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Assessment of Biochemical Cardiac Marker among Type 2 Diabetes Mellitus

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ABSTRACT
The aim of this study is to estimate the changes in biochemical cardiac markers with duration in type 2 diabetic patients. In this observational cross -sectional study, 60 patients with diabetes mellitus type 2 were recruited. The biochemical marker of each patient is compared after 8 month period. Blood samples were gathered and processed for the estimation of CK-MB, LDH, and HbA1c. Diabetic individuals had high levels CK-MB, LDH and HbA1c as compared with before 8 month same diabetic patients.. Study suggested that cardiac marker levels were significantly increased after 8 month in patients who's suffering from diabetes mellitus and these same patients gradually progress towards the hypertensive condition. Changes in cardiac function are common in diabetic patients, hence, there is need for periodical assessment of the cardiac function and biochemical markers in diabetic patients and it proves to be an early and simple tool to give warning signal for the patients to take early preventive measures.
Keywords: *CK-MB (Creatine Kinase), LDH(Lactate Dehydrogenase), CVD (cardiovascular diseases) , HbA1c (Glycated hemoglobin).*

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INTRODUCTION

DM is a chronic disease characterized by impaired glucose metabolism and neuropathic and vascular complications that develop late in life. There is a high risk of premature mortality and morbidity resulting from cardiovascular diseases (CVD) such as hypertension (HTN), stroke, and end-stage renal disease among people with type 2 diabetes mellitus (T2DM). In T2DM patients, hypertension is the most common CVD-related cause of morbidity and mortality [1-3]. The co morbidity between diabetes and hypertension is on the rise around the world [4]. Despite being the world's second most populous nation, India has made remarkable economic progress, but on the other hand, today it lags behind its peers in terms of healthcare. A fifth of the population in India is diabetic, making it the world's capital of Diabetics (DM). However, hypertension (HT) is closely linked to diabetes and even exceeds it in some areas [5].

There is a strong probability that hypertension will soon overtake diabetes in Asian Indians, who are genetically susceptible [6]. In terms of DM and HT as separate disorders, we can see that they reach large parts of the world's population. According to estimates, there will be a total of 366 million people with diabetes by 2030 and a total of 1.56 billion people with hypertension by 2025 [7]. It is not uncommon for patients with both disorders to exhibit insulin resistance. Up to 75% of adults with DM also have HT. HT and DM are therefore closely related and share common underlying risk factors (such as ethnicity, familial factors, dyslipidemia, and lifestyle factors) and complications [8]. A diagnosis of both HT and DM may be made at the time of the initial consultation [9].

Among different ethnic, racial, and socioeconomic groups, coexistent hypertension and diabetes are more prevalent. Hypertension causes significant increases in vascular complications in diabetic patients which may also lead to chronic kidney disease. Diabetes and hypertension are both associated with significantly increased risks of ischemic cerebrovascular disease, retinopathy, and sexual dysfunction. The presence of hypertension has a markedly increased risk of coronary artery disease in those with DM. Pregnant women with diabetes and hypertension have a greater risk of having preeclampsia. In addition, children with type 1 diabetes and hypertension risk of developing end-organ complications. In children with type 2 diabetes, cardiovascular risk factors early in life may lead to accelerated atherosclerosis as they grow [10]. A significant proportion of diabetic patients die from CVD, especially from hypertension and stroke

[11-12]. Furthermore, diabetes exacerbates diabetic cardiomyopathy, aggravates diabetic renal failure, and accelerates the progression of CVD [13].

The previous study showed that cardiovascular disease is responsible for 44% of all-cause fatalities in the diabetic patient population [14]. Patients with DM are more likely to suffer from high blood pressure, which is also responsible for the high costs. Non-DM patients are more likely to suffer from HTN. Hyperlipidemia, insulin resistance, and hyperglycemia all play a role in the higher prevalence of hypertension among diabetes patients Atherosclerosis is induced by the combination of inflammatory response, endothelial dysfunction, derangements of various cell types like platelets and promotion of coagulation. These factors disturb the blood vessel wall, leading to disruption of the blood vessel wall and atherosclerosis [15]. Hypertension results from the narrowing of blood vessels and an increase in peripheral arterial resistance. Due to insulin's role in sodium retention and sympathetic nervous system activation, hyperinsulinemia and insulin resistance are associated with elevated blood pressure [16].

In addition, insulin resistance is associated with the inappropriate activation of the Renin-Angiotensin-Aldosterone System (RAAS). Activating RAAS will activate multiple mechanisms that increase blood pressure. When RAAS is activated, angiotensin II is produced, which stimulates vasoconstriction and the production of aldosterone, a hormone that causes the kidney to retain salt and water, thus causing hypertension [17]. In addition, the presence of renal insufficiency secondary to diabetes may impair the excretion of water and solutes, perpetuating the volume expansion induced by these various factors. High salt diets are also linked to the development of high blood pressure (BP) along with T2DM. Because of the kidney's osmotic effect, consuming a high salt diet increases the concentration of sodium in the blood, which then reduces the kidney's ability to excrete water from the body. A high blood pressure is caused by an excess sodium in the blood causing excess water retention in the body. This in turn puts extra strain on the walls of the arteries. This increased blood pressure caused the muscle layer of the artery to thicken, reducing the space in the vessel and raising the blood pressure [18]. The study's goal was to determine the extent of heart damage in diabetes people. This study stresses that cardiac markers may be a significant predictor of diabetes-induced myocardial damage.

MATERIAL AND METHODS

This is an observational cross –sectional study that was conducted in Santosh Medical College from 2020 to 2021, with a study group of 60 patients in the age group 30-50 years, who were given a comprehensive history, physical examination, and laboratory tests. The WHO criteria are used to diagnose and classify diabetes as Type II .The subjects with diabetes mellitus having any acute and chronic disease, severely anaemic (<6.0gm% of Hb) and those suffering from any other systemic disorder were excluded from the study.The cases were studied with informed written consent. A detail clinical history including age, sex, occupation, socio-economic status, duration of disease and any associated risk factor contributing for the disease was elicited from the subjects. Apart from a thorough history and physical examination, all 60 patients had received extensive laboratory testing, including random blood sugar, fasting and postprandial blood sugar, HbA1c, CK-MB, and LDH. The local ethical committee of the Santosh Medical College in Ghaziabad gave its approval to this investigation. With all aseptic precautions blood sample (3ml) were drawn by venipuncture and collected in fluoride and EDTA(ethylenediamine tetraacetic acid) tubes to measure FBS(fasting blood sugar),HbA1C, CK-MB((creatine kinase),LDH(lactate dehydrogense). They all are measured in the MINDRAY BS-240 PRO autoanalyzer and all biochemical parameters will be measured using internationally recommended methods.

STATISTICAL ANALYSIS

The result are presented in mean±SD . The FBS, HbA1C , CK-MB, LDH levels were compared by using unpaired t-test. The pearson's correlation coefficient were calculated among the study parameters .All the analysis was carried out by using Statistical Package for Social Sciences (SPSS) version 22.

RESULTS

In table 1 , the levels of B.P,FBS ,HbA1C,CK-MB, LDH were observed that in starting and after 8 month in clinical factors systolic BP (P=0.005); FBS (P=0.001); HbA1C (P=0.001); CK-MB (P=0.001); and LDH (P=0.013) were statistically significant. FBS and HbA1C level was observed to be higher after 8 months 167.918 ± 46.964,9.287 ±10.50 as compared to baseline 154.136± 46.522 and 7.805 ± 1.681 respectively . The level of CK-MB was found higher in after 8 month cases 23.198± 3.280 respectively when compared with baseline .The level of LDH was found to be increased in after 8 month 212.857 ± 44.799 compared with before 8 month cases .

Table 1: Comparison starting and after 8 month of clinical factors

Variables	Baseline	After 8 month	P-value*
Duration of disease	4.45 ± 1.926	4.45 ± 1.926	> 0.005
Systolic BP	132.42 ± 9.929	139.25 ± 17.928	0.005
Diastolic BP	83.13 ± 5.209	84.67 ± 9.768	0.217
FBS	154.136 ± 46.522	167.918 ± 46.946	0.001
HbA1C (%)	7.805 ± 1.681	9.287 ± 10.508	0.001
CK-MB (U/L)	21.01 ± 3.411	23.198 ± 3.280	0.001
LDH (mg/dl)	197.915 ± 42.557	212.857 ± 44.799	0.013

*paired t test used for paired comparison

In the present study, biochemical cardiovascular markers such as CK-MB and LDH are demonstrated to be significantly correlated with patients with type 2 diabetes mellitus and the progression of hypertension. The same significant relationship was found by Thomas r et al . this study examined data from 57 articles with 4,549,481 patients with T2DM. The study found that overall CVD affects approximately 32.2% of sufferers of T2DM. In 4,549,481 patients with type 2 diabetes, 52.0% were male, 47.0% were obese, aged 63.6 ± 6.9 years, and with a T2DM duration of 10.4± 3.7 years. The most articles were produced in Europe (46%), followed by the Western Pacific/China (21%), and North America (13%). Overall, 32.2% of people had CVD (53 studies, N = 4,289,140); 29.1% of people had atherosclerosis (4 studies, N = 1153), 21.2% of people had coronary heart disease (42 articles, N = 3,833,200), 14.9% of people had heart failure (14 studies, N = 601,154), and 14.6% of people had angina (4 studies, N = 354,743). In 13 studies involving 3,518,833 patients, 10.0% had a myocardial infarction, and in 39 studies, 7.6% had a stroke. CVD accounted for 50.3% of fatalities among these T2DM patients. Microvascular complications affect millions of patients with Type II diabetes.

DISCUSSION

Our study shows the correlation between short duration, glycemic control, and hypertension. A microvascular complication can lead to vision, renal, and neurological impairments, and even death, as well as increase healthcare costs for the patient and society [19].Cardiovascular diseases (CVDs) are one of the leading causes of mortality in diabetes patients, and a number of factors, including hypertension, contribute to this high rate of CVDs. It is estimated that patients with diabetes are twice as likely to have hypertension as people without diabetes. On the other hand, recent data suggest that hypertensive people are more prone to developing diabetes than normotensive people. In addition, it is estimated that up to 75% of CVDs in diabetics may be due to hypertension, which should lead to more aggressive treatment options for diabetics with hypertension. The aim of this study was to assess the levels of LDH and CK-MB in diabetic patients and investigate the relationships between the levels of LDH and other variables, including age, gender, duration, and blood glucose levels. After 8 months, the mean level was 212.857 ± 44.799mg/dl, significantly higher than 197.915± 42.557 before. As a result, diabetes adversely affects the body by increasing LDH levels.The LDH level in diabetic patients has been reported to be 328.347 ± 8 U/L, a value in the range of 140-280 U/L by Asem Hussein et al [20]. Data from the present study showed that LDH levels were significantly correlated with duration. As other studies have suggested, this relationship is logical and accounts for the direct measure of diabetes (glucose) and the indirect effect of diabetes (LDH) [21]. There is a CK-MB that is diagnostic for myocardial injury, but it depends on the muscle mass, as well as on the activity of the chest muscles, which increase with exercise or in patients with respiratory difficulties. A clinical feature like this affects the specificity especially in patients with concurrent myocardial and skeletal muscle injuries [22]. A positive correlation was found between cardiac marker CK-MB and increase in duration in diabetic patients. According to the results, the mean level of 21.01 ± 3.411 U/L before 8 months was significantly higher than 23.198 3. ± 280 after 8 months. According to the findings of a previous study by Marti Frank et al, there was a significant correlation between the frequency of patients with diabetes mellitus having elevated CK levels, and the likelihood of that elevated CK being due to primary myopathy [23]. There is uncertainty regarding the role of cardiac biomarkers in the assessment and management of young people with Type 2 diabetes. These markers, particularly CK-MB, will need long-term follow-up to determine whether they can identify those at risk for future ventricular dysfunction, heart failure, or other complications associated with CVD. These cardiac biomarker concentrations were not negatively impacted by follow-up of the study, unlike conventional risk factors such as lipids and blood pressure. A high degree of variability exists in CK-MB, LDH measurements, which makes them challenging to interpret, especially if there are no symptoms or a diagnosis of CVD.

CONCLUSIONS

According to our findings, diabetic patients without previously diagnosed cardiovascular disease face an increased risk of the disease. Based on these data, diabetic patients should be treated as aggressively for cardiovascular risk factors as non-diabetics should be. Since these biochemical cardiac markers are early indicators of the disease, so it may be used as a diagnostic tool to assess the cardiac changes in diabetic patients. A panel of cardiac markers is useful for the specific diagnosis and follow-up of diabetic patients based on the nature of CK-MB and LDH as sensitive cardiac markers for the diagnosis of cardiovascular disease.

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