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Prevalence of Metabolic Syndrome in Chronic Kidney Disease: A Hospital Based Cross-sectional Study

Poudel B,[1] Gyawali P,[2] Yadav BK,[3] Nepal AK,[4] Mahato RV,[5] Jha B,[6] Raut KB[7]

[1]Department of Biochemistry, Manipal College of Medical Sciences (MCOMS), Manipal Teaching Hospital (MTH), Pokhara, Nepal, [2]PhD Scholar, Charles Sturt University, NSW, Australia, [3]Research Institute of Clinical Medicine, Chonbuk National University Medical school and Hospital, Jeonju 561-712,South Korea, [4]Department of Biochemistry, B. P. Koirala Institute of Health Sciences, Dharan, Nepal, [5]Department of Biochemistry, Central College of Technology, Hattishar, Dharan, [6]Department of Biochemistry, Institute of Medicine, Tribhuwan University Teaching Hospital (IOM, TUTH), Kathmandu, Nepal, [7]Department of Internal Medicine, Institute of Medicine, Tribhuwan University Teaching Hospital (IOM, TUTH), Kathmandu, Nepal.

ABSTRACT

Background: The components of metabolic syndrome (MetS) are the established risk factors of chronic kidney disease (CKD). Therefore, MetS and interplay of its various components, have deleterious effects on patients with chronic kidney disease. The aims of our study was to find out the prevalence of MetS in chronic kidney disease patients and to find out the association of each component of MetS with chronic kidney disease.

Methods: A Hospital based cross-sectional study was carried out from February 2008 to August 2009. One hundred and sixty confirmed chronic kidney disease diagnosed patients were included in this study. Chronic kidney disease was defined from national kidney foundation guidelines. Anthropometric measurements of subjects were noted in a semi-structured pro-forma. Fasting blood sample was collected for the estimation of fasting blood glucose, triglyceride and HDL-cholesterol. Chronic kidney disease patients were diagnosed as having the metabolic syndrome by using the modified National Cholesterol Education Program Adult Treatment Program III criteria. Data were assessed by the t-test and Chi Square Test.

Results: Sixty (37.5%) of the chronic kidney disease patients had MetS according to modified National Cholesterol Education Program Adult Treatment Program III criteria. The prevalence of hypertension, high fasting blood glucose, high triglyceride, low HDL Cholesterol and high waist circumference in chronic kidney disease patients was 112 (70.0%), 36 (22.5%), 74(46.25%), 98 (61.25%) and 30 (18.75%) respectively. Among the five components of the metabolic syndrome, waist circumference has the highest positive predictive value (73.34%) for chronic kidney disease.

Conclusions: MetS occurs in more than one-third of chronic kidney disease patients. The prevalence of individual components of MetS is higher in chronic kidney disease patients.

Keywords: chronic kidney disease, dyslipidemia, hypertension, metabolic syndrome.

INTRODUCTION

Over caloric nutrition and sedentary lifestyle, the root causes of metabolic syndrome (MetS), are now common even in the developing countries. There are several studies, which have linked MetS with Chronic Kidney Disease (CKD).[1-4] Besides traditional risk factors like hypertension and hyperglycemia, waist circumference (WC) has also been significantly correlated with reduced estimated glomerular filtration rate (eGFR) and microalbuminuria.[1] The components of MetS are the established risk factors of CKD. Therefore, MetS

Correspondence: Bibek Poudel, Department of Biochemistry, Manipal College of Medical Sciences, Manipal Teaching Hospital, Pokhara, Nepal. E-mail: bibekclb@yahoo.com, Fax: 00977-61-527862, Phone number: +977-9841-553607.

and interplay of various components of MetS may have deleterious effects on patients with CKD.[1-3] Most of these studies were conducted in the general population. To the best of our knowledge, this is the first study to find out the prevalence of MetS in CKD patients and to find out the association of each component of MetS with CKD in South East Asia. Our study aims to find out the prevalence of MetS in CKD patients and to study the association of each component of MetS with CKD.

METHODS

This hospital based cross-sectional study was conducted between February 2008 to August 2009, at Department of Clinical Biochemistry in collaboration with Department of Internal Medicine (nephrology unit), Tribhuvan University Teaching Hospital, Institute of Medicine, Nepal. Ethical approval was taken as per the requirements of Institutional Review Board. One hundred and sixty CKD diagnosed patients were included in the study. CKD was defined as either an eGFR of <60 mL/min per 1.73m^2 body surface area or urinary albumin-creatinine ratio of greater than 30 mg/gram.[1] Anthropometric measurements like height, weight, WC of subjects were noted in a semi-structured pro-forma. WC was measured at the highest point of the iliac crest during minimal respiration. Two readings of blood pressure (BP) were measured using a mercury sphygmomanometer in the seated position after a 10 min rest period and mean was used for analysis. Fasting blood sample was collected for the estimation of glucose (FBG), triglyceride (TG) and HDL-cholesterol (HDL-C). All the biochemical parameters were assayed on BT 2000 Plus Biotechnica Instruments - clinical chemistry analyser. CKD patients were diagnosed as having the metabolic syndrome by using the modified National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) criteria.[1] According to the NCEP report, participants who had three or more of the following criteria were defined as having the MetS 1) abdominal obesity WC >102 cm in men and >88 cm in women, 2) TG ≥1.7 mmol/l, 3) HDL-C <1.03 mmol/l in men and <1.29 mmol/l in women, 4) systolic blood pressure ≥130 mmHg or a diastolic blood pressure ≥85 mmHg), and 5) FBG≥5.6 mmol/l. The participants who currently reported using anti-hypertensive or anti-diabetic medication were counted as having high blood pressure or diabetes, respectively.

The data was analyzed using Excel 2003, R 2.8.0 and Statistical Package for the Social Sciences (SPSS) for Windows Version 11.5 (SPSS Inc; Chicago, IL, USA). Difference for continuous variables was assessed by using the t-test, whereas association between categorical variables was assessed by using the Chi Square Test. A p-value of <0.05 was used to establish two tailed level of statistical significance at 95% confidence intervals.

RESULTS

One hundred and sixty patients with a confirmed diagnosis of CKD as per national kidney foundation guidelines were enrolled with their consent. Among these patients, 60 (37.5%) had the MetS according to modified NCEP ATPIII criteria. The prevalence of the individual components of MetS in CKD patients is given in (Table 1).

Table 1. Prevalence of various components of MetS in CKD patients.

Components of MetS	Number of patients	Percentage (%)
Hypertension	112	70
High FBG	36	22.5
High TG	74	46.25
Low HDL-C	98	61.25
High WC	30	18.75

All the five components of MetS were significantly more prevalent in MetS group than in non-MetS group among CKD patients. While comparing the prevalence of individual components of metabolic syndrome between patients with metabolic syndrome and patients without metabolic syndrome, higher percentage of individual component was reported in patients with metabolic syndrome. However, there were no significant differences among gender and mean age in the prevalence of MetS in CKD patients.

Table 2. Comparison of subjects with and without MetS.

Characteristic	Patient with MetS (n =60)	Patient without MetS (n =100)	Positive Predictive Value (%)	P value
Age(year)	46.97± 11.77	45.7± 9.58		NS
Sex Male	26	54		NS
Female	34	46		NS
High systolic BP	48	44	52.17%	0.002
High diastolic BP	58	50	73.3%	0.000
High FBG	26	10	72.23%	0.001
High TG	52	22	70.27%	0.000
Low HDL-C	54	44	55.1%	0.000
High WC	22	8	73.34%	0.003

Statistically significant at P-value <0.05. NS-Statistically non-significant

Among the five components of the metabolic syndrome, WC has the highest positive predictive (PPV) value (73.34%) for CKD (True Positive (TP)=22, False Positive(FP)=8), and was followed by FBG level (72.23%)

(TP=26, FP=10), TG level (70.27%) (TP=52, FP=22), decreased HDL-C level (55.1%) (TP=52, FP=22), and systolic BP (52.17%) (TP=48, FP=44), diastolic BP (73.3%) (TP=22, FP=8) (Table 2).

DISCUSSION

Metabolic syndrome is the worldwide public health problem. Several studies have been reported from South East Asia regarding the prevalence of metabolic syndrome.[1-4] Most of these studies were conducted in the general population. To the best of our knowledge, this is the first study to find out the prevalence of MetS in CKD patients in South East Asia. In the present study the prevalence of MetS in CKD patients was found to be 37.5%. In the study of Johnson et al, 2007 the prevalence of MetS (using WHO definition) in 200 stages 4 and 5 CKD patients was 30.5%. The same study reported the 50% prevalence of MetS among the patients undergoing Peritoneal Dialysis.[1] Chen et al, in 2004 found a significant correlation between the number of MetS traits and albuminuria and an eGFR of less than 60 mL/min per 1.73m^2, suggesting that the MetS might be an important factor involved in the development of CKD.[1]

Present study showed the high prevalence of hypertension (70%) in CKD patients. Decreasing glomerular filtration rate causes the retention of salt and water and hence leads to hypertension. Many other factors like activation of renin-angiotensin system are also attributed as an etiologic agent of hypertension in CKD.[1] Similar high prevalence was shown by the third National Health and Nutrition Examination Survey in United States which 70% of the subjects with elevated serum creatinine were shown to have hypertension.[1]

Our study showed that 46.25% and 61.25% of CKD patients had higher TG and lower HDL-C level respectively. Several studies have suggested dyslipidemia is a common feature of CKD patients.[1,2] Type and severity of lipid abnormality vary among different renal patient populations.[1] The study of Parikh et al, 2008 in Pakistan showed that 40% of CKD patients had higher TG level and 45% had lower HDL-C level.[1] Hosseinpanah et al, 2009 found 65.6% prevalence of dyslipidemia in CKD patients in Iran, being in agreement with our study.[1]

Among the individual components of the MetS, we found that high WC had the highest PPV (73.34%) followed by high DBP and FBG; high SBP had the least PPV. It indicates that central obesity is one of the greatest risk factor of CKD and it may predispose CKD patients to higher morbidity and mortality. Hyperglycaemia and hypertension are the established risk factors of CKD, so both of these factors are implicated in the pathogenesis of CKD, independently of MetS.[1]

CONCLUSIONS

Our results indicate that MetS, as defined by the modified NCEP criteria, occurs in more than one-third of CKD patients. Moreover, WC was found to have the highest PPV. So, more emphasis needs to be given regarding the control of blood lipids level and central obesity in CKD patients. Further studies are needed to determine if identification and treatment of the MetS and its component might be beneficial in improving the outcome of CKD patients.

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