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EVALUATION OF MICROALBUMINURIA, RENAL FUNCTION AND LIPID IN ESSENTIAL HYPERTENSION

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ABSTRACT

Background: Microalbuminuria is defined as urinary albumin excretion ranging from 30 – 300 mg/day, microalbuminuria is a predictor for developing renal disease in diabetes, hypertension and recently for cardiovascular disease. So it is important for early detection of renal damage in hypertension patients. **Aim**: This study aim to measure microalbumin/creatinine ratio (MCR) in essential hypertensive adults and controls, also to correlate the microalbumin/creatinine ratio with the duration of hypertension and to assess the renal function test in patients with hypertension. **Materials and Methods**: Patients with essential hypertensive cases male and female (*n* = 250) and normal subjects as controls (*n* = 250) were enrolled. The specimens include urine and serum; Fasting urine sample for microalbumin–creatinine index, and 5 ml of venous blood was collected after 8 hours of fasting and divided into fluoride oxalate container for glucose and an plain container (without anticoagulant) for analysis of the other parameters. Concentration of microalbumin was measured by turbidimetry spectorphotometry method, manufactured by BioSystem. Creatinine in serum and urine measured by using kinetic Jaffe method. Descriptive statistics and correlation were used for the analysis using SPSS 20 software and Microsoft Office Excel. **Result**: according to urinary excretion patients are classify to three groups; normal protein in urine group (n = 185), microalbuminuria group (n = 39), and macroalbuminuria group (n = 26). A positive correlation was found between duration of hypertension and MCR among patients *P-value* 0.000. A significant increase in blood urea concentration over control value was seen. A significant increase in serum creatinine concentration over control value was also seen. **Conclusion**: MCR is increase in hypertensive patients than control, and the positive correlation between MCR and duration of hypertension, MCR well be a good marker for early detection of renal damage.

KEYWORDS: Microalbuminuria, turbidimetry spectrophotometry, creatinine.

INTRODUCTION

Hypertension (HTN) or high blood pressure is defined as a cardiac chronic medical condition in which the systemic arterial blood pressure is raised. Hypertension is divided to either primary (essential) or secondary. About 90–95% of cases are described as "primary hypertension", which refers to high blood pressure for which no medical cause can be found.[1] The remaining 5–10% of cases (Secondary hypertension) is caused by other conditions that influence the kidneys, arteries, heart, or endocrine system.[2] Persistent hypertension is one of the risk factors for stroke, myocardial infarction, heart failure and arterial aneurysm, and is a leading cause of chronic kidney failure.[3] In the year 2000 it is estimated that nearly one billion people or ~26% of the adult population have hypertension worldwide.[4] It was common in both developed (333 million) and undeveloped (639 million) countries.[4] **Complications of hypertension**: Hypertension is the most common risk factor for death in industrialized countries.[5] It increases hardening of the arteries[6] thus individuals well be more likely to have heart disease[7], peripheral vascular disease[8], and strokes.[9] Types of heart disease that may happen include: myocardial infarction[9], heart failure[10], and left ventricular hypertrophy.[11] Other complications include: Hypertensive retinopathy.[12] Hypertensive nephropathy.[13] If blood pressure is very high hypertensive encephalopathy may occur. Microalbuminuria occurs when the kidney excretes small amounts of albumin into the urine, in other definition, when there is an abnormally high permeability for albumin in the renal glomerulus. The amount of albumin protein produced by microalbuminuria cannot be detected by urine dipstick methods. Microalbuminuria is diagnosed either from a 24-hour urine sample (between 30-300 mg/24 hours) or, more commonly, from increased concentrations in a spot sample (30 to 300 mg/L). To avoid the variations in urine concentration

in spot-check samples, it is useful to compare the amount of albumin in the sample against its concentration of creatinine. This is called the albumin/creatinine ratio (ACR).[14] Microalbuminuria is associated with glomerular damage and endothelial dysfunction and is prognosis of development of nephropathy because albumin are the first proteins appear in the urine after the glomeruli damage, so microalbuminuria has a great diagnostic significance especially in patients with diabetes or hypertension, because it associated with an increased risk of renal disorder.[15] Re from thesis. Microalbuminuria (MAU) in essential hypertension is associated with the elevated mortality. Microalbuminuria is the independent risk factor to develop cardiovascular and cerebrovascular diseases. Furthermore, MAU has been described as an early sign of kidney damage and a redactor for end stage renal disease (ESRD) and cardiovascular disease.[16]

MATERIALS AND METHODS

This study is descriptive, and the design was case study in which serum and urine of hypertensive patient were compared with that of normal subjects. The study was included 250 patients come to the hospital with essential hypertension from October 2013 to May 2014 and 250 normotensive subject as control, 92 male and 158 female and the mean age was 58.5±9.6 years for patients, 101 male and 149 female and the mean age was 53.7±10.4 for control. And the study took place in Khartoum state, and the analysis of samples was being done in Center for Medical Laboratory Services. Concentration of microalbumin was measured by spectorphotometry, the principle of method depend on albumin in sample causes agglutination of the latex particles coated with anti-human albumin. The agglutination of the particles is proportional to the albumin concentration and can be measured by turbidimetry spectorphotometry method, manufactured by BioSystem. Creatinine concentration in blood and urine was measured using kinetic Jaffe method. Then the microalbumin/creatinine ratio calculated. Also the concentration of glucose, urea, creatinine, cholesterol and triglyceride were measured by automatic analysers ACCENT-200.

For internal quality control, normal and pathological control was been used. Permission to carry out this research will be obtained from health authorities. Patients will be fully informed about this work. Inclusion Criteria: Apparalenty healthy individual not known to be suffering from hypertension or other disease (as control). Patients with essential hypertension (case).
Exclusion Criteria: patients with diabetes mellitus, chronic kidney disease, end stage renal failure, and nephrotic syndrome.

STATISTICAL ANALYSIS

For data analysis the Statistical Package for Social Science (SPSS 20) and Microsoft Office Excel will be used.

RESULTS

Table (1) demonstrates classifications of patients according to urinary microalbumin. In which patients are classify to three groups; normal protein in urine group (n = 185), microalbuminuria group (n = 39), and macroalbuminuria group (n = 26).

Table (1): demonstrate classifications of patient according to MCR.

TYPE	Frequency	Percent
Normal protein in urine	185	74.0%
Microalbuminuria	39	15.6%
Macroalbuminuria	26	10.4%
Total	250	100%

Table (2) shows the mean of age in different groups. It can be seen that the mean of age of normal protein in urine group (52±10.5) was lower than microalbuminuria group (58±8.4) and microalbuminuria group was lower than macroalbuminuria (62±9.9).

Table (2) show the distribution of patients according to age.

TYPE	Mean age (years)
Normal protein in urine	52±10.5
Microalbuminuria	58±8.4
Macroalbuminuria	62±9.9

Table (3) represents the mean of concentration of glucose, blood urea, creatinine, cholesterol and triglyceride in patients and controls. It can be seen that a significant increase in all of them in patients than controls, (P-value 0.000) except for cholesterol no significant increase in total cholesterol in patients and control (P-value 0.093).

Table (3): represents the mean of concentration of glucose, blood urea, creatinine, cholesterol and triglyceride in patients and controls.

T-test		Mean	Std. Dev.	P-value
Blood glucose mg/dl	Patients with hypertension	98	10	0.000**
	Healthy individuals	88	9	
Blood Urea mg/dl	Patients with hypertension	37.5	11.3	0.000**
	Healthy individuals	26.0	6.7	
Serum Creatinine mg/dl	Patients with hypertension	1.0	0.2	0.000**
	Healthy individuals	0.8	0.1	
Serum Cholesterol mg/dl	Patients with hypertension	176.1	26.3	0.093*

	Healthy individuals	172.3	25.1	
Serum Triglyceride mg/dl	Patients with hypertension	123.9	21.2	0.000**
	Healthy individuals	112.4	26.2	

- T-test p-value less than 0.05 that's considered as statistically significant. **.Significant.
- T-test p-value more than 0.05 that's considered as statistically insignificant. *.Insignificant.

Table (4) demonstrates the mean value of MCR in different groups. In which there was no significant difference in MCR between control group and normal protein in urine group ($p > 0.05$). The MCR in microalbuminuria group and macroalbuminuria group was notably higher than that in control group and normal protein in urine group ($p < 0.05$), and, of course, the MCR in microalbuminuria group was lower than that in macroalbuminuria group ($p < 0.05$).

Table (4) demonstrate the mean value of MCR in different groups

One Way ANOVA multiple comparison	**MCR µg/mg *(Mean ± Std. Dev.)***	***P-value***
Healthy individuals	(10.2±2.8)	0.555*
Normal protein in urine	(10.1±3.1)	
Healthy individuals	(10.2±2.8)	0.000**
Microalbuminuria	(107.0±54.4)	
Healthy individuals	(10.2±2.8)	0.000**
Macroalbuminuria	(332±78.6)	

- One Way ANOVA p-value less than 0.05 that's considered as statistically significant. **.Significant.
- One Way ANOVA p-value more than 0.05 that's considered as statistically insignificant. *.Insignificant.

Fig (1) show the correlation between duration of hypertension and MCR (P-value < 0.01). It can be seen that there was a significant correlation.

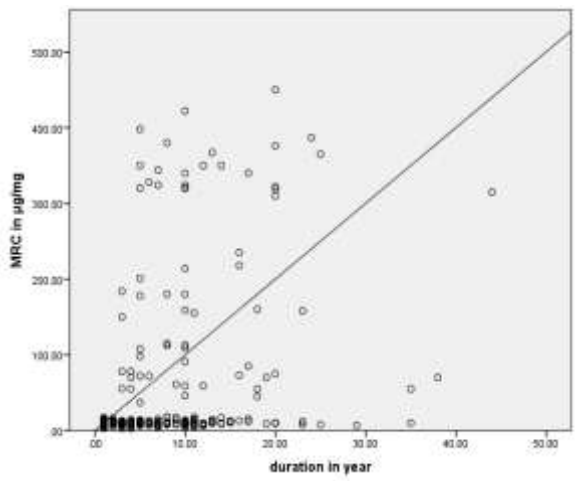

Fig (1) demonstrate the correlation between duration of hypertension and MCR

DISCUSSION

The finding of this study indicated that of the 250 hypertensive patients; 74 % with normal protein in urine, 15.6 % with microalbuminuria and 10.4 % with macroalbuminuria. These findings are in agreement with the result of *Atkins et al* (2004) who postulated that among the 106 hypertensive patients, 51 patients with non CKD had normoalbuminuria, 42 patients had microalbuminuria, and 13 patients had macroalbuminuria. We found 51.88% of overall hypertensive patients had microalbuminuira positive and 13.2% of general population had microalbuminuria positive by taking the cutoff point of ACR 3.4 mg albumin/mmol creatinine to define microalbuminuria. Some of the study showed approximately 30% of hypertensive patients had microalbuminuria positive[17,18] and some other studies reported even higher prevalence of microalbuminuria in hypertensive patients.[19,20]

The preliminarily findings obtained from this study showed that the mean of age of normal protein in urine group (52±10.5) years, microalbuminuria group (58±8.4) years and macroalbuminuria (62±9.9) years. The finding agrees with the finding of *Bibek et al* (2012) who reported that higher level of urinary ACR was noted with the advances of age (*P*-value <0.001).[21] Association of microalbuminuria with age was also reported by *Anderson GH* (1999) who pointed out that our results are consistent with the epidemiological data on the general population that systolic and diastolic blood pressure increase with age and that systolic blood pressure continues to increase after the seventh decade, while the diastolic blood pressure declines[22]

This study also presented that a significant increase in glucose, blood urea, creatinine and triglyceride in patients than controls, (P-value 0.000). This finding agree with the observation of *Bibek et al* (2012) who postulated that serum level of uric acid (*P*-value 0.047) and creatinine (*P*-value <0.001) were increased with the increased level of urinary ACR, although, both the parameters fell well within the normal reference range. An increasing urinary albumin excretion was noted with the severity of hypertension. And disagree with the observation of *Xin et al* (2010) that no statistically significant difference was found in terms of gender, BMI, blood glucose, lipid profile, Blood urea nitrogen, and Creatinine between four groups[23] The study also indicated that there was no significant difference in MCR between control group and normal protein in urine group ($p > 0.05$). The MCR in microalbuminuria group and macroalbuminuria group was higher than that in control group and normal protein in urine group ($p < 0.05$), and the MCR in microalbuminuria group was lower than that in macroalbuminuria group ($p < 0.05$). This study represented the correlation between duration of hypertension and MCR was a significant correlation (P-

value < 0.01), These remarks are in line with the observation of *Hitha et al* (2008) who claimed that microalbuminuria was significantly higher in those with longer duration and greater severity of hypertension (p < 0.001 in each). Older age (p < 0.001), adverse lipid profile (p < 0.01) and higher BMI (p < 0.04) were the other identifiable risk factors for microalbuminuria.[24] While it disagree with other studies that found no correlation between the duration of hypertension and ACR.[25]

CONCLUSION

This study indicated that there was a significant correlation between hypertension and microalbuminuria. MCR was increased in hypertensive patients than control, and the positive correlation between MCR and duration of hypertension, MCR well be a good marker for early detection of renal damage.

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