

Prevalence of Renal Function Abnormalities and Their Association with Components of Metabolic Syndrome

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ABSTRACT

Background: Metabolic syndrome (MetS) is increasingly associated with renal dysfunction, particularly in South Asian populations. **Objectives:** To determine prevalence of renal dysfunction and its association with individual MetS components. **Methods:** Cross-sectional study of 100 MetS patients. Clinical, biochemical parameters including urine ACR and eGFR were analyzed. **Results:** Albuminuria was present in 66% (micro 24%, macro 42%) and reduced eGFR (<60) in 30%. Waist circumference showed strongest correlation with ACR ($r=0.540$, $p<0.001$) and eGFR decline ($r=-0.460$, $p<0.001$). All components of MetS showed significant correlation with albuminuria, while all except HDL were significantly associated with reduced eGFR. **Conclusion:** MetS components strongly correlate with renal dysfunction, with central obesity being the most significant predictor.

Keywords: Metabolic syndrome, Albuminuria, eGFR, Insulin resistance, Chronic kidney disease

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INTRODUCTION

Metabolic syndrome (MetS) is a cluster of metabolic abnormalities including central obesity, hypertension, dyslipidemia, and impaired glucose metabolism. It is associated with increased risk of cardiovascular disease and chronic kidney disease (CKD) [1,2]. Emerging evidence suggests that MetS contributes to renal dysfunction through mechanisms such as insulin resistance, inflammation, and endothelial dysfunction [3–5]. This study evaluates prevalence of renal dysfunction and its association with MetS components.

MATERIALS AND METHODS

This hospital-based cross-sectional study included 100 patients with MetS as per IDF criteria. Anthropometric, clinical, and biochemical parameters including BMI, waist circumference, blood pressure, fasting glucose, lipid profile, urine ACR, and eGFR were assessed. Statistical analysis was performed using SPSS v29 with Pearson correlation.

RESULTS

Key findings are summarized in Tables 1–3.

Table 1: Baseline Characteristics

Parameter	Cases	Controls
Age (years)	38.82 ± 10.4	Matched
BMI (kg/m ²)	32.9 ± 10.4	21.0

WC (cm)	109.4	76.4
SBP (mmHg)	130.3	114.3
DBP (mmHg)	81.2	73.3
FBS (mg/dL)	100.8	96.8
HDL (mg/dL)	41.5	52.5
TG (mg/dL)	165.7	101.1

Table 2: Prevalence of Renal Dysfunction

Parameter	Value
Albuminuria	66%
Microalbuminuria	24%
Macroalbuminuria	42%
Reduced eGFR (<60)	30%
Both ACR↑ and eGFR↓	23%

Table 3: Correlation of MetS Components with Renal Parameters

Component	ACR (r)	eGFR (r)
WC	0.54*	-0.46*
TG	0.32*	-0.38*
SBP	0.33*	-0.32*
DBP	0.39*	-0.40*
FBS	0.32*	-0.35*
HDL	-0.32*	NS
BMI	0.38*	-0.31*

*p < 0.05 statistically significant; NS = not significant

DISCUSSION

This study demonstrates a high prevalence of renal dysfunction among patients with metabolic syndrome, consistent with previous studies [5,6]. Albuminuria was present in 66% of patients, highlighting early glomerular injury, while 30% had reduced eGFR, indicating established renal impairment. These findings support the concept that MetS contributes to both functional and structural kidney damage. Central obesity, measured by waist circumference, showed the strongest correlation with both albuminuria and reduced eGFR. This aligns with findings by He et al. and Oh et al., which demonstrated that waist circumference is a better predictor of renal

dysfunction than BMI [8,9]. Visceral adiposity contributes to insulin resistance, activation of the renin-angiotensin-aldosterone system, and chronic inflammation, all of which promote glomerular hyperfiltration and subsequent damage. Hypertension and hyperglycemia also showed significant correlations with renal parameters. Elevated blood pressure leads to increased intraglomerular pressure and endothelial injury, while impaired fasting glucose contributes to glycation end products and oxidative stress [10,11]. These mechanisms collectively accelerate nephron loss. Dyslipidemia, particularly elevated triglycerides, was significantly associated with renal dysfunction, supporting prior studies [12,13]. However, HDL did not show significant correlation with eGFR

decline in our study, which differs from some earlier reports, suggesting population-specific variations. The coexistence of multiple MetS components appears to have a synergistic effect, amplifying renal damage. This clustering effect emphasizes the importance of comprehensive risk factor control rather than isolated management. Limitations include small sample size, hospital-based design, and limited generalizability. Longitudinal studies are needed to establish causality.

CONCLUSION

Metabolic syndrome is strongly associated with renal dysfunction. Central obesity is the most significant predictor. Routine screening using ACR and eGFR should be implemented in all MetS patients for early detection and intervention.

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