ORIGINAL RESEARCH PAPER

General Medicine

"ASSOCIATION OF CAROTID ATHEROSCLEROSIS AND METABOLIC SYNDROME IN YOUNG PATIENTS IN A TERTIARY CARE HOSPITAL, MANDYA"

KEY WORDS:

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ABSTRACT

Background: Metabolic Syndrome (MetS) comprises a constellation of metabolic abnormalities that heighten the risk of atherosclerotic cardiovascular disease. Carotid intima-media thickness (CIMT), assessed via ultrasonography, serves as a validated early marker of subclinical atherosclerosis. **Objectives:** 1. To evaluate young adults with MetS for carotid atherosclerosis using duplex ultrasound. 2. To examine the relationship between individual MetS components and CIMT. **Methods:** A cross-sectional descriptive study was conducted on 60 patients aged 18–40 years diagnosed with MetS according to NCEP-ATP III criteria. Carotid Doppler assessed CIMT, and metabolic parameters including BMI, triglycerides, HDL cholesterol, waist circumference, fasting glucose, and blood pressure were analyzed. **Results:** Increased CIMT was found in 33% of patients, predominantly males (60%). Hypertriglyceridemia (82%) and increased waist circumference (72%) were most common. Low HDL was present in 65%, hypertension in 22%, and hyperglycemia in 8%. **Conclusion:** A significant proportion of young individuals with MetS exhibit subclinical carotid atherosclerosis. Central obesity and dyslipidemia were the strongest predictors. Early screening and intervention are essential to mitigate long-term cardiovascular risk.

INTRODUCTION

Metabolic Syndrome (MetS) is a cluster of interconnected metabolic disorders, including central obesity, insulin resistance, hypertriglyceridemia, low high-density lipoprotein (HDL) cholesterol, and elevated blood pressure.[1,2] Together, these factors substantially increase the risk of cardiovascular disease and type 2 diabetes mellitus.[3]

Carotid intima-media thickness (CIMT) measured via B-mode ultrasonography is a recognized surrogate marker for early atherosclerosis [4,5]. Increased CIMT is independently associated with a higher incidence of myocardial infarction and stroke, as shown in longitudinal cohorts such as the ARIC and Framingham Heart studies.[6,7]

While MetS prevalence is increasing in young adults due to sedentary lifestyles and dietary habits, data on its vascular impact in this age group, particularly in Indian populations, remains limited.[8,9]

Objectives

1. To evaluate individuals aged 18–40 years with MetS for carotid atherosclerosis using duplex ultrasound.
2. To determine the significance of individual MetS components in relation to CIMT.

MATERIALS AND METHODS

Study Design:

Hospital-based cross-sectional descriptive study conducted at the Department of General Medicine, Mandya Institute of Medical Sciences (MIMS), Mandya.

Sample Size: 60

Inclusion Criteria

1. Age range: 18–40 years
2. Diagnosis: MetS based on NCEP-ATP III criteria (presence of ≥3 of the following: abdominal obesity, elevated triglycerides, low HDL cholesterol, hypertension, hyperglycemia).[10]

Exclusion Criteria:

Patients with pre-existing ischemic heart disease, cerebrovascular accidents, or peripheral arterial disease.

Investigations:

All Participants Underwent:

1. Clinical evaluation and anthropometry
2. Measurement of waist circumference, BMI, BP, fasting lipid profile, fasting glucose
3. Carotid ultrasound using 7.5 MHz transducer. CIMT >0.8 mm was considered abnormal.[11]

RESULTS

The study included 60 young adults aged 18 to 40 years (mean age: 32.1 ± 5.6 years) diagnosed with metabolic syndrome. Of the participants, 36 (60%) were male and 24 (40%) were female. Carotid intima-media thickness (CIMT) was increased (≥0.8 mm) in 20 patients, accounting for 33% of the study population. Among those with increased CIMT, 60% were males and 40% were females, indicating a slightly higher prevalence of subclinical atherosclerosis in men.

Hypertriglyceridemia was the most prevalent metabolic abnormality, observed in 82% of participants. Central obesity, defined by increased waist circumference, was present in 72% and emerged as a strong independent predictor of increased CIMT. Low HDL cholesterol levels were found in 65% of patients, also showing a significant association with CIMT. In contrast, hypertension was identified in 22% of the patients, and elevated fasting blood glucose was present in only 8%, suggesting a relatively lower contribution of these parameters to early atherosclerotic changes in this young cohort.

Overall, dyslipidemia (hypertriglyceridemia and low HDL) and central obesity were the most common and strongly associated components of MetS in relation to carotid atherosclerosis. Blood pressure and glycemic abnormalities were less frequently observed and had a weaker correlation with increased CIMT in this age group.

Table 1 Showing Prevalence Of CIMT

Gender	Increased CIMT (n)	Increased CIMT (%)
Male	12	33.3
Female	8	33.3

Table 2 showing prevalence of components of metabolic syndrome

MetS Component	Prevalence (%)
Hypertriglyceridemia	82
Central Obesity	72
Low HDL	65
Hypertension	22
Hyperglycemia	8

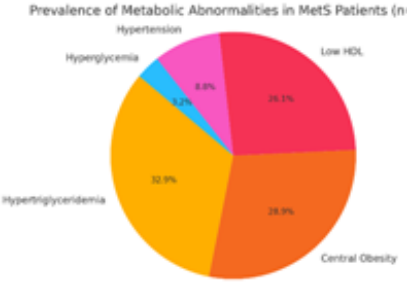

Figure 1 showing prevalence of metabolic syndrome components

DISCUSSION

This study highlights a significant association between metabolic syndrome (MetS) and subclinical carotid atherosclerosis in young adults aged 18–40 years. One-third (33%) of participants demonstrated increased carotid intima-media thickness (CIMT), indicating early vascular changes despite their relatively young age. This finding is consistent with previous studies, such as those by Lorenz et al. and Nagamatsu et al., which established CIMT as a reliable early marker of cardiovascular risk, particularly in individuals with metabolic abnormalities. [6,21]

Among the components of MetS, hypertriglyceridemia was the most prevalent, observed in 82% of patients. Elevated triglyceride levels are known to promote endothelial dysfunction, oxidative stress, and systemic inflammation—all of which are integral to atherosclerosis development [14] Similarly, low HDL cholesterol, present in 65% of the cohort, likely contributed to atherosclerosis due to its reduced ability to mediate reverse cholesterol transport and its anti-inflammatory properties. [15]These lipid abnormalities showed a strong correlation with increased CIMT, underscoring the critical role of dyslipidemia in the early stages of atherosclerotic disease.

Central obesity, present in 72% of the participants, also emerged as a major contributor to increased CIMT. Abdominal adiposity is metabolically active and strongly associated with insulin resistance, chronic low-grade inflammation, and adverse lipid profiles—all of which drive atherosclerotic changes. [16,17] These findings reinforce the hypothesis that visceral obesity is a key early driver of cardiovascular risk in MetS.

Interestingly, hypertension and hyperglycemia—traditionally considered major cardiovascular risk factors—were less prevalent in this cohort, seen in only 22% and 8% of patients, respectively. This suggests that in younger individuals, lipid abnormalities and obesity may precede the development of glucose intolerance and elevated blood pressure in the progression of MetS, a sequence supported by previous metabolic cascade models. [18]

Gender differences were also noted, with a higher proportion of males exhibiting increased CIMT. This aligns with existing literature indicating that men are more likely to develop atherosclerotic disease earlier than women, potentially due to differences in hormonal protection, particularly estrogen in premenopausal females, and lifestyle risk factors such as tobacco and alcohol use, though these were not assessed in this study. [19]

Comparing the present findings with global and Indian studies, such as those by Grundy et al., Misra et al., and the ARYA study, similar trends in the predominance of central obesity and dyslipidemia in MetS-associated vascular changes are evident . The results further emphasize the need for early identification of at-risk individuals using non-invasive tools like carotid ultrasound, particularly in resource-limited settings where preventive strategies can significantly reduce future cardiovascular burden.

In summary, this study underscores the early onset of vascular changes in young adults with MetS, driven primarily by dyslipidemia and abdominal obesity. These findings highlight the urgent need for early lifestyle and pharmacological interventions to delay or prevent cardiovascular events later in life.

CONCLUSION

This study confirms a significant association between MetS and subclinical carotid atherosclerosis in young adults. Central obesity, hypertriglyceridemia, and low HDL cholesterol were the most influential components linked to increased CIMT.

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