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CORRELATION OF METABOLIC SYNDROME WITH RENAL DYSFUNCTION :A CASE-CONTROL STUDY

Endocrinology

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ABSTRACT

Background: Metabolic syndrome is a multiplex risk factor that arises from insulin resistance accompanying abnormal adipose deposition and function. And not very much data and knowledge are available on the relationship between metabolic syndrome and renal dysfunction. The objective of the study is to Study Renal Functions in Metabolic Syndrome & its correlation with individual components of Metabolic Syndrome. **Material and Methods:** The study was a cross-sectional study conducted in the Department of Medicine & Department of Endocrinology R.G.KAR Medical College &Hospital, Kolkata. A total of 50 cases of Metabolic Syndrome and 50 controls were included. The statistical analysis was performed using Statistical Package for Social Sciences version 22(SPSSv22). Correlation analysis was done. p-value less than 0.05 was considered statistically significant. **Results:** Mean (SD) age in the case group is 37.76 (±9.76) years whereas in control group it was 38.3 (±8.9). Thirty seven patients (74%) among cases have raised serum creatinine (>1mg/dl.(p value = 0.001). Thirty six patients (74%) among Cases have eGFR<60mL/min/1.73 m2(p value = 0.001). There is a positive correlation between systolic BP, Fasting blood sugar and serum Triglycerides with serum creatinine. (p value <0.05). There is a negative correlation of fasting blood sugar, diastolic BP, systolic BP, HDL and serum triglycerides with eGFR.(p value <0.05) **Conclusions:** The study found a relation between metabolic syndrome and renal dysfunction. Monitoring of renal parameters among those with metabolic syndrome is essential to avoid renal deterioration.

KEYWORDS

Metabolic Syndrome, Renal Function, Creatinine Clearance, Microalbuminuria

INTRODUCTION

Metabolic syndrome also called syndrome X or insulin resistance syndrome. It is a multiplex risk factor that arises from insulin resistance accompanying abnormal adipose deposition and function. It is a risk factor for coronary heart disease, as well as for diabetes, fatty liver, and several cancers. [1] However, only sparse data is available on relationship between Renal Dysfunction and Metabolic Syndrome.[2] The Essential parameters to define Renal Dysfunction would be Microalbuminuria and Glomerular Filtration Rate (GFR).

Chronic kidney disease (CKD) is a common condition in which there is a loss of kidney function over time. Kidney disease is the leading cause of death all over the world. Chronic kidney disease (CKD) can have a variety of different presentations depending on the stage of the disease and its cause, as well as patient factors such as age. A detailed history and physical examination is essential. In addition to routine laboratory studies, the workup should include calculation of the estimated glomerular filtration rate (GFR), measurement of albumin levels, and acquisition of radiologic studies. The KDOQI (Kidney Disease Outcomes Quality Initiative) defines CKD as either kidney damage or a decreased glomerular filtration rate (GFR) of less than 60 mL/min/1.73 m2 for 3 or more months.[3]

In an update of its CKD classification system, the National Kidney Foundation (NKF) advised that GFR and albuminuria levels be used together, rather than separately, to improve prognostic accuracy in the assessment of CKD.[4,5]

Because many of mentioned cytokines have been suggested to control renal disease pathophysiology,[6] it is tempting to reason that progressive kidney disease could also be regulated by proinflammatory cytokines in the context of the metabolic syndrome. Other mechanisms include physical compression of kidney parenchyma by adipose tissue, reduced birth weight and nephron number, enhanced glucocorticoid activity, or altered uric acid metabolism. From the previous studies it has been found that Metabolic Syndrome is a risk factor for Chronic kidney Disease not just indirectly through diabetes and hypertension but also directly.[7-10] Thus the objective of the present study is to study the association between renal functions and metabolic syndrome and its risk factors.

MATERIALS & METHODS

Study design and study setting

The study was a cross-sectional study conducted in the Department of Medicine & Department of Endocrinology R.G.KAR Medical College &Hospital, Kolkata.

A total of 50 cases of Metabolic Syndrome and 50 controls (age and sex matched) were evaluated. Controls included patients who do not satisfy the criteria for metabolic syndrome. Sample was taken from both Medicine Outdoor, Indoor &Endocrinology OPD.

Study population

The study population was patients with metabolic syndrome (as per International Diabetes Federation Consensus- definition of the metabolic syndrome,2006 [11])

Cases:

Inclusion criteria :

1. Age > 20 years
2. Both sexes

Exclusion criteria :

1. Patients with Nephrotic syndrome or Other known Kidney Disease
2. Patients who were pregnant
3. Patients with overt CKD
4. Patients on Nephrotoxic Drugs

Controls
Age and sex matched controls who did not have metabolic syndrome were the controls in this study.

Sample size determination
Sample size is calculated using the formula used for calculation of sample size in cross sectional studies $n=4PQ/L^2$ where n = sample size , P= prevalence, Q=1-P, L = Relative Error. Assuming 95% level of confidence =1.96,Prevalence =19 .52%,Precision of Error = 8%. Prevalence of Metabolic Syndrome from previous studies[12,13] taken as 19.52%. The total calculated sample size was 100. Thus a total of 100 cases and controls were studied on the basis of case selection criteria of patients presenting to the Out Patient Department and Indoor of Department of General Medicine and from the Endocrinology Clinic of RGKAR Medical College and Hospital, Kolkata.

Sampling methods
First Sample will be selected via simple random sampling using 2 digit random number table and subsequent samples will be chosen by systematic random sampling as determined by the sampling interval. Average number of Metabolic syndrome patients admitted & screened under our unit in one week is approximately 25(Sampling interval= 10) So every 10th patient will be selected as our study sample after choosing the first sample by simple random sampling.

Mode of collection of data:
All the cases matching with the criteria of Metabolic Syndrome were recruited. The Data regarding the detailed history & examination were collected in pre designed proforma. Necessary laboratory investigation conducted for each subjects.

- Blood Glucose Levels Fasting and OGTT.
- SERUM ELECTROLYTES- Na & K
- Kidney function tests—Blood Urea and Serum Creatinine with estimation of GFR by Estimated GFR (eGFR) Calculation using Modification of Diet in Renal Disease (MDRD) formula-[25] $eGFR=175 \times Serum\ Creatinine^{-1.154} \times Age^{-0.203} \times [1.212\ if\ Black] \times [0.742\ if\ Female]$
- Hb%
- USG Abdomen and KUB to rule out any structural abnormality, determine kidney size, echotexture and symmetry
- Urine routine and microscopical examination
- Lipid profile including serum triglycerides & HDL

Statistical Analysis:
The statistical analysis was performed using Statistical Package for Social Sciences version 22(SPSSv22). The mean, standard deviation, median and ranges were calculated for continuous variables whereas proportion and frequency tables used to summarize categorical variables. The statistical analysis aimed to find out the correlation between renal function and individual components of the metabolic parameter. The most important factor associated with renal dysfunction in metabolic syndrome is ascertained. Appropriate statistical methods were applied. p-value less than 0.05 was considered statistically significant.

RESULTS
The present study included a total of 100 individuals. There were two groups in the study – one group comprised of 50 patients and the other group consisted of 50 controls. The study group consisted of patients with metabolic syndrome as defined by International diabetic federation (IDF) criteria. The control group consisted of individuals who were otherwise healthy but didn't fall under metabolic syndrome. Mean (SD) age in the case group is 37.76 (±9.76) years whereas in control group it was 38.3 (±8.9). Among the study participants, 52% (26) patients were males and 48% (24) patients were females. Among Controls, there were 26 Females (52%) and 24 Males(48%).(Table 1)

Table 1 Profile of the study participants. (N=100)

S. No.	Variable	Cases N=50 N(%)	Controls N=50 N(%)
1.	Age group		
	20-29	6(12)	9(18)
	30-39	23(46)	22(44)
	40-49	14(28)	13(26)
	50-59	5(10)	6(12)
	60-69	2(4)	0
2.	Sex		
	Male	26(52)	26(52)
	Female	24(48)	24(48)
3.	Residence		
	Urban	34(68)	30(60)
	Rural	16(32)	20(40)

Table 2 Renal parameters study participants. (N=100)

S.No.	Parameter	Case (SD)	Control (SD)	Mean difference 95%CI	P value
1.	Serum creatinine	1.32(0.45)	0.66(0.276)	0.662 (0.5115-0.8125).	0.001
2.	eGFR	64.46(30.53)	99.76(22.8)	35.27 with 95%CI (-45.97,-24.577).	0.001

Independent t test, p value <0.05 is significant

Thirty seven patients (74%) among cases have raised serum creatinine (>1mg/dl) and 13 Individuals (26%)among controls have raised serum creatinine. (p value = 0.001). Thirty six patients (74%)(N=50) among Cases have eGFR<60mL/min/1.73 m^2(out of them 14 have eGFR 30-45 range & 2 have e GFR less than 30) and 5 individuals(10%)(N=50)among controls have eGFR<60mL/min/1.73 m^2. (p value = 0.001) (Table 2)

Table 3 Risk factors of metabolic syndrome among the study participants. (N=100)

S. No.	Variable	Cases N=50 Mean (SD)	Controls N=50 Mean (SD)
1.	Fasting blood sugar	125(25)	92(21)
2.	Systolic blood pressure	148(12)	124(8)
3.	Diastolic blood pressure	91(6)	78(6)
4.	Serum Triglycerides	172(24)	140(9)
5.	Serum HDL	45(10)	50(5)
6.	Waist circumference	90(5.6)	87(4.7)

Table 4 Correlation between serum creatinine and eGFR with blood parameters of cases (N=50)

S. No.	parameters	Serum creatinine (r)	P value	eGFR (r)	P value
1	Age	0.467	0.001	-0.586	0.001
2	Waist Circumference	0.442	0.001	-0.259	0.069
3	Fasting Blood Sugar	0.919	0.001	-0.820	0.001
4	Systolic BP	0.727	0.001	-0.667	0.001
5	Diastolic BP	0.268	0.06	-0.381	0.006
6	Serum Triglycerides	0.561	0.001	-0.443	0.001
7	Serum HDL	0.128	0.376	-0.268	0.06

r- Pearson correlation

There is a positive correlation between systolic BP, Fasting blood sugar and serum Triglycerides with serum creatinine. (p value <0.05). There is a negative correlation of fasting blood sugar, diastolic BP, systolic BP, HDL and serum triglycerides with eGFR.(p value <0.05) (Table 4)

DISCUSSION
The Scope of this study was to evaluate the renal functions in patients of Metabolic Syndrome and compare with the controls (without Metabolic Syndrome). 38 (i.e.76%). Patients out of 50 among cases had deranged renal functions as compared to 9 individuals among controls out of 50 had deranged renal functions. There were 12(24%) cases who had normal renal functions and 41 individuals among controls had normal renal functions. The Difference was found to be Statistically Significant (P value<0.05). The Results were similar to studies done by Chen et al[14] ,Kurella et al[15], Bonnett et al[17],Sun et al[18], Watanabe et al[19],Ryu S et al[20],Wang Q et al[21].

Renal Functions were assessed by eGFR and Urine for

Microalbuminuria. Patients with either eGFR<60mL/min/1.73 m^2 or positive for urine micro albuminuria (1+ and 2+) were considered as having derangement of renal functions. 36(72%) patients out of 50 among cases had eGFR<60mL/min/1.73 m^2 as compared to 5(10%) individuals out of 50 among Controls had eGFR<60mL/min/1.73 m^2. There were 14(28%) Cases who had (normal)eGFR>60mL/min/1.73 $m^2$and 45(90%) individuals among controls had eGFR<60mL/min/1.73 m^2 .P value is 0.001(<0.05).The mean difference was -35.27 with 95%CI(-45.97,-24.577).It was found to be statistically Significant. The Results were similar to studies done by Chen et al[14],Kurella et al[15], Bonnett et al[17],Sun et al[18], Watanabe et al[19],Ryu S et al[20],Wang Q et al[21].

Study shows that 37 Patients(74%) among Cases have Raised Serum Creatinine(>1mg/dl) as comparable to 13 Individuals (26%)among controls have Raised Serum Creatinine. The mean serum creatinine of Cases was 1.32 as comparable to mean serum creatinine of controls which was 0.66.P Value was 0.001(<0.05).Mean Difference between was 0.662 with 95% CI(0.5115,0.8125). It was statistically Significant. The results were similar to study done by Chen et al[14].

LIMITATIONS

1. Our study is a single centre study of relatively homogeneous population. Multi centric study with heterogeneous population could increase the external validity of the study.
2. Another Limitation is limited follow up period.
3. The drawback of eGFR (estimated glomerular filtration rate)was that it was not the directly measured GFR. Estimated-GFRs using a serum creatinine-based equation (MDRD) were used to define CKD. The MDRD-equation might have overestimated or underestimated the actual GFR.

CONCLUSION

The study found a relation between metabolic syndrome and renal dysfunction. There has been a significant correlation between certain risk factors of metabolic syndrome with renal function. Patients with metabolic syndrome had both increased creatinine and eGFR. Monitoring of renal parameters among those with metabolic syndrome is essential to avoid renal deterioration.

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