100 mmHg.

Body weight

Body weight was measured while the subject were minimally clothed and without shoes, standing motionless on a weighing scale and it will be recorded to the nearest 0.1kg.[8]

Renal function tests

Procedure: 3ml of blood was withdrawn from the subject and fed into the autoanalyser.
Serum urea was measured by UV kinetic urease method.
Serum creatinine by Jaffe method.
Serum uric acid was measured by uricase method using standard kits from Agappe Diagnostics on a fully automated analyser Cobas Miras from Roche.

Normal values

Serum urea: 15-40mg/dl
Serum creatinine:0.9-1.3mg/dl
Serum uric acid:3.5-7.2mg/dl[10]

Creatinine clearance

Cockcroft-Gault Formula

$$\text{Estimated Creatinine Clearance} = \frac{(140 - \text{Age in years}) \times \text{Body weight in kg}}{\text{Serum creatinine(mg/dl)} \times 72}$$

Normal Creatinine clearance: 140ml/min.[11]

Statistical analysis

The results were expressed as mean ± standard deviation. The data analysis was carried out using SPSS for windows software version 16. Comparison of parameters between hypertensive subjects and normotensive healthy controls will be done with student't' test. Pearson's correlation will be applied to test for association between continuous variables. A p value <0.05 was considered statistically significant.

RESULT

The results are presented as mean ± standard deviation in table 1.Table 1 summarizes the descriptive statistics of renal function tests and creatinine clearance in hypertensive group and the control group. The mean values of urea, creatinine and uric acid were significantly increased in patients with hypertension in comparison with the controls ($p<0.05$). Figure 1 shows the comparison of mean values of serum urea in the hypertensive group and the control group. Figure 2 shows the comparison of mean values of creatinine and uric acid in the hypertensive group and the control group.Theyshow statistically significant elevation of urea, creatinine and uric acid in the hypertensive group in comparison with the controls. Table 2 shows the correlation of creatinine clearance with renal function tests. Creatinine clearance is found to be negatively correlated with urea, creatinine and uric acid.

Table 1: Comparison of various parameters between the hypertensive and normotensive group

Parameters	Cases(n=50)	Controls(n=50)
Age (years)	45.16 ± 5.88	45.08±5.67
Weight(kg)	59.72±13.71	61.56±8.01
Urea(mg/dl)	37.22±7.64	32.7±7.53
Creatinine(mg/dl)	1.23±0.39	0.92±0.22
Uric acid(mg/dl)	6.51±1.16	5.88±1.04
Creatinine clearance(ml/min)	75.39±25.94	93.49±25.17

Data are presented as Mean ±SD.

Table 2-Correlation of creatinine clearance with renal function tests among the cases

Parameters (cases, n=50)	Creatinine clearance	
	R value	P value
Urea	-0.474	0.001*
Creatinine	-0.843	0.001*
Uric acid	-0.419	0.002*

Pearson correlation analysis was performed to analyze the data.
*p<0.05 is considered statistically significant.

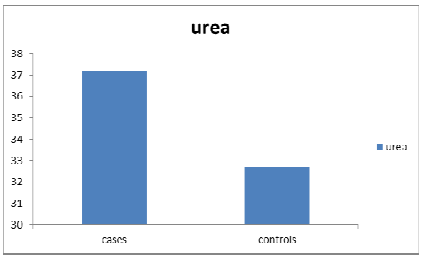

Figure1: Comparison of serum urea between the cases and controls

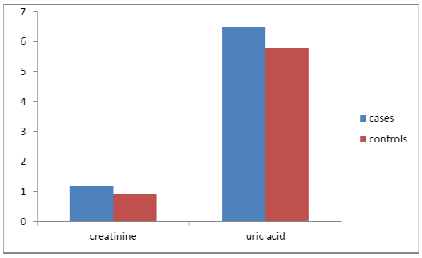

Figure 2: Comparison of creatinine and uric acid between the cases and controls

This study relates the renal function tests and creatinine clearance in normotensive healthy subjects and in hypertension. The results of our study revealed that hypertensive patients have significantly higher serum urea, creatinine and uric acid levels as compared with the controls. This elevation may be due to the renal dysfunction in hypothyroidism. However clinical symptoms were not usually the chief compliant at presentation in hypothyroid patients. Measurements of the plasma concentration of creatinine are often used clinically as an index of kidney function. Creatinine produced as a waste product of muscle creatine, about 1-2 % of the total muscle creatine pool is converted daily to creatinine through the spontaneous, nonenzymatic loss of water .Since it is released into the blood at a constant rate, and since its excretion is closely matched to the glomerular filtration rate (GFR), an abnormal decrease in GFR causes increase the plasma creatinine concentration.[5] Various mechanisms have been proposed as causing elevated renal function tests in hypertension.In our study 34% of hypertensive patients had elevated urea levels, 38%of hypertensive patients had elevated creatinine levels and 26% of hypertensive patients had elevated uric acid levels. A marked decrease in creatinine clearance is associated with increase in serum urea, creatinine and uric acid levels suggesting that the severity of renal dysfunction increases serum urea, creatinine and uric acid levels.

CONCLUSION

From the present study, it is evident that hypertension can cause significant increase in serum urea, creatinine and uric acid levels, which indicates that these can be used as

parameters for screening early onset of renal dysfunction in patients with hypertension. Compared to creatinine clearance serum creatinine and uric acid levels can be used as a better biochemical marker for assessing renal dysfunction in hypertension. A large scale study is warranted to further validate the findings of the present study.

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