International Journal of Advances in Medicine
Ali MS et al. Int J Adv Med. 2024 Jul;11(4):304-308
http://www.ijmedicine.com
pISSN 2349-3925 | eISSN 2349-3933
DOI: https://dx.doi.org/10.18203/2349-3933.ijam20241621

Original Research Article

Examining the prevalence of cardiovascular complications among individuals with early-onset type 2 diabetes: a cross-sectional analysis at a tertiary care hospital

M. Shawqat Ali[1]*, Golam Mahfuz Rabbani[1], Mohammad Touhidul Islam[2], Muhammad Fazlul Haque Khalid[2], M. Monirul Islam[2], M. Hamid Uddin[2]

[1]Department of Cardiology, Jashore Medical College, Jashore, Bangladesh
[2]Department of Cardiology, CCU, General Hospital, Jashore, Bangladesh

Received: 06 April 2024
Revised: 10 May 2024
Accepted: 16 May 2024

***Correspondence:**
Dr. M. Shawqat Ali,
E-mail: drshawqatali@gmail.com

ABSTRACT

Background: Type 2 diabetes mellitus poses a global health threat, with over 60% of cases in Asia. T2DM significantly increases the risk of diabetic cardiomyopathy and cardiovascular disease, contributing to heart failure through mechanisms like myocardial infarction. Diabetic patients face a two to fourfold increased likelihood of developing coronary artery disease and myocardial infarction. The objective of this investigation was to assess the frequency of cardiovascular complications in individuals with early-onset type 2 diabetes.
Methods: This cross-sectional observational study was conducted at the Department of Cardiology, Jashore Medical College, Jashore, Bangladesh. The study duration was one year from January 2023 to December 2023. and focused on adult Type 2 Diabetes patients admitted to tertiary care wards. Inclusion criteria encompassed ages 20-35, both sexes, Type 2 Diabetes diagnosis, and voluntary participation. Exclusion criteria included age under 20, severe concomitant diseases, Gestational Diabetes, advanced renal failure, and Type 1 Diabetes.
Results: This study analyzed 270 cases, with participants predominantly aged 32-35 years (48.52%). Gender distribution showed 56.36% female and 43.64% male participants. Echocardiographic findings revealed normal electrocardiograms in 81.82% of cases, with myocardial infarction observed in 16 cases showing diverse cardiac abnormalities. Diabetic patients exhibited left ventricular diastolic dysfunction 1(0.91%) and hypertrophy 2(1.82%).
Conclusions: The high prevalence of risk factors like obesity and hypertension highlights the intricate connection between metabolic and cardiovascular health. Early monitoring and intervention in young adults with type 2 diabetes are crucial for reducing cardiovascular risks.

Keywords: Investigation, Cardiovascular, Complications, Early-onset and type-2 diabetes

INTRODUCTION

Type 2 diabetes mellitus (DM) is a metabolic disorder that elevates the risk of diabetic cardiomyopathy and atherosclerotic cardiovascular disease (CVD).[1] These conditions can contribute to heart failure through various mechanisms, including myocardial infarction and chronic pressure overload.[2] Pathogenetic mechanisms, primarily associated with hyperglycemia and chronic sustained hyperinsulinemia, involve alterations in metabolic profiles, intracellular signaling pathways, energy production, redox status, increased susceptibility to ischemia, and extracellular matrix remodeling.[3] Type 2 diabetes mellitus (T2DM) has become a global health

concern, with more than 60% of global diabetes cases occurring in the Asian population.[4] In a recent survey of 18,385 individuals with diabetes in Japan, the frequencies of death from coronary artery disease (CAD) and cerebrovascular disease (10.2% and 9.8%, respectively) were similarly higher than from renal failure (6.8%).[5] According to the International Diabetes Federation, an estimated 463 million adults had diabetes worldwide in 2019, and by 2045, the number of affected adults will increase to 700 million.[6] Cardiovascular disease remains a significant global health challenge.[7] Prospective studies have shown that diabetic patients have a two- to fourfold increased likelihood of developing coronary artery disease and myocardial infarction (MI), establishing type 2 DM as an independent risk factor for stroke and heart disease.[8,9] Indeed, approximately 70% of individuals with type 2 DM aged ≥65 years die from CVD, while those with no history of CAD have an equal cardiovascular risk as patients with a previous MI.[10] Therefore, individuals with diabetes face heightened vulnerability to CVD-related mortality and morbidity.[11] The close association between type 2 DM and CVD has given rise to the common soil hypothesis, suggesting that both conditions share common genetic and environmental factors influencing this connection.[12] However, while common risk factors such as obesity, insulin resistance, dyslipidemia, inflammation, and thrombophilia can be identified in the majority of affected patients, less is known about how these factors influence both conditions. Therefore, there is an ongoing need for a more comprehensive understanding of this relationship.[13] The genetic, epigenetic, and environmental backgrounds of both type 2 DM and CVD have been more recently studied and updated.[14] Cardiovascular disease remains a leading health issue globally.[15] In particular, insulin resistance and hyperglycemia are linked to low-grade inflammation, as well as chronic enhancement of oxidative stress, leading to endothelial dysfunction and promoting atherogenesis.[16-18] Additionally, it is well documented that type 2 DM is associated with an enhancement of platelet and hemostatic activities.[19] The objective of this investigation was to assess the frequency of cardiovascular complications in individuals with early-onset type 2 diabetes.

METHODS

This cross-sectional observational study was conducted at the Department of Cardiology, Jashore Medical College, Jashore, Bangladesh. The study duration was one year from January 2023 to December 2023. The sample was collected by a convenient sampling method and the sample size of the study was 110. Adult patients of both sexes with Diabetes admitted to tertiary care hospital wards were eligible for the study.

Inclusion criteria

Inclusion criteria were; Patients age from 20 to 35 years, both males and females, patients diagnosed with DM Type 2 based on the above diagnostic criteria and willing to participate in the study voluntarily.

Exclusion criteria

Exclusion criteria were; patients aged under 20 years, the presence of any concomitant severe disease limits life expectancy, patient with gestational diabetes, advanced renal failure and type 1 diabetic patient.

Eligible participants were enrolled purposively in the study. A complete history was obtained from all the patients. A thorough clinical examination was carried out, and the diagnosis of hypertension, diabetes mellitus, and metabolic syndrome was made as per the guidelines given below. All data were presented in a suitable table or graph according to their affinity. Each table and graph were described to help us understand them clearly. All statistical analysis was performed using the statistical package for social science (SPSS) program and Windows. Continuous parameters were expressed as mean±SD and categorical parameters as frequency and percentage. The students' t-test made comparisons between groups (continuous parameters). The significance of the results, as determined by a value of $p<0.05$, was considered statistically significant.

RESULTS

This study encompassed a total of 270 cases, subject to thorough analysis. The age distribution within the study population is detailed in (Table 1), highlighting that the majority of participants 131 (48.52%) fell within the 32-35 years age range.

Table 1: Age distribution of the study population (n=110).

Age groups (years)	N	%
20-23	7	2.59
24-27	61	22.59
28-31	71	26.30
32-35	131	48.52

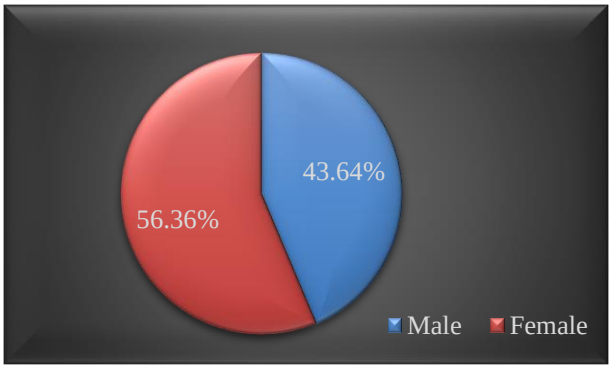

Figure 1: Gender distribution of the study population (n=110).

The second-largest age group consisted of participants 71 (26.30%) aged between 28-31 years. Gender distribution revealed that 56.36% were female, while 43.64% were male, as illustrated in (Figure 1). The (Table 2) provides insights into the identified risk factors, with 180 (66.67%) of participants exhibiting obesity, 32 (11.85%) experiencing overshadowing dyslipidemia, and 12 (4.44%) presenting with hypertension. Smoking was reported by 37 (13.70%), whereas alcohol use was observed in 9 (3.33%) of participants. Notably, none of the participants reported tobacco chewing.

Table 2: Risk factor and clinical feature distribution of the study population (n=110).

Variables	N	%
Risk factors		
Dyslipidemia	32	11.85
Obesity	180	66.67
Hypertension	12	4.44
Smoking	37	13.70
Alcohol	9	3.33
Tobacco chewer	0	0.00
Clinical features		
Polydipsia	123	45.56
Polyuria	108	40.00
Fatigue	98	36.30
Breathlessness	42	15.56
Chest pain	32	11.85
Tingling and numbness in hand and feet	7	2.59

Table 3: Clinical record of the study population.

Variable	Mean±SD
Blood pressure	
Systolic blood pressure (mmHg)	117.04±11.4
Diastolic blood pressure (mmHg)	79.54±4.74
Pulse pressure (mmHg)	38.2±7.3
Blood sugar estimation	
Fasting blood sugar (mg/dl)	186±39.27
2hr-post-prandial blood sugar (mg/dl)	204.5±41.8
HbA1C	6.64±1.8
Lipid profile	
Serum cholesterol (mg/dl)	177.4±48.2
Serum triglyceride (mg/dl)	106.2±33.6
VLDL cholesterol (mg/dl)	79.52±8.4
LDL cholesterol (mg/dl)	76.9±28.4
HDL cholesterol (mg/dl)	27.44±7.3

Clinical features, detailed in (Table 2), highlighted that 123 (45.56%) and 108 (40.00%) of patients experienced polydipsia and polyuria, respectively. Fatigue was reported by 98 (36.30%) of participants, while breathlessness and chest pain were noted in 42 (15.56%) and 32 (11.85%) of patients, respectively. The (Table 3) presents vital physiological parameters among study participants. The mean systolic and diastolic blood pressure was 117.04±11.4 and 79.54±4.74 mmHg, respectively. The mean pulse pressure was 38.2±7.3 mmHg. Fasting blood sugar and 2-hour postprandial blood sugar were 186±39.27 mg/dl and 204.5±41.8 mg/dl, respectively. Lipid profile analysis revealed mean serum cholesterol, triglyceride, VLDL, LDL, and HDL cholesterol levels among participants (Table 3).

Table 4: ECG examination of the study population.

ECG examination	N	%
Normal	222	82.22
LVH with strain pattern	7	2.59
ST elevation	41	15.19
NSTEMI	0	0.00

Table 5: Echocardiographic examination of the study population.

Echocardiographic examination	N	%
Normal	90	81.82
Myocardial infarction	16	14.55
Ejection fraction <45 RWMA (regional wall motion abnormalities)	29	26.36
Ejection fraction >45 RWMA	81	73.64
Dilation of left ventricle	29	26.36
Valvular lesion MR (mitral regurgitation)	22	20.00
Left ventricular diastolic dysfunction	1	0.91
Left ventricular hypertrophy	2	1.82

Echocardiographic findings, detailed in (Table 5), indicated that over 90 (81.82%) of patients had normal electrocardiogram results. Some patients 2 (1.82%) exhibited left ventricular hypertrophy with a strain pattern, while 41 (15.19%) had ST elevation in ECG leads. Myocardial infarction was observed in 16 cases, with 29 (26.36%) showing an ejection fraction below 45 RWMA and approximately 81 (73.64%) presenting an ejection fraction exceeding 45 RWMA. Left ventricular dilatation 1 (0.91%) and valvular lesions were noted in 2 (1.82%) and 16 (14.55%) of myocardial infarction patients, respectively. Additionally, 2.73% of diabetic patients exhibited left ventricular diastolic dysfunction and left ventricular hypertrophy.

DISCUSSION

The purpose of this investigation was to assess the occurrence of cardiovascular complications among individuals with early-onset type 2 diabetes. A significant portion of the participants, 131 (48.52%), fell within the age range of 32-35 years. In a study by Patil et al the average age was 35.94 years, with 60.8% of patients falling between 36 and 40 years.[20] Sosale et al reported a mean age of 34.68±4.23 years, and 84% of their patients were between 31 and 40 years old.[21] The younger onset age indicates a prolonged duration of diabetes exposure, coupled with sub-optimal control of hyperglycaemia and

cardiovascular (CV) risk factors, elevating the risk of complications. The high prevalence of undiagnosed diabetes in participants under 40 underscores the need for surveillance and screening among younger populations for early diabetes detection in India. In our study, gender distribution showed 43.64% males and 56.36% females, with all young females experiencing myocardial infarction in Type 2 diabetes. Comparative studies by Patil et al and Sosale et al revealed varying gender ratios.[20-21] Our study reported an obesity prevalence of 180 (66.67%), and 32 (11.85%) of patients had dyslipidaemia. The coexistence of type 2 diabetes, visceral adiposity, and excess ectopic fat signify heightened risks of cardiovascular morbidity and mortality. Individuals with elevated visceral adipose tissue, where fat deposits occur in lean tissues like the liver, skeletal muscle, and heart, face increased risk. The simultaneous presence of obesity and diabetes should further amplify cardiovascular risks.

In our study, 37 (13.70%) were smokers, 9 (3.33%) were alcoholics, and none reported tobacco chewing. Comparable studies by Patil et al and Sosale et al reported varying smoking rates of 42.10% and 24.3%, respectively.[20-23] Gupta et al found a higher prevalence of smoking and smokeless tobacco in diabetes.[24] Smoking-related chemicals induce cell damage and inflammation, hinder insulin response, and elevate type 2 diabetes risk. Cigarette smoke irritates arterial lining, potentially leading to cardiovascular diseases, heightened heart rate, blood pressure, and reduced oxygen supply to tissues. Our study reported a 16 (14.55%) myocardial infarction rate, with Patil et al observing 73.34% STEMI.[20] The coexistence of diabetes and cardiovascular risks poses a substantial health and economic burden globally if trends persist. In our study, 123 (45.56%) exhibited polydipsia, 108 (40.00%) polyuria, and 98 (36.30%) fatigue, while 42 (15.56%) reported breathlessness and 32 (11.85%) chest pain. Type 2 diabetes often coincides with hypertension, with diabetic patients being twice as prone to hypertension. Conversely, hypertensive individuals face a higher diabetes risk due to insulin resistance. Cardiovascular disease, exacerbated by hypertension, is a leading cause of mortality among people with diabetes. Shared risk factors like endothelial dysfunction, vascular inflammation, atherosclerosis, and obesity contribute to both conditions. Our study noted a mean systolic/diastolic blood pressure of 117.04±11.4/ 79.54±4.74 mmHg and pulse pressure of 38.2±7.3 mmHg. Diabetes with hypertension occurred in 14.55%, with five cases experiencing myocardial infarction.

The American diabetes association and the European Association for the Study of Diabetes recommend three markers for diabetes control: fasting blood glucose, postprandial glucose, or glycated haemoglobin (HbA1c). Among our study participants, fasting blood sugar averaged 186±39.27 mg/dl, 2-hour PPBS was 204.5±41.8 mg/dl, and glycosylated haemoglobin was 6.64±1.8. Persistent hyperglycaemia is the primary etiopathogenic factor for atherosclerosis in type 1 diabetes, contributing to cardiovascular risk factors like nephropathy and neuropathy. Dyslipidaemia, prevalent in diabetes, is a significant cardiovascular disease risk factor. In our study, mean serum cholesterol was 177.4±48.2 mg/dl, triglycerides 106.2±33.6 mg/dl, LDL cholesterol 76.9±28.4 mg/dl, and HDL cholesterol 27.44±7.3 mg/dl. All patients with diabetes and dyslipidaemia experienced myocardial infarction. In this study, 81.82% of patients had average electrocardiogram results, while 41 (15.19%) exhibited ST elevation. In echocardiograms, 90 (81.82%) were average, with 16 cases showing myocardial infarction, 29 (26.36%) having ejection fraction below 45%, and 22 (20.00%) displaying valvular lesions. Left ventricular hypertrophy and diastolic dysfunction occurred in 2.73%. Compared to research by Sardesai et al where 53.1% had abnormal ECG findings, our study demonstrated a lower prevalence of abnormal-ities.[23] Diabetic patients with left ventricular diastolic dysfunction, seen in 0.91%, need early examination due to its role in diabetic cardiomyopathy progression. Shrestha et al reported a 71% LVDD prevalence in diabetics, indicating increased collagen deposition and decreased ventricular compliance in diabetic hearts.[24]

Limitations

Despite the comprehensive exploration of cardiovascular complications in early-onset type 2 diabetes, this study has certain limitations. Firstly, the cross-sectional design hinders the establishment of causation, providing only associations between variables. Secondly, the study's reliance on a single-centre, convenient sampling method in Jeshore, Bangladesh, may limit generalizability to broader populations. The exclusion of patients with concomitant severe diseases and advanced renal failure may introduce selection bias, impacting the representation of individuals with more complex health conditions. Additionally, the one-year study duration might not capture the long-term progression of cardiovascular complications.

CONCLUSION

In conclusion, this study sheds light on the significant association between early-onset type 2 diabetes and cardiovascular complications, emphasizing the need for heightened awareness and preventive measures. The prevalence of cardiovascular risk factors, such as obesity, dyslipidaemia, and hypertension, underscores the complex interplay between metabolic and cardiovascular health.

Recommendations

The study's findings highlight the importance of comprehensive monitoring and early intervention in young adults with type 2 diabetes to mitigate the risk of cardiovascular morbidity and mortality. Further research and public health initiatives are crucial to developing targeted strategies for preventing and managing cardio-vascular complications in this vulnerable population.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Low Wang CC, Hess CN, Hiatt WR, Goldfine AB. Clinical update: cardiovascular disease in diabetes mellitus: atherosclerotic cardiovascular disease and heart failure in type 2 diabetes mellitus mechanisms, management, and clinical considerations. Circulation. 2016;133(24):2459-502.
2. Pagliaro BR, Cannata F, Stefanini GG, Bolognese L. Myocardial ischemia and coronary disease in heart failure. Heart Failure Rev. 2020;25(1):53-65.
3. Shah MS, Brownlee M. Molecular and cellular mechanisms of cardiovascular disorders in diabetes. Circulation Res. 2016;118(11):1808-29.
4. Chan JC, Malik V, Jia W, Kadowaki T, Yajnik CS, Yoon KH, et al. Diabetes in Asia: epidemiology, risk factors, and pathophysiology. JAMA. 2009;301(20):2129-40.
5. Hotta N, Nakamura J, Iwamoto Y, Ohno Y, Kasuga M, Kikkawa R, et al. Causes of death in Japanese diabetics: a questionnaire survey of 18,385 diabetics over a 10-year period. J Diab Invest. 2010;1(2):66-76.
6. Agarwal A, Gossain VV. Diabetes in the Elderly. Drugs Diab. 2021;31:183.
7. McAloon CJ, Osman F, Glennon P, Lim PB, Hayat SA. Global epidemiology and incidence of cardiovascular disease. Academic Press. 2016;1:57-96.
8. Kannel WB, McGee DL. Diabetes and cardiovascular disease: the Framingham study. JAMA. 1979;241(19):2035-8.
9. Grundy SM, Benjamin IJ, Burke GL, Chait A, Eckel RH, Howard BV, et al. Diabetes and cardiovascular disease: a statement for healthcare professionals from the American Heart Association. Circulation. 1999;100(10):1134-46.
10. Kim JA, Koh KK, Quon MJ. The union of vascular and metabolic actions of insulin in sickness and in health. Arterioscleros Thrombos Vasc Biol. 2005;25(5):889-91.
11. Kaur J, Singh P, Sowers JR. Diabetes and cardiovascular diseases. Am J Therap. 2002;9(6):510-5.
12. De Rosa S, Arcidiacono B, Chiefari E, Brunetti A, Indolfi C, Foti DP. Type 2 diabetes mellitus and cardiovascular disease: genetic and epigenetic links. Front Endocrinol. 2018;9:2.
13. Patel TP, Rawal K, Bagchi AK, Akolkar G, Bernardes N, Dias DD, Gupta S, Singal PK. Insulin resistance: an additional risk factor in the pathogenesis of cardiovascular disease in type 2 diabetes. Heart failure Rev. 2016;21:11-23.
14. Murea M, Ma L, Freedman BI. Genetic and environmental factors associated with type 2 diabetes and diabetic vascular complications. RDS. 2012;9(1):6.
15. Benjamin EJ, Blaha MJ, Chiuve SE, Cushman M, Das SR, Deo R, et al. Heart disease and stroke statistics 2017 update: a report from the American Heart Association. Circulation. 2017;135(10):e146-603.
16. Woods M, Mitchell JA, Wood EG, Barker S, Walcot NR, Rees GM, Warner TD. Endothelin-1 is induced by cytokines in human vascular smooth muscle cells: evidence for intracellular endothelin-converting enzyme. Mol Pharmacol. 1999;55(5):902-9.
17. Petersen KF, Dufour S, Befroy D, Garcia R, Shulman GI. Impaired mitochondrial activity in the insulin-resistant offspring of patients with type 2 diabetes. New Eng J Med. 2004;350(7):664-71.
18. Wang CC, Hess CN, Hiatt WR, Goldfine AB. Atherosclerotic cardiovascular disease and heart failure in type 2 diabetes mechanisms, management, and clinical considerations. Circulation. 2016;133(24):2459.
19. Ross R. Atherosclerosis an inflammatory disease. New Eng J Med. 1999;340(2):115-26.
20. Patil RS, Shetty LH, Chidananda CG, Raj VS, Trivedi AS, Raghu RT, et al. Coronary artery disease in young diabetics (under 40 years): Are they Different?. J Indian Coll Cardiol. 2020;10(4):163-7.
21. Sosale B, Sosale AR, Mohan AR, Kumar PM, Saboo B, Kandula S. Cardiovascular risk factors, micro and macrovascular complications at diagnosis in patients with young onset type 2 diabetes in India: CINDI 2. Indian J Endocrinol Metab. 2016;20(1):114.
22. Gupta A, Gupta R, Sharma KK, Lodha S, Achari V, Asirvatham AJ, et al. Prevalence of diabetes and cardiovascular risk factors in middle-class urban participants in India. BMJ Diab Res Care. 2014;2(1):32.
23. Sardesai VV, Kokane HT, Mukherjee S, Sangle SA. A study of electrocardiographic and 2D echocardiographic changes in type 2 diabetes mellitus patients without cardiovascular symptoms. J Family Med Prim Care. 2022;11(3):1036.
24. Shrestha NR, Sharma SK, Karki P, Shrestha NK, Acharya P. Echocardiographic evaluation of diastolic function in asymptomatic type 2 diabetes. JNMA. 2009;48(173):20-3.

Cite this article as: Ali MS, Rabbani GM, Islam MT, Khalid MFH, Islam MM, Uddin MH. Examining the prevalence of cardiovascular complications among individuals with early-onset type 2 diabetes: a cross-sectional analysis at a tertiary care hospital. Int J Adv Med 2024;11:304-8.