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Assessment of Cardiovascular Risk and Factors among Post COVID-19 Patients with Type 2 Diabetes Mellitus and Dyslipidaemia

Donna Shibu Kaniyadan[1], Fathima V. S[1], Hasna[1], Melvin Lowrance[1], Manohar R. Pillai[2], Tamilselvan, T[3*]

[1]Pharm.D Interns, Nehru College of Pharmacy, Pampady, Kerala, India
[2]Professor and Head, Department of General Medicine, PK DAS Institute of Medical Sciences, Vaniyamkulam, Kerala, India
[3]Professor and Head, Department of Pharmacy Practice, Nehru College of Pharmacy, Pampady, Kerala, India

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***Corresponding author:** Tamilselvan, T
Professor and Head, Department of Pharmacy Practice, Nehru College of Pharmacy, Pampady, Kerala, India

Abstract

Background: The current study aims to assess the impact of structured patient education on cardiovascular complications in post-covid patients with type-2 diabetes mellitus and dyslipidaemia. ***Objectives***: To assess the prevalence of cardiovascular risk among type-2 diabetes mellitus with dyslipidaemia in post-covid patients. to analyse the cardiovascular risk correlated with diabetes and lipid profile. to assess the impact of patient education on cardiovascular risk complications. ***Method***: A total of 300 patients were screened and of them, 205 were enrolled in the study based on the inclusion and exclusion criteria. Patient education was given to selected patients using structured patient leaflets and oral education after baseline. They are followed up after 2 months. Cardiovascular risk was assessed by ASCVD and Framingham risk assessment score. ***Results***: The study analysed that there was a high prevalence in males, the age group 51-70 years, non-alcoholic, and non-smokers. At the baseline, most patients were at high risk. On comparing the baseline with the review, a 49.3% difference was seen in the high-risk category. ***Conclusion***: The study revealed that age, gender, low density lipoprotein, total cholesterol, and random blood sugar were the important cardiovascular risk factors. The implementation of pharmacist care in collaboration with physicians and nurses may reduce cardiovascular risk complications and help in better medication management.

Keywords: Diabetes Mellitus, Dyslipidaemia, post COVID-19 patient, Cardiovascular risk.

INTRODUCTION

Diabetes is a firmly established autonomous risk factor for cardiovascular diseases (CVD) [1]. A frequently occurring metabolic irregularity linked with diabetes is dyslipidemia, which is distinguished by a range of quantitative and qualitative alterations in lipids and lipoproteins [2]. COVID-19 is a systemic, potentially severe, and life-threatening illness, initiated by the SARS-CoV-2 infection, which encompasses both immune and inflammatory reactions, endothelial cell dysfunction, complement activation, and a hypercoagulable condition. In 2022, it is projected that the global prevalence of diabetes will be 9.3%, affecting approximately 463 million individuals. The prevalence is notably higher in urban areas at 10.8% compared to rural areas at 7.2%, as well as in high-income countries at 10.4% in contrast to low-income countries at 4.0%. Additionally, the global prevalence of impaired glucose tolerance is estimated to be 7.5% in 2022, affecting around 374 million people. This figure is expected to rise to 8.0% (454 million) by 2030 and further increase to 8.6% (548 million) by 2045 [3].

Diabetes mellitus gives rise to various complications, including myocarditis, myocardial interstitial fibrosis, thrombotic events, endothelial cell dysfunction and vasculitis, cardiac arrhythmias, acute myocardial infarction, acute heart failure, and cardiomyopathy, among others [4-6]. The invasion of host human cells by SARS-CoV-2 occurs through the interaction between the virus and the angiotensin-converting enzyme 2 (ACE2) receptor. This binding process is facilitated by the transmembrane protease serine 2 (TMPRSS2), SARS-CoV-2 main protease (Mpro) and other factors [7, 8]. The burden of CVD, the major cause of morbidity and mortality around the world, is particularly high among patients with T2DM, with the proportion of CVD attributable to diabetes increasing in the general population. The macrovascular complications of diabetes mellitus-CVD, cerebrovascular disease, and peripheral vascular disease account for more than 70% of all deaths in patients with T2DM [9-11].

Cardiovascular disease (CVD) events are significantly more prevalent in individuals with diabetes due to dyslipidemia, a metabolic abnormality characterized by alterations in lipids and lipoproteins. This dyslipidemia is more frequently observed in younger individuals with diabetes and is associated with a higher fatality rate [2]. The specific type of dyslipidemia commonly seen in diabetic patients is believed to be a major contributing factor to the elevated risk of CVD events in this population.

MATERIALS AND METHODS

This study used a prospective cross-sectional study. Data were collected from diabetes patients with dyslipidemia at P. K DAS Institute of Medical Science from October 2022 to March 2023. The study was reviewed and approved by the Ethical Committee (IEC/14/76/23). A total of 300 patients were screened and of them, 205 were enrolled in the study based on the inclusion and exclusion criteria. Subjects who met the inclusion criteria were patients aged more than 18 years, both male & female patients with a history of type 2 DM with dyslipidemia, and patients with a previous history of CV events, whereas the ones excluded were patients with end-stage kidney disease or renal transplantation, psychiatric & thyroid disorder patients, pregnant & lactating mothers.

The subjects were asked for their obligingness to participate in this research and to provide informed consent. The baseline data collection was facilitated through patient demographics, family history, vital signs, diabetic, lipid profile, atherosclerotic cardiovascular disease (ASCVD) risk and Framingham risk Score. Patient education was given to the patients using structured patient leaflets and oral. They are followed up after two months. Patient education was given and risk score was assessed on every follow-up. Patient education included measures to manage and prevent cardiovascular risk factors in the patients. The measures included lifestyle modifications such as eating patterns, physical activity, maintaining a healthy weight, the importance of medication adherence, and monitoring of blood sugar levels.

Statistical Analysis

The data obtained were input into Microsoft Excel and analyzed with the use of IBM SPSS v.26. Categorical variables were displayed as frequency and percentage, while continuous variables were shown as mean ± Standard deviation. The association between ASCVD risk score and categorical variables was examined using Chi-Square tests. ANOVA tests were conducted to compare the mean differences among various continuous variables and the ASCVD risk score. A P-value less than 0.05 was considered as statistically significant.

RESULTS

The patient characteristics of this research showed that most patients were in the age group 51-70 years (52.70%) followed by 71- 100 years (36.10%), 31-50 years (10.70%), and 0-30 years (0.50%). Almost 53.7% of patients were male, 46.3% were female, 77.10% were non-smokers and 22.90% were smokers. Most of them were non-alcoholics 75.10%, followed by Ex- alcoholics 12.70% and 62.40% were without a family history of T2DM/CAD/DLP whereas 37.60% had a family history (Table-1).

Table 1: Patient Demographics (n=205)

Characteristics	Variables	Frequency	Percentage
Age	0-30 Yrs	1	0.5
	31-50 Yrs	22	10.7
	51-70 Yrs	108	52.7
	71-100 Yrs	74	36.1
Gender	Female	95	46.3
	Male	110	53.7
Smoker	No	158	77.1
	Yes	47	22.9
Alcoholic	No	154	75.1
	Yes	51	24.9
Family History	No	128	62.4
	Yes	77	37.6

On measuring ASCVD risk at baseline, most patients had high high-risk (68.30%), intermediate risk (19.00%), low risk (8.30%) and borderline risk (4.40%).

Table 2: Severity of ASCVD Risk Score at baseline (n=205)

Risk	Frequency	Percentage
High Risk (>=20%)	140	68.30
Intermediate Risk (7.5%-19.9%)	39	19.00
Borderline Risk (5%-7.4%)	09	4.40
Low Risk (<5%)	17	8.30

After patient education, the ASCVD risk score was measured. This showed patients with high-risk scores (19.00%), low-risk scores (19.00%), and borderline risk scores (14.60%) and most of them belonged to intermediate risk scores (47.30%).

Table 3: ASCVD Risk Score at Review (n=205)

Risk	Frequency	Percentage
High Risk (>=20%)	39	19.0
Intermediate Risk (7.5%-19.9%)	97	47.3
Borderline Risk (5%-7.4%)	30	14.6
Low Risk (<5%)	39	19.0

Age is positively correlated with LDL (0.182) as age increases LDL also increases. Age and HDL are negatively correlated (-0.180*) as age increases HDL decreases. Age is correlated with Systolic pressure (0.157*). Age and Diastolic pressure are correlated (0.146*). LDL is positively correlated with T. cholesterol (0.269**). HDL is correlated with T. cholesterol (0.292**). T. cholesterol is correlated with Diastolic pressure (0.145*), Systolic pressure is correlated with Diastolic pressure (0.288**), and RBS is correlated to FBS and PPBS with values (0.251**) and (0.269**) respectively.

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Table 4: Impact of Patient Education on Cardiovascular Complications (n=205)

Variables	Baseline	Review	Mean Difference	t value	P value
Systolic pressure	136.45 ± 23.36	107.97 ±14.92	28.478	18.653	0.001*
Diastolic pressure	84.29 ± 13.47	69.78 ± 8.56	14.512	15.078	0.001*
RBS	183.35 ± 81.53	172.20 ±67.92	11.151	3.277	0.001*
FBS	190.52 ± 93.32	174.36 ±81.51	16.161	2.964	0.003*
PPBS	233.09 ± 83.48	216.13 ±80.18	16.961	3.633	0.000*
HbA1C	12.05 ± 17.93	11.62±14.21	0.4210	0.423	0.673
Triglycerides	139.13 ±50.44	132.12 ±49.56	07.0132	03.274	0.001*
LDL	109.90 ± 29.88	78.81 ± 18.44	31.088	15.160	0.000*
HDL	47.072 ± 16.63	56.05 ± 25.89	-08.9815	-04.296	0.000*
Total cholesterol	197.36 ± 56.70	147.21 ±40.83	50.141	15.573	0.000*

* $p < 0.05$

Systolic pressure at baseline and review showed significant differences 84.29 ± 13.47 & 69.78 ± 8. Diastolic pressure has no significant difference. The mean RBS at baseline is 190.52 ± 93.32 and in review is 174.36 ± 81.51 and it's indicating a high statistically difference between the mean. FBS was statistically significant differences between both FBS baseline and review (190.52 ± 93.32 & 174.36 ± 81.51). HbA1C has no statistically significant difference. Triglycerides are statistically significant differences between both triglycerides baseline and review Mean ± SD is 139.13 4 ± 50.44 & 132.121 ± 49.56. In the case of HDL was 47.072 ± 16.63 and the review is 56.05 ± 25.89, and it's indicating that there is a statistically significant difference between the two values. On considering total cholesterol mean at the baseline was 197.36 ± 56.70 and review was 147.21 ± 40.83.

DISCUSSION

In our study, out of the total number of 205 patients, the number of patients 110 (53.70%) were male and the rest 95(46.30%) were female. However, not much difference was seen in the number of both genders on the prevalence of type 2 diabetes mellitus in post-COVID patients. It can be correlated to the result of various other studies [1, 12].

Probably the prevalence of type 2 diabetes mellitus was higher in men due to the larger amount of visceral fat and lack of physiological factors. While women are less prone to type 2 diabetes mellitus in post-COVID, one of the reasons was the multiple protective mechanisms of the estrogen, 17 β-estradiol protects insulin production and prevents diabetes [13].

The prevalence of type 2 diabetes mellitus in post-COVID was higher in mature adults (51-70). In our study, the prevalence of type 2 diabetes mellitus was more seen in the age group of 51-70 years, which comprises 52.70%. It correlates with the study conducted by A. G. Unnikrishnan *et al*., with more patients in the age group of 45-59 years (49.40%) [11]. But in a study done by Yasmin Karimah Ikhsan *et al*., more patients belonged to the age group of 55-59 years (52.10%) [14]. The youngest patient was 29 years old and the oldest patient was 79 years old in our study.

Cardiovascular disease is one of the major complications of type 2 diabetes mellitus in post-COVID patients, which can be assessed by the ASCVD risk score and Framingham risk score. In our study, most patients belonged to high risk in ASCVD risk score i.e., 68.30% [11]. It correlates with the result in the study conducted by Taras I.Griadil *et al*., [15]. However, in the study conducted by Yasmin Karimah Ikhsan *et al*., and Hongmei Zhang *et al*., more individuals belonged to borderline risk in the ASCVD risk score (19% and 28%) [14, 16].

In our study, considering the association between sociodemographic variables and ASCVD risk score, it was evident from our data that age was significantly associated with ASCVD risk score (p-0.00), especially age group 51-70. It correlates with the result in the study conducted by Yasmin Karimah Ikhsan *et al*., the more patients belonged to the age group 50-54 years (27%) [14]. This was similar to the study of A. G. Unnikrishnan *et al*., which concluded that the 45-55 age group had a high risk of ASCVD risk [11].

On considering gender, males were more significantly associated with ASCVD risk score (p-0.004). It correlates with the result in the study conducted by A.G.Unnikrishnan *et al*., where males had more association with ASCVD risk score (68.90%) [11]. Bello-Ovosi *et al*., got a similar result in their study which indicated that 50.70% of the males had an association with ASCVD risk score. [17] In our study, the absence of family history in the patients shows a significant association with cardiovascular risk and was also shown by similar studies A. G. Unnikrishnan *et al*., and Yasmin Karimah Ikhsan *et al*., [11, 14].

On analyzing the correlated relation between lab variables, our study shows a positive correlation with age, LDL, HDL, systolic blood pressure, diastolic blood pressure, total cholesterol, and RBS ($p<0.005$). This shows that there is a relationship between diabetes and lipid profile. Beatrice Ohunene Bello-Ovosi *et al*., have shown a well-established association between lipid disorders and cardiovascular risk in type 2 diabetes in post-COVID patients and clinical characteristics such as mean FBS, mean postprandial blood sugar, mean duration of diabetes mellitus, the median duration of hypertension, and mean serum lipid level of the type 2 diabetes patients are correlated [17]. Bishwajit Bhowmik *et al*., evaluated serum lipid profile and its association with type 2 diabetes patients in post-COVID and the results showed a strong association between serum lipids and type 2 diabetes patients [18]. S Wang *et al*., assessed the relationships between FPG control and lipid profile type 2 diabetes in post-COVID patients in Qingdao, China, and the result showed that FPG was significantly associated with HDL and total cholesterol and was not associated with LDL and triglycerides with adjustment for different confounding factors [19]. Findings suggested that total cholesterol and HDL should be focussed on the process of type 2 diabetes health management [19-22].

In the analyzing impact of patient education on lipid profile, diabetic profile, and vital signs, it was clearly shown from our study that statistically significant differences in pulse rate, blood pressure, random blood sugar, fasting blood sugar, postprandial blood sugar, triglycerides, HDL, total cholesterol with cardiovascular complication ($p<0.05$) and remarkable reduction in cardiovascular complication in type 2 diabetes patients were obtained. It correlates with the conclusions in the study conducted by Joe M. Chehade *et al*., managing risk factors in people with diabetes should include therapeutic agents with an established ability to reduce cardiovascular events [2]. Bartolomeu Fagundes de Lima Filho *et al*., concluded that most patients had low levels of in-depth knowledge of the disease and that telephone contact was an efficient means of health education for this vulnerable population, and it appears reasonable to continue with this type of care when aiming to clarify issues and challenges concerning post-COVID-19 [23]. Valerie Santschi *et al*., conducted a study that demonstrated the statistical significance of pharmacist care intervention in various health parameters [24]. These parameters include diastolic and systolic blood pressure, total cholesterol level, LDL-C level, and smoking cessation. The study found that the pharmacist care intervention resulted in a significant improvement in these parameters ($p<0.001$). Furthermore, the study also highlighted the additional benefits of pharmacist care interventions compared to usual care. Specifically, the interventions led to a greater reduction in diastolic and systolic blood pressure, total cholesterol level, LDL-C level, and a decreased risk of smoking. The interventions were primarily focused on patient education and counselling regarding medications, lifestyle modifications, and addressing patient concerns. Additionally, pharmacists collaborated with physicians and nurses to provide feedback on drug-related problems and recommendations for medication adjustments. Medication management, including reviewing medical records and monitoring drug therapy, was also a key aspect of the interventions [25-27].

As per the study results, cardiovascular complications are highly prevalent in type 2 diabetes mellitus patients with dyslipidemia in post-COVID-19 and are highly correlated with diabetes and lipid profile. Inpatient education, there was a remarkable reduction in cardiovascular complications in these patients.

CONCLUSION

The present study assisted in identifying copious risk factors and prerequisites for the effective control of cardiovascular complications in post-COVID-19 patients with type 2 diabetes mellitus and dyslipidemia. Hence, post-COVID-19 patients with type 2 diabetes mellitus patients and dyslipidemia were more with controllable risk factors than uncontrollable risk factors. The proper counselling and early management of the controllable risk factors of the patients (at least below 45 years) can decrease the incidence of cardiovascular risks. As per the study results, the cardiovascular risk factor is highly prevalent in males, age group 51-70 years, non-smokers, and non-alcoholics and highly correlated with the RBS, LDL, HDL, and Total cholesterol. There was a remarkable reduction in cardiovascular complications with structured patient education. So, the implementation of pharmacist care in collaboration with physicians and nurses may reduce cardiovascular risk complications and help in better medication management.

Conflict of Interest: The authors have no conflict of interest.

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