Evidence-Based Risk Assessment for Cardiovascular Disease Prevention: A Prospective Study on A Cardiometabolic Approach

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Abstract

The study aimed to determine the prevalence of determinants associated with cardiometabolic health risks and cardiovascular disease using an evidence-based, prospective approach in a tertiary care hospital. A single-centered, prospective observational study included 60 subjects with coronary artery disease aged 30–90 years attending the cardiology department between November 2024 and May 2025. Parameters such as BMI, blood glucose, and blood pressure were assessed. Hypertension was the primary prevalent risk factor, frequently observed in diabetic (83.3%) and obese (11.6%) individuals. A significant proportion presented with diabetes (75%) and obesity (16.6%). The results suggest that hypertension and diabetes are the most prevalent conditions, with obesity acting as a substantial risk element linked to multiple cardiometabolic conditions. Strong associations were observed among hypertension, diabetes, and obesity. Cardiometabolic disease (CMD) leads to early and progressive complications, with a high burden in India. Comprehensive, evidence-based strategies including early diagnosis, multifactorial therapy, and specialist referral are crucial to reduce CMD burden.

Keywords: Cardiometabolic disease, Hypertension, Diabetes mellitus, Obesity, Cardiovascular risk factors, Prospective study.

Introduction

Heart and vascular conditions stand as the primary drivers of illness and mortality among diabetic individuals.[1] These cardiovascular complications frequently appear alongside other health concerns such as

elevated blood pressure readings, excess body weight, and irregular cholesterol profiles—collectively sometimes referred to as metabolic or cardiometabolic syndrome. Scientists have found through various studies that diabetes itself can directly elevate cardiovascular disease risk through specific biological mechanisms. Consequently, effective management of these risk factors in diabetic patients remains essential for preventing serious cardiac complications in later years.[2]

In 2019, the ESC emphasized this integrated approach following significant cardiac outcome research. Since then, their guidance has received endorsement from other prominent health authorities, including a recent position from the AHA.[3]

CAD develops when the blood vessels supplying the heart muscle become constricted or obstructed due to atherosclerotic plaque accumulation. This restriction in blood flow can manifest as chest discomfort (angina), and in severe instances, myocardial infarction. Dysregulated glucose metabolism, particularly in type 2 diabetes (T2DM), heightens cardiovascular risk. This occurs partly because diabetes increases concentrations of atherogenic lipids with low density, which more readily infiltrates arterial walls. Contemporary research supports utilizing GLP-1 receptor agonists in high-risk diabetic patients to reduce myocardial infarction and stroke incidence.[4]

Key Modifiable and Multifactorial Determinants of Cardiovascular Disease (CVD) Cardiovascular disease risks stem from numerous factors, though most remain amenable to modification or control. The most prevalent include:

- Obesity
- Central/abdominal adiposity
- Hyperglycemia
- Dyslipidemia
- Hypertension [5]

The Impact of Cardio-Metabolic Burden (CMD)

The global burden of non-communicable diseases (NCDs) continues to expand rapidly, with cardio-metabolic disease (CMD) remaining the predominant cause of and disability. CMD encompasses conditions including obesity, metabolic syndrome, insulin resistance, pre- diabetes, and diabetes. CMD complications may manifest early or progress over time. This condition disproportionately affects younger populations, resulting in significant premature cardiovascular event incidence.

Metabolic Syndrome

Metabolic syndrome represents a condition characterized by three or more of the following health abnormalities: increased waist circumference, elevated triglyceride levels, reduced high-density lipoprotein cholesterol (HDL-C), hypertension, and elevated fasting glucose.[6]

Metabolic syndrome independently doubles cardiovascular disease risk, even without concurrent diabetes. Nearly two-thirds of the population—approximately 62%—exhibited at least one metabolic risk factor. These included diabetes (4.7%), prediabetic states such as impaired fasting glucose (41.3%), hypercholesterolemia (5.5%), hypertriglyceridemia (11.5%), and hypertension

(10.4%).[7]

Screening and Diagnosis of Cardiometabolic Diseases and Their Complications

Identifying high-risk individuals for cardiometabolic events enables healthcare providers to implement enhanced preventive measures reducing heart failure (HF) or arterial sclerosis and CV risk. Various risk factors assess individual susceptibility to both cardiovascular and cardiometabolic conditions.[8] Obesity and insulin resistance (IR) represent primary underlying

cardiometabolic syndrome causes, potentially leading to glucose intolerance and dysglycemia. These conditions disrupt normal glycemic regulation, increasing various metabolic and cardiovascular disorder risks.

Cardiometabolic syndrome diagnosis importance lies in identifying individuals at elevated CVD and T2DM risk. Early identification allows healthcare providers to implement preventive measures and individualized treatments addressing condition- associated risk factors.[9] Furthermore, effective cardiometabolic syndrome management reduces long-term diabetes and cardiovascular disease complications. Early intervention addressing weight, glycemic control, and lipid profiles significantly decreases serious health condition incidence and improves affected individuals' quality of life.[10] cardiovascular diseases (CVDs) remain the leading cause of mortality worldwide, often interlinked with diabetes, obesity, hypertension, and dyslipidemia. The interplay between these risk factors constitutes a cluster known as cardiometabolic disease (CMD). This study aims to evaluate the prevalence and determinants associated with CMD using an evidence-based, prospective approach in a tertiary care hospital.

Materials and Methods

Study Design

This was a single-centered, prospective observational study conducted between November 2024 and May 2025 in the cardiology department of a tertiary care hospital.

Study Population

A total of 60 patients aged 30–90 years with confirmed coronary artery disease (CAD) were enrolled. Data on BMI, blood glucose, and blood pressure were recorded.

Inclusion and Exclusion Criteria

Participants with hypertension, diabetes, or obesity were included. Patients below 30 years, pregnant women, and those with active malignancy were excluded.

Statistical Analysis

Data were analyzed using SPSS. Continuous variables were expressed as mean ± SD, and categorical variables as percentages. Associations were tested using Chi-square analysis. The ethical committee clearance was obtained from the Institutional Ethical Committee of tertiary care hospital before initiating the study.

Results and Discussion

Table 1: Dissemination of Patients Based on Sex

SEX	MALE	FEMALE
NO. OF PATIENTS (%)	43(71.6%)	17(28.3%)

Out of a sample of 60 patients, 43 (72%) were male and 17 (28%) were female. Therefore, this study indicates a higher proportion of male patients.

Table 2: Dissemination of Patients Based on the Age

AGE(Yrs)	25-34 yrs	35-44 yrs	45-54 yrs	55-64 yrs	≥65yrs
MALE	2	4	15	10	12
FEMALE	0	5	3	4	5

Interpretation: The study's findings indicate that the highest proportion of the sample (30%) falls within the 45-54 age range.

Table 3: Dissemination of Patients Based On the Association between Cardio-Metabolic Risk Factors

RISK FACTOR	AGE		Risk of presenting a metabolic disorder		
	<50	≥50	HTN	OBESITY	DM
Normal weight (<25kg/m²)	20	24	50		45
Overweight (25-30kg/m²)	05	07	04		05
Obese (>30kg/m²)	06	05	03		02
Class-III obese (>40kg/m²)	01	03	02		01
FBG	28	28	45	10	
BP	28	28		07	50

Graph 1:
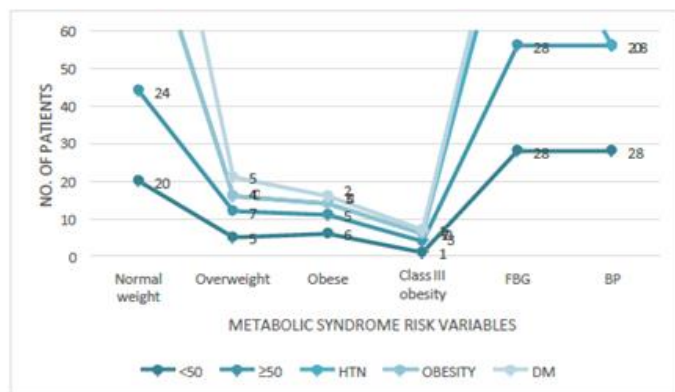
Interpretation: Substantial connections were found between each pair of risk factors. The average BMI was 26.8 kg/m², indicating that the population, on average, falls within the overweight category. In total, 12 participants (20.0%) were classified as overweight, and 11 individuals (18.3%) were obese. Morbid obesity (Grade III, BMI ≥ 40 kg/m²) was observed in 6.6% of the sample. The prevalence of hypertension increased with DM (83.3%). The frequency of hypertension increased with obesity (11.6%). The commonness of DM increased with HTN (75%). The rate of DM increased with obesity (16.6%). The Prevalence of obesity increased with both HTN and DM (16.6%).

Table 4: - Dissemination of Patients Based on the EF

S.NO	EF(%)	HTN	OBESITY	DM
1.	NORMAL (55-70)	16	20	8
2.	FAIR (51-54%)	2	2	1
3.	MILD (45-50%)	11	7	2
4.	MODERATE (30-44%)	16	15	5
5.	SEVERE (<30%)	5	5	3

The distribution of LVEF categories revealed that patients with moderate dysfunction (EF 30– 44%) had the highest frequency of hypertension (n=16), obesity (n=15), and diabetes mellitus (n=5). Notably, the number of subjects with comorbid conditions declined progressively in both higher (normal) and lower (severe) EF categories.

Table 5: Dissemination of Patients Based on Drugs Prescribed Among Study Participants

S.NO	DRUG THERAPY	NO. OF PATIENTS	PERCNTAGE
1.	ANTIPLATELETS	55	92%
2.	ANTICOAGULANT	38	63%
3.	CCB	20	33%
4.	PPI	60	100%
5.	BETA-BLOCKERS	54	90%
6.	DIURETICS	45	75%
7.	OHA	17	28%
8.	INSULINS	30	50%
9.	VASODILATORS	34	57%
10.	NITRATES	19	32%
11.	STATINS	44	73%

The results demonstrate that all patients (100%) received Proton Pump Inhibitors (PPI), while the majority received antiplatelets (92%) and beta-blockers (90%). The least common therapies were Oral Hypoglycemic Agents (OHA) at 28% and nitrates at 32%.

This study assessed the prevalence of cardiometabolic syndrome (MetS) among patients with coronary artery disease (CAD) with a mean age of 50 years. MetS was strongly associated with obesity, diabetes, hypertension, smoking, and alcohol use. Similar findings by Franco et al. and Moreira et al. linked MetS to high BMI, insulin resistance, low education, and sedentary lifestyle, with prevalence increasing with age. Kokubo et al. also identified impaired fasting glucose and high-normal blood pressure as independent cardiovascular risk factors. Sedentary behavior, obesity, and low education were key predictors of MetS. Logistic regression highlighted hypertension, central obesity, and diabetes as the most common components, particularly among males. Lifestyle-based preventive measures, early screening, and community education are essential to mitigate MetS risk. Studies by Gomes et al. and Maggi et al. confirmed stronger cardiovascular risk associations with lipid

abnormalities than glycemic control, and a fivefold higher risk of diabetes in MetS patients, respectively. Among 60 participants, 72% were male, with the highest prevalence in the 45–54 age group. The mean BMI was 26.8 kg/m², indicating an overweight population. Hypertension was most frequent in diabetics (83.3%) and increased with obesity. Patients with moderate LV dysfunction (EF 30–44%) had the highest burden of MetS components. Pharmacologic management included universal PPI use, antiplatelets (92%), and beta-blockers (90%). The findings underscore the interlinked nature of cardiometabolic risk factors and the importance of early, comprehensive management to prevent cardiovascular complications. Hypertension was found to be the most prevalent risk factor (83.3%) among study participants, followed by diabetes (75%) and obesity (16.6%). The interrelationship between these risk factors indicates that individuals with hypertension frequently exhibit metabolic disturbances such as insulin resistance. The study highlights the growing burden of CMD in India and the necessity of early identification and intervention.

Conclusion

This study highlights the rising burden of key cardiometabolic risk factors—hypertension, diabetes, and obesity—reflecting lifestyle and dietary transitions contributing to increased metabolic disease incidence. Impaired glucose metabolism and dyslipidemia emerged as major determinants of cardiovascular risk, with strong interrelationships underscoring the complexity of metabolic syndrome and its management challenges. These findings emphasize the need for targeted, evidence-based interventions focusing on lifestyle modification, early risk identification, and prevention to curb cardiovascular disease progression in this population.

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