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STUDY OF THE CONNECTIONS BETWEEN HYPERINSULINEMIA AND GLUCOSE INTOLERANCE IN EARLY-ONSET CORONARY ARTERY DISEASE

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ABSTRACT:

Background: Indians experience their first myocardial infarction 5 to 10 times sooner than other populations, and they experience coronary artery disease (CAD) 5 to 10 years earlier than other populations. IGT, also known as type 2 diabetes, has several risk factors in common with coronary artery disease (CAD), and an increase in the prevalence of diabetes also suggests a rising risk of CAD.
Aims & objectives: The current study looked at the relationships between early-onset coronary artery disease, glucose intolerance, and hyperinsulinemia in tertiary care hospital patients.
Material and Methods: The current study involved subjects with coronary artery disease who were either male or female and under the age of 45. Serum insulin levels and glucose intolerance (GI) were assessed.
Results: 42 patients in all who met the study requirements were included in the current study. The average age was 42.07 5.39. Males (73,81%) outnumbered females (26,19%). The average BMI was 23.26 3.33 kg/m2. The prevalence of impaired fasting glucose (IFG), impaired glucose tolerance (IGT), diabetes mellitus (DM), and hyperinsulinemia (>25 IU/ml) were 9.52%, 7.14%, 7.14%, and 9.52%, respectively, in the current study. There were 14.29% cases of glucose intolerance overall (12 patients). Major risk factors identified in the current study included hypertension (26.19%), BMI (> 25 kg/m2) (26.19%), smoking (21.43%), dyslipidemia (19.05%), family history of CAD (16.67%), and family history of diabetes (14.29%). We found a statistically significant difference between patients with normoglycemia and those with glucose intolerance in their fasting plasma glucose (mg/dl), 2-hour plasma glucose (mg/dl), fasting serum insulin (uIU/ml), and HbA1C values.
Conclusion: Early diagnosis through testing for glucose intolerance is strongly advised in high risk individuals because it is linked to early-onset coronary artery disease and hyperinsulinemia.
Keywords: early-onset coronary artery disease, glucose intolerance, hyperinsulinemia, impaired glucose tolerance

Introduction:

Cardiovascular disease (CVD) is a widespread public health issue that is becoming epidemic in both industrialized and developing nations[1]. Indians experience their first myocardial infarction 5 to 10 times sooner than other populations, and they experience coronary artery disease (CAD) 5 to 10 years faster than other populations[2-5]. Age, hypertension, dyslipidemia, obesity, physical inactivity, and stress are some of the risk factors for type 2 diabetes and impaired glucose tolerance (IGT), and a growth in the incidence of diabetes implicitly implies an expanding risk of CAD as well[6]. While asymptomatic cardiometabolic risk indicators like dyslipidemia, hypertension, and central adiposity are linked to subclinical hyperinsulinemia, including obesity, type 2 diabetes, cardiovascular disease, and these conditions[7]. High levels of PAI-1, a plasminogen activator inhibitor, have been linked to hypertriglyceridemia and

hyperinsulinemia in Indians. By preventing fibrinolysis, this combination encourages thrombosis[8]. Additionally, increased glucose causes oxidative stress, protein kinase C activation, and nonenzymatic protein glycosylation. Myocardial fibrosis and collagen deposition have been linked to hyperinsulinemia. Due to the potential for greater psychological and socioeconomic repercussions, the potential consequences of early-onset coronary artery disease may have a significant effect on future health and wellbeing[9]. To create efficient prevention strategies, identifying the key risk factors for early-onset coronary artery disease is essential. The current study looked at the relationships between early-onset coronary artery disease, glucose intolerance, and hyperinsulinemia in tertiary care hospital patients[10].

MATERIAL AND METHODS

The current study was a prospective, observational study carried out on patients with early-onset coronary artery disease who were admitted to the pathology department of a tertiary care facility. The study lasted a year (from October 2021 to September 2022). The current study received approval from the institutional ethical committee.

Inclusion criteria

Male or female volunteers under the age of 45 who met any two of the following three criteria were included in the study.

1. Common symptoms (Chest discomfort).
2. A typical ECG pattern (fresh left bundle branch block or ST segment elevation of 0.1mv in at least two consecutive leads).
3. Increased levels of enzyme (Serum CPKMB two times the upper limit of normal level).

Exclusion criteria

1. A history of taking insulin or any other oral diabetes treatments.
2. Comorbid conditions such as primary hyperparathyroidism, chronic liver disease, kidney disease, any ailment that lasts a long time, and cancer
3. Participants with both stable and unstable angin
4. Subjects who declined to take part

After a formal consent was obtained, the study was discussed. Clinical examination findings, routine investigations (CBC, RFTs, LFTs, blood sugar profile, lipid profile, and serum CPKMB, chest x-ray) findings, and baseline clinical history, complications, risk factors for coronary artery disease, prior illnesses were documented. LVEF and consequences of MI were studied using 2-D echo and Doppler in a select few instances. A condition known as glucose intolerance (GI) is a dysglycemia that includes both prediabetes and diabetes. It comprises diabetes mellitus, impaired glucose tolerance, and impaired fasting glucose (IFG) disorders (DM). Following stabilization (between the fifth and seventh day of admission), all cases were monitored, and a commercially available glucose and insulin IRMA kit was used to measure blood sugar, HbA1c, and serum insulin levels. Following an 8-hour overnight fast, a fasting blood sample is taken. IFG is diagnosed by FPG levels between 100 and 125 mg/dL (5.6 to 6.9 mmol/L). Measurements of fasting serum insulin levels revealed hyperinsulinemia (>25 IU/ml), which was observed. Plasma glucose is assessed in the Two-Hour Oral Glucose Tolerance Test (GTT) two hours after 75 gm of glucose has been consumed. When the plasma glucose (PG) level in the 2-hour sample ranges from 140 to 199 mg/dL (7.8 to 11.0 mmol/L), IGT is considered to be present. If the PG is greater than or equivalent to 200 mg/dl, DM is identified. Data was gathered and entered into an Excel spreadsheet. The SPSS 21 statistical analysis program was used. The percentages and mean/SD of the data were presented. Unpaired t-tests were used to compare continuous clinical characteristics between the two groups, and Chi square statistics were used to compare categorical characteristics between the two groups. P0.05 was considered statistically significant.

RESULTS

84 patients in all who met the study requirements were included in the current study. The average age was 42.07± 5.39. Males (73.81%) outnumbered females (26.19%). The average BMI was 23.26± 3.33 kg/m2. The prevalence of impaired fasting glucose (IFG), impaired

glucose tolerance (IGT), diabetes mellitus (DM), and hyperinsulinemia (>25 IU/ml) were 9.52%, 7.14%, 7.14%, and 9.52%, respectively, in the current study. There were 14.29% cases of glucose intolerance overall (12 patients). Major risk variables identified in the current study included hypertension (26.19%), BMI (> 25 kg/m2) (26.19%), smoking (21.43%), dyslipidemia (19.05%), family history of CAD (16.67%), and family history of diabetes (14.29%).

Table 1: General characteristics

Variables	No. of patients / Mean ± SD (N = 84)	Percentage (%)
Age (years)	42.07 ± 5.39	
Gender		
MALE	62	73.81
FEMALE	22	26.19
Body mass index (kg/m2)	23.26 ± 3.33	
Waist circumference (cm)	83.78 ± 4.49	
Impaired fasting glucose (IFG)	8	9.52
Impaired glucose tolerance (IGT)	6	7.14
Diabetes mellitus (DM)	6	7.14
Hyperinsulinemia (>25 µIU/ml)	12	9.52
Risk factors		
Hypertension	22	26.19
BMI (> 25 kg/m^2)	22	26.19
Smoking	18	21.43
Dyslipidemia	16	19.05
Family history of CAD	14	16.67
Family history of diabetes	12	14.29

We found a statistically significant difference between individuals with normoglycemia and those with glucose intolerance in their fasting plasma glucose (mg/dl), 2-hour plasma glucose (mg/dl), fasting serum insulin (uIU/ml), and HbA1C values.

Table 2: Comparison of Glycaemic parameters

Variable	Glucose intolerance (n = 12)	Normoglycemic (n = 72)	p-value	Significance
Fasting Plasma Glucose (mg/dl)	100.12 ± 9.09	84.14 ± 7.22	<0.001	Significant
2-hour Plasma Glucose (mg/dl)	153.44 ± 13.28	124.19 ± 11.23	<0.001	Significant
Fasting serum Insulin (uIU/ml)	18.13 ± 12.07	10.41 ± 8.15	<0.001	Significant
HbA1C	8.33 ± 2.22	5.40 ± 0.40	<0.001	Significant

DISCUSSION

Prediabetes, which is defined as Impaired Fasting Glucose (IFG) and Impaired Glucose Tolerance (IGT) [2 hr plasma glucose 140 and 199 mg/dl] after ingesting 75 g of glucose (OGTT); or a combination of both, is an intermediate stage between normal blood sugar levels and the clinical entity of type 2 diabetes (T2D) [11]. Even in patients without diabetes, acute MI can result in hyperglycemia, which can be brought on by an increase in catecholamines, a decrease in insulin release, the emergence of

insulin resistance, as well as an increase in cortisol and growth hormone[12]. Asymptomatic hyperglycemia is a risk factor for cardiovascular disease (CVD), and hyperglycemia can develop during an acute MI. The negative effects of hyperglycemia may be due to both the effects of glucose and hyperinsulinemia[13]. Increases in reactive oxygen species and the production of advanced glycation products are two outcomes of diabetes. Vascular smooth muscle cells have been linked to mitogenic effects of hyperinsulinemia. India is rapidly urbanizing and industrializing, and as a result, sedentary lifestyle changes are a common result[14]. According to the India State-Level Disease Burden Initiative, high systolic blood pressure, high total cholesterol, and high fasting plasma glucose were more common across all state groups since 1990, despite the fact that the prevalence of cardiovascular disease risk factors varied significantly among India's states[15]. Smoking appears to be the most frequent risk factor for juvenile CAD in India. Smoking increases a young person's chance of future acute coronary events when combined with other risk factors like diabetes, hypertension, and obesity[16]. Similar results were seen in the current investigation. In a prospective trial, participants with fasting immune reactive insulin levels above 20 IU/ml had a five- to six-fold increased risk of developing coronary artery disease (CAD). They discovered that increased insulin levels were consistently linked to CAD as measured by angiograms in a different cross-sectional investigation[17]. Srinivasan M investigated the associations between cardiovascular risk variables and significant adverse cardiac events in patients who underwent coronary angiograms for the assessment of CAD (MACE). After adjusting for potential confounders, a substantial association between hyperinsulinemia (>20 IU/ml) and MACE was still present. In type 2 diabetes mellitus, basal hyperinsulinemia above 20 IU/ml strongly predicts adverse cardiac events at 1 year[18]. High coronary risk among south Asians was linked to hyperinsulinemia, insulin resistance, and the increased frequency of metabolic syndrome in persons with type 2 diabetes. Even after controlling for hypertension, dyslipidemia, and obesity, several long-term studies have demonstrated that high fasting insulin levels are directly related to carotid intima thickness and arterial wall stiffness and that hyperinsulinemia is linked to new cardiac events in the general population[19]. When insulin levels are elevated over the normal range, it's known as hyperinsulinemia or impaired glucose tolerance. However, there does not seem to be a risk of serious vascular problems until the insulin levels reach their maximal amounts[20].

CONCLUSION

Early detection through testing for glucose intolerance is particularly advised in high risk individuals because it is linked to early-onset coronary artery disease and hyperinsulinemia. The incidence of CVD can be reduced by addressing a number of behavioral risk factors, such as tobacco use, unhealthy eating habits, obesity, physical inactivity, and harmful alcohol use, in addition to disturbances in glucose metabolism.

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