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DETERMINATION OF MYOCARDIAL INFARCTION RATES IN DIABETIC AND NON-DIABETIC MELLITUS PATIENTS

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Abstract

Background: *Diabetes Mellitus (DM) is a chronic metabolic disorder with a well-established association with cardiovascular diseases, particularly Myocardial Infarction (MI). The interplay between poor glycemic control, dyslipidemia, and cardiovascular risk amplifies the need to assess and compare Myocardial Infarction incidence in diabetic and non-diabetic populations.*

Objective: *This study aimed to determine the frequency of myocardial infarction among diabetic and non-diabetic patients and to evaluate the association of lipid profile parameters between Myocardial Infarction and Diabetes Mellitus.*

Methods: *A cross-sectional study was conducted on 264 patients in District Peshawar, comprising 168 diabetic and 96 non-diabetic individuals. Data were collected through Laboratory Analysis of patient's HbA1c, lipid profiles (total cholesterol, triglycerides, HDL, LDL), and cardiac markers (Troponin I, CK-MB). Statistical analysis was performed using SPSS version 24. Chi-square and independent t-tests were applied, with $p < 0.05$ considered statistically significant.*

Results: *The incidence of Myocardial Infarction was significantly higher in diabetic patients (66.1%) compared to non-diabetics (44.8%) ($p = 0.001$). Diabetic individuals exhibited significantly higher levels of triglycerides, total cholesterol, and LDL, alongside lower HDL levels. Atherogenic lipid patterns were strongly associated with the presence of Myocardial Infarction. Patients with MI had higher mean values of triglycerides, cholesterol, and LDL compared to non-MI individuals, while HDL levels were slightly lower but not statistically significant.*

Conclusion: *This study found that persons with diabetes mellitus have a considerably greater chance of myocardial infarction than people without the disease. The findings are consistent with national and international literature, reinforcing the status of diabetes as a major independent risk factor for cardiovascular disease. Diabetic patients not only presented more frequently with MI, but also exhibited more adverse biochemical profiles, including elevated LDL, triglycerides, and HbA1c levels, indicating poorer glycemic and lipid control.*

INTRODUCTION

Diabetes mellitus is a common yet potentially fatal medical disorder that has grown more widespread in recent decades, making it an important health issue of the twenty-first century [1]. The number of people

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with diabetes mellitus is expected to rise by up to 439 million by 2030 as a result of ageing and the westernization of lifestyles [2]. Patients with type 2 diabetes mellitus are at high risk for complications of the heart, including sudden cardiac death (SCD) and acute myocardial infarction (AMI). The UKPDS Hazard Score is a type 2 diabetes mellitus-specific risk score based on the United Kingdom Prospective Diabetes Study (UKPDS) for ischemic heart disease. However, reasons and prognostic differences between acute coronary syndromes and fatal ventricular rhythm disturbances were not taken into consideration by these risk ratings, which typically show lipid and HbA1c profiles and predict composite outcomes of primary cardiovascular adverse outcomes or cardiovascular mortality [3].

Myocardial infarction, a kind of acute coronary syndrome, is characterized as a pathological event that takes place in the setting of myocardial ischemia and causes significant heart damage and insult. Increasing perfusion in as little time as possible is the goal of early rehabilitation for acute myocardial infarction in order to preserve as much of the damaged myocardium as possible. Myocardial infarction is the primary component of cardiovascular disease (CVD), which is the most common cause of death worldwide. It is anticipated that 2,36,000,000 people will die from CVD by 2030. More than 75 per cent of deaths from CVD occurred in countries with lower incomes. The most significant number of CVDs occurs in South Asian nations, particularly Bangladesh, Sri Lanka, Nepal, India, and Pakistan. In South Asian countries, on the other hand, the highest prevalence of myocardial infarction is found in individuals under 45 as opposed to those over 60. Men were three times more likely than women to suffer a myocardial infarction. According to the Global Burden of Disease Survey, India has a higher age-standardized CVD mortality rate than the world average of 235 per 100,000, at 272 per 100,000 [4].

The fact that diabetes can result in cardiovascular disease (CVD) is one of its most concerning features. Numerous studies have demonstrated that persons with diabetes have a two to four time's greater risk of contracting cardiovascular disease (CVD) than people without the illness. Add to this higher danger by promoting the growth and development of atherosclerosis, the underlying cause of a great deal of cardiovascular events. Diabetes additionally raises the likelihood of cardiovascular disease by increasing endothelial dysfunction, oxidative stress, and aberrant platelet activity. Additionally, having both diabetes and CVD often exacerbates the condition, increasing the likelihood that the same problem will recur and driving up healthcare expenses [3].

Glycemic management, which tries to maintain blood glucose levels within a specific range, is one of the most important aspects of managing diabetes. Strict blood sugar management has been documented to reduce the risk of microvascular problems, including retinopathy and nephropathy. The management of people with diabetes at cardiovascular risk has changed in recent years, with more emphasis on multifactorial approaches to intervention. Numerous significant studies have discovered that aggressive risk factor treatment can lower the number of cardiovascular events in people with diabetes [5].

Cardiovascular disease (CVD) dramatically increases morbidity and death in people with diabetes mellitus. It has been established that diabetes is an important cause of risk for coronary artery disease (CAD), a condition in which the accumulation of atherosclerotic plaques narrows and blocks the coronary arteries. CAD has been identified as a significant contributor to the number of diabetes-related fatalities that have occurred worldwide in recent years, according to data collected by the Global Burden of Disease Study. Both ischemic and hemorrhagic strokes are considerably more likely to occur among individuals with diabetes. The inter-stroke study's statistics show a substantial correlation between diabetes and an increased risk of stroke. Inadequate diabetes control may exacerbate other stroke risk factors, such as hypertension and dyslipidemia [6].

Methodology

This study employed a cross-sectional research design and was conducted in District Peshawar. The study population included diabetic and non-diabetic individuals, as well as those with and without a history of myocardial infarction. Inclusion criteria encompassed all diabetic, non-diabetic, myocardial infarcted, and non-myocardial infarcted patients,

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while individuals with other diseases were excluded. A total sample size of 264 participants was determined using Epi Info™ software version 7, developed by the Centers for Disease Control and Prevention (CDC). Ethical approval for the study was obtained from the City University of Science and Information Technology. A convenient sampling technique was used to recruit participants. For sample collection, 3 ml of venous blood was drawn from each participant into both an EDTA tube and a gel tube. Samples were transported under controlled conditions at 2–8°C to the laboratory for analysis. Laboratory investigations included Glycated hemoglobin (HbA1c), lipid profile parameters (total cholesterol, triglycerides, high-density lipoprotein [HDL], and low-density lipoprotein [LDL]), and cardiac markers (Troponin I and CK-MB). Statistical analysis was performed using IBM SPSS Statistics version 24. Descriptive statistics such as means, standard deviations, and p-values were calculated to describe the baseline characteristics. The Chi-square (χ^2) test was applied to assess associations between categorical variables, while independent samples t-tests were conducted to compare the mean values of lipid profile parameters across groups (e.g., diabetic vs. non-diabetic and myocardial infarction vs. non-myocardial infarction). Cross-tabulation analyses were also performed to evaluate the distribution and frequency of myocardial infarction across different HbA1c categories and diabetic statuses. A p-value of less than 0.05 was considered statistically significant for all inferential tests.

Results

A total of 264 patients were included in the study, comprising 168 diabetic and 96 non-diabetic individuals. Among the diabetic patients, 111 (66.1%) had a history of myocardial infarction (MI), while 57 (33.9%) did not. In comparison, 43 (44.8%) of the non-diabetic patients experienced MI, and 53 (55.2%) had no history of MI, as shown in the table below.

Table 1: Cross tabulation of Diabetic Status and Myocardial Infarction (MI) Status

Diabetic Status	MI: No	MI: Yes	Total	% with MI	% without MI
Diabetic	57	111	168	66.1%	33.9%
Non-Diabetic	53	43	96	44.8%	55.2%
Total	110	154	264	—	—

Table 2: Chi-Square Test for Association between Diabetic Status and Myocardial Infarction. The relationship between HbA1c category (Diabetic vs. Non-Diabetic) and Myocardial Infarction (MI) status (Yes vs. No) used a chi-square test of independence to examine. The two variables demonstrated a statistically significant connection, as shown by χ^2 (1, N = 264) = 11.382, p =.001. According to these findings, people with diabetes, or high HbA1c levels, had a far higher risk of myocardial infarction than people without the disease.

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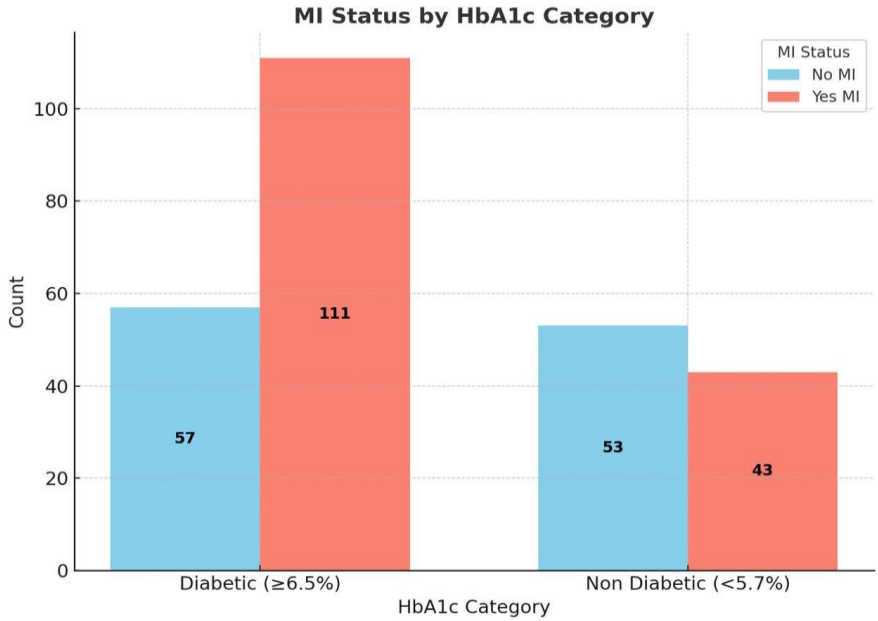
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.382[a]	1	.001

Graphical Representation for Association between Diabetic Status and Myocardial Infarction



The Figure 1: presents a comparative analysis of myocardial infarction (MI) status in relation to HbA1c categories, distinguishing between diabetic (HbA1c ≥ 6.5%) and non-diabetic (HbA1c < 5.7%) individuals. The chart is divided into two sections based on MI status: "No" (absence of MI) and "Yes" (presence of MI). Among individuals without MI, 57 were categorized as diabetic and 53 as non-diabetic, indicating a relatively even distribution. In contrast, among those with MI, a substantially higher number of individuals (111) were diabetic compared to 43 non-diabetic cases. This pattern demonstrates a higher prevalence of MI among diabetic individuals. The data suggest a potential association between elevated

HbA1c levels and increased risk of myocardial infarction, underscoring the clinical
importance of effective glycemic control in reducing cardiovascular events among diabetic patients.

Table 3: Comparison of Lipid Profile values between Diabetic and Non-Diabetic. The outcomes showed that the lipid profiles of patients with diabetes and those without the disease differed significantly. Triglycerides (230.57 ± 72.32 mg/dL), total cholesterol (225.33 ± 34.18 mg/dL), and low-density lipoprotein (LDL) (137.36 ± 23.52 mg/dL) were significantly greater in diabetics than in non-diabetic patients (139.84 ± 11.89 mg/dL, 180.77 ± 11.87 mg/dL, and 103.10 ± 8.36 mg/dL, respectively). On the other hand, patients with diabetes had significantly lower levels of high-density lipoprotein (HDL) (43.50 ± 7.12 mg/dL) than individuals without diabetes (52.31 ± 4.43 mg/dL). Every alteration remained statistically significant ($p < 0.001$), indicating that diabetes patients had a higher atherogenic lipid profile, which could be an element in their increased likelihood of cardiovascular disease.

Group Statistics	

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	DIABETIC STATUS	N	Mean	Std. Deviation	Std. Error Mean	P Value
Triglycerides (mg/dL)	DIABETIC	168	230.57	72.323	5.580	$p < 0.001$
	NON-DIABETIC	96	139.84	11.887	1.213	
HDL (mg/dL)	DIABETIC	168	43.50	7.117	.549	$p < 0.001$
	NON-DIABETIC	96	52.31	4.426	.452	
Cholesterol (mg/dL)	DIABETIC	168	225.33	34.183	2.637	$p < 0.001$
	NON-DIABETIC	96	180.77	11.871	1.212	
LDL (mg/dL)	DIABETIC	168	137.36	23.516	1.814	$p < 0.001$
	NON-DIABETIC	96	103.10	8.363	.854	

Graphical Representation of the Association

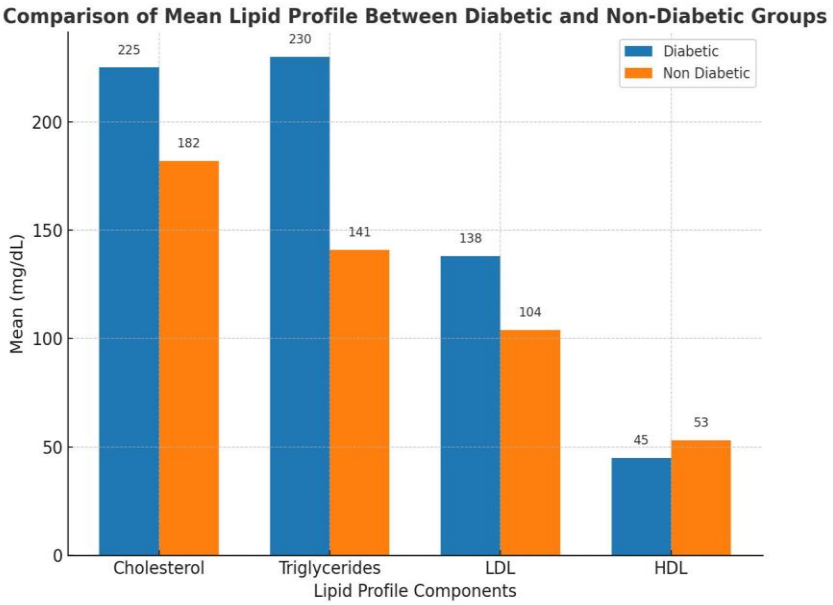

Figure 2: The bar chart illustrates a comparative analysis of the mean lipid profile parameters between diabetic and non-diabetic individuals. The parameters assessed include total cholesterol, triglycerides, low-density lipoprotein (LDL), and high-density lipoprotein (HDL). Diabetic individuals demonstrated higher mean levels of cholesterol (225 mg/dL), triglycerides (230 mg/dL), and LDL (138 mg/dL) compared to non-diabetic individuals, whose corresponding values were 182 mg/dL, 141 mg/dL, and 104 mg/dL, respectively. In contrast, HDL levels were lower in the diabetic group (45 mg/dL) than in the non-diabetic group (53 mg/dL). This pattern suggests a more atherogenic lipid profile among diabetic patients, characterized by elevated levels of lipids associated with cardiovascular risk and decreased levels of protective HDL. The findings emphasize the importance of regular lipid profile monitoring and effective lipid management strategies in diabetic populations to reduce the risk of cardiovascular complications.

Table 4: Comparison of Lipid Profile Values between Myocardial Infarction and Non-Myocardial Infarction Patients. Significant variations in the mean values of all measured parameters were found

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when lipid profiles from people with and without myocardial infarction (MI) were compared. A correlation between elevated triglycerides and myocardial infarction has been suggested by the higher mean triglyceride levels of patients with MI (n = 154) (205.05 ± 73.28 mg/dL) compared to those without MI (187.12 ± 70.88 mg/dL). The association between hypercholesterolemia and cardiovascular risk was further reinforced by the fact that total cholesterol was higher in the MI group (214.37 ± 36.16 mg/dL) than in the non-MI group (201.79 ± 33.12 mg/dL). Similar trends were seen for LDL cholesterol, where MI patients had a higher mean value (128.08 ± 26.65 mg/dL) than non-MI people (120.46 ± 23.13 mg/dL), indicating that MI cases had a more atherogenic lipid profile. HDL cholesterol, on the other hand, which is thought to be protective, was marginally lower in the MI group (46.16 ± 7.64 mg/dL) than in the non-MI group (47.47 ± 7.43 mg/dL). Despite the few modifications, the overall trend indicates that individuals with MI typically have more adverse lipid profiles, which include reduced HDL and higher triglycerides, cholesterol, and LDL. These lipid profiles could play a role in the onset and advancement of coronary artery disease.

Group Statistics					
	MI STATUS	N	Mean	Std. Deviation	Std. Error Mean
Triglycerides (mg/dL)	MI YES	154	205.05	73.281	5.905
	MI NO	110	187.12	70.875	6.758
Cholesterol (mg/dL)	MI YES	154	214.37	36.164	2.914
	MI NO	110	201.79	33.124	3.158
LDL (mg/dL)	MI YES	154	128.08	26.651	2.148
	MI NO	110	120.46	23.129	2.205
HDL (mg/dL)	MI YES	154	46.16	7.644	.616
	MI NO	110	47.47	7.428	.708

Table 5: Comparison of Lipid Profile Values between Myocardial Infarction and Non-Myocardial Infarction Patients Triglyceride levels were significantly greater in MI patients (M = 205.05, SD = 73.28) than in non-MI patients (M = 187.12, SD = 70.88), based to an independent samples t-test (t(239.52) = 1.998, p = 0.047). Similarly, MI patients had noticeably higher LDL values and cholesterol (p = 0.014 and p = 0.004, respectively). The HDL principles of MI and non-MI patients did not, however, differ statistically significantly (p = 0.162).

Parameter	Mean Difference	p-value	Significant?	Interpretation
Triglycerides	+17.93 mg/dL	**0.047**	Yes	Higher in MI patients
Cholesterol	+12.58 mg/dL	**0.004**	Yes	Higher in MI patients

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Parameter	Mean Difference	p-value	Significant?	Interpretation
LDL	+7.61 mg/dL	0.014	Yes	Higher in MI patients
HDL	–1.32 mg/dL	0.162	No	No significant difference

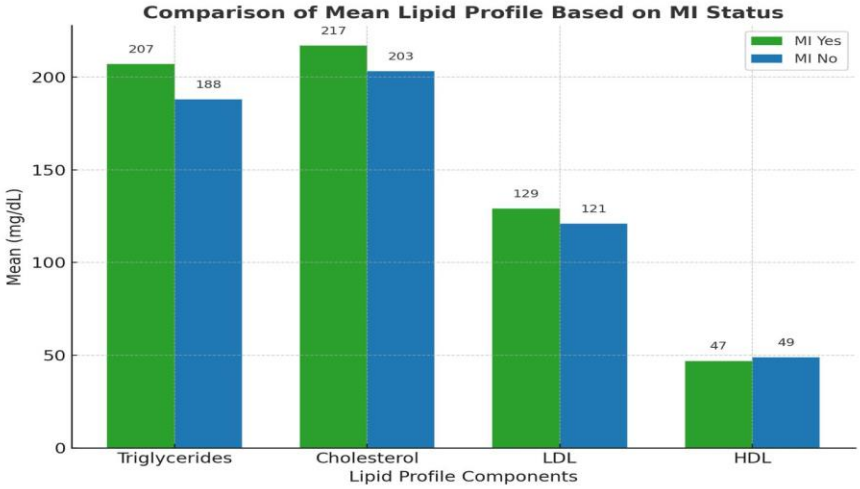

Figure 3: The bar chart displays a comparative analysis of mean lipid profile components between individuals with and without a history of myocardial infarction (MI). The lipid parameters examined include triglycerides, total cholesterol, low-density lipoprotein (LDL), and high-density lipoprotein (HDL). Individuals with MI exhibited higher mean levels of triglycerides (207 mg/dL), cholesterol (217 mg/dL), and LDL (129 mg/dL) compared to those without MI, whose corresponding values were 188 mg/dL, 203 mg/dL, and 121 mg/dL, respectively. Conversely, the mean HDL level was slightly lower in the MI group (47 mg/dL) than in the non-MI group (49 mg/dL). This lipid profile pattern suggests a more atherogenic profile among individuals who experienced

myocardial infarction, characterized by elevated concentrations of lipids associated with cardiovascular risk and a modest reduction in protective HDL levels. These findings underscore the clinical importance of lipid monitoring and management in the prevention and control of coronary events.

Discussion

The current investigation focused on the rates of myocardial infarction (MI) in individuals with and without diabetes mellitus. The findings demonstrated that diabetics had a much higher incidence of MI than non-diabetics. This trend is in line with additional studies that found a stronger link between diabetes and heart disease. In their observational study examining data from Spanish hospitals from 2016 to 2022 [7]. found that diabetes patients admitted with MI had worse in-hospital outcomes and required more therapeutic procedures than their non-diabetic peers. Similarly [8]. discovered that diabetic individuals continue to show worse survival rates following their first MI despite improvements in acute cardiac treatment over time, highlighting the persistent burden of heart disease related to diabetes. Several factors contribute to the pathophysiological association between diabetes and MI. Patients with diabetes who have chronic

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hyperglycemia are more inclined to develop endothelial dysfunction, inflammation, and accelerated atherosclerosis, all of which raise their risk of heart attack or stroke [9]. provided proof for this by confirming through the Look AHEAD trial that metabolic dyslipidemia—which is defined by elevated triglycerides, low HDL, and tiny dense LDL particles—is substantially linked to worse cardiovascular outcomes among people with type 2 diabetes.

The idea that diabetic patients are more likely to have atherogenic risk profiles, which significantly raises the likelihood of plaque formation and rupture, was further supported by [10] substantial association between elevated blood glucose levels and deregulated lipid ratios and in addition to having a greater incidence of MI, diabetes individuals in the current study also had more severe lipid abnormalities and higher levels of cardiac markers such troponin I, triglycerides, and LDL. The findings agree with the findings of [11] who noted that diabetic MI patients frequently have less ejection fraction and multi-vessel coronary artery disease. In patients with acute MI [12] also found a significant association between diabetes and lipid abnormalities, indicating that the combination of dyslipidemia and hyperglycemia could end up in more widespread coronary artery involvement. Additionally, there is ample evidence of atypical clinical presentations in diabetic MI patients.

According to research conducted by [13] and [14] diabetes individuals often exhibit less common symptoms, such as fatigue or dyspnea, instead of the characteristic chest pain, leading to delays in recognition and prompt treatment. Due to their full potential to increase mortality and infarct sizes, these delays are clinically relevant. Long-term glycemic management is a key factor influencing cardiovascular risk in diabetes individuals. In line with the findings of [15] who demonstrated that elevated HbA1c is an independent predictor of myocardial infarction in diabetes adults, nearly all diabetic patients with MI in their study had elevated HbA1c values. Continuous hyperglycemia increases the risk of atherothrombotic events by causing oxidative stress, ongoing vascular damage, and glycation of vascular proteins. As a result, HbA1c is a predictor of cardiovascular risk as well as a marker for glycemic management. Strict glycemic control must thus be the foundation of preventative measures in order to prevent long-term heart problems. The results of the current study similarly mirror trends seen in the Pakistani populations in the area. According to [16] a sizable fraction of Pakistani post-MI patients, particularly those with diabetes, failed to achieve optimal cholesterol control, indicating deficiencies in both post-event therapy and preventative measures. According to [17] and [18] diabetics, especially those in middle age, had greater rates of in-hospital complications as well as mortality after MI. Poor awareness, underutilization of preventative cardiovascular services, and restricted access to healthcare may all contribute to these results.

Additionally, in a study carried out at a hospital, [13] emphasized the rising incidence of MI in groups with long-term comorbidities like diabetes, calling on medical professionals to recognize diabetes as an important cardiovascular risk factor that requires that demands more aggressive management protocols.

Additionally, [16] prediction models provide useful clinical tools for determining which diabetic patients have the most significant risk for acute coronary events. In order to guarantee early intervention and a better prognosis, their work highlights the importance of integrating risk stratification methods into routine clinical assessments. These models, which are based on variables including lipid levels, comorbidity profiles, and HbA1c, may greatly help identify those at most significant risk who ought to get close monitoring and preventive treatment. Our results, which are backed by regional and worldwide data, highlight how diabetes mellitus significantly increases the risk of myocardial infarction. Inadequate cholesterol management, poor glycemic control, and delayed symptom detection all add to this increased risk in addition to the metabolic aspect of the illness. Our research adds to the rising need for integrated, multimodal cardiovascular risk management in diabetic populations, which is consistently supported by the literature. Reducing the incidence of MI in people with diabetes requires a focus on early screening, public health education, regular blood sugar and cholesterol level monitoring, and customized management strategies. Diabetes has become recognized as a cardiovascular risk illness,

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which calls for intensive prevention and management strategies to stop its increasing incidence rather than just a metabolic problem [19].

Conclusion

This study found that persons with diabetes mellitus have a considerably greater chance of myocardial infarction than people without the disease. The findings are consistent with national and international literature, reinforcing the status of diabetes as a major independent risk factor for cardiovascular disease. Diabetic patients not only presented more frequently with MI, but also exhibited more adverse biochemical profiles, including elevated LDL, triglycerides, and HbA1c levels, indicating poorer glycemic and lipid control. The data supports the hypothesis that chronic hyperglycemia, dyslipidemia, and associated metabolic disturbances contribute to the increased risk and poorer outcomes of myocardial infarction in diabetic patients.

Recommendations

This study recommends that future research should be expanded through multicenter, prospective studies to confirm these findings in diverse populations over time. To better understand the long-term association between diabetes mellitus and myocardial infarction, particularly the effect of glycemic variability and duration of diabetes, focus of future research should be on conducting extensive, long-term cohort studies. Future research might benefit from incorporating additional risk variables such obesity, renal failure, hypertension, and lifestyle choices in order to create a more thorough cardiovascular risk model.

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