



Research Article

ASYMPTOMATIC CARDIAC CHANGES IN TYPE 2 DIABETES MELLITUS

Dr. Kamlesh Patidar¹, Dr. Milind Manvar^{*2} and Dr. R.K.Jha³

^{1,2} Postgraduate Students Department of Gen. Medicine Sri Aurobindo Medical College & PG Institute-Indore

³Professor & HOD Department of Gen. Medicine Sri Aurobindo Medical College & PG Institute-Indore

ARTICLE INFO

Article History:

Received 06th October, 2019

Received in revised form 14th

November, 2019

Accepted 23rd December, 2019

Published online 28th January, 2020

Key words:

Type2 diabetes mellitus, Cardiac Changes.

ABSTRACT

Background and Aim India is world's diabetes Capital. The prevalence of Type 2 Diabetes Mellitus is expected to raise more rapidly in the future in India and 40 other countries because of increasing obesity and reducing activity levels and other life style changes. It is well established that coronary artery disease is a major complication of diabetes mellitus, representing the ultimate cause of death in more than half of all patients with this disease. In this study we made an effort to know the cardiac changes present in the patients of Type 2 Diabetes, who do not have any symptoms relating to cardiovascular system and to demonstrate the presence of silent myocardial ischemia in asymptomatic patients of Type-2 Diabetes Mellitus. Methodology 60 Type 2 diabetes patients for more than one year duration with age 30-75 yrs who do not have any complaints relating to cardiovascular system were included in this study. All were assessed with detailed history, clinical examination and relevant investigation including resting ECG and Treadmill test. Patients with H/O d myocardial infarction, uncontrolled blood pressure and other chronic diseases were excluded from the study Results in the 60 diabetes patients in our study, 32 patients were males and remaining 28 were Females. None of our patients showed Resting. ECG and 2D ECHO changes. 11 patients from our study group showed inducible ischemia in the Treadmill test. Hypertriglyceridemia which is a common risk factor associated with coronary artery disease was found in 31 patients (51.66%) in our study group. Conclusion this study shows that type 2 diabetes patients especially of longer duration should undergo cardiac evaluation even though they do not have any symptoms relating to cardiovascular system.

Copyright© 2020 Dr. Kamlesh Patidar, Dr. Milind Manvar and Dr. R.K.Jha. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Type 2 Diabetes: The term diabetes mellitus refers to a group of metabolic disorders characterized by chronic hyperglycaemia and these disorders usually result from defects in Insulin secretion, insulin action, or both. Sustained hyperglycaemia is associated with complication in the macro vasculature, Micro vasculature and nerves, causing protracted morbidity and premature mortality. Macro vascular complications, particularly coronary artery disease and stroke are increase two to four fold and diabetic patients have a higher prevalence of peripheral vascular disease. Micro vascular complications such as retinopathy and nephropathy, and peripheral and autonomic neuropathy are also common.¹ Two main categories of diabetes are distinguished.

Type 1. Formerly known as insulin-dependent diabetes mellitus (IDDM) or juvenile-onset diabetes – usually manifests before adulthood and accounts for about 5% of all cases. Type I diabetes arises mainly through auto immune destruction of pancreatic β - cells, which leaves the patients severe Insulinopenia and extreme hyperglycaemia.

If untreated, insulin deficiency culminates in fatal ketoacidotic coma.

Type 2. Diabetes- Formerly known as non-insulin dependent diabetes mellitus (NIDDM) or maturity-onset diabetes- usually manifests in later adult life and accounts for about 95% of all cases.²

This type of diabetes develops mostly through a combination of insulin resistance and defective β --Cell function. This causes less severe hyperglycaemia that is not usually life threatening. However the catalogue of chronic complications of type 2 diabetes represents a serious clinical burden, eroding quality of life and reducing life expectancy. The progressive and heterogenous nature of type 2 diabetes adds to the complexity of treatment, which usually requires one or more oral anti diabetic agents and may also necessitate the use of insulin. It is well established that Coronary artery disease is a major complication of diabetes mellitus representing the ultimate case of death in more than half of all patients with this disease. Myocardial infarction in diabetic patients is more expensive when compared to non-diabetic patients and the long term Survival rates for diabetic patients is lower than that among non diabetic patients. Chest pain is certainly the

***Corresponding author: Dr. Milind Manvar**

Postgraduate Students Department of Gen. Medicine Sri Aurobindo Medical College & PG Institute-Indore

predominant symptom of ischemic heart diseases and the one most commonly used to establish the type and efficacy of the treatment. However several studies suggest that many individuals with severe coronary artery lesions do not have angina pectoris in these patients Episodes of transient myocardial ischemia may be silent, although abnormal asymptomatic ST changes may be recorded during ambulatory electrocardiogram monitoring. Numerous studies have demonstrated that the presence of silent ischemia during exercise testing or AECG monitoring predicts adverse clinical outcome. It is well established that patients with diabetes mellitus have a greater morbidity and mortality from cardiovascular disease than non diabetic patients.

This study conducted at **SAIMS Hospital Indore** will help to add the growing literature on silent ischemia in patients with type-2 diabetes mellitus.

Aims

To know the cardiac changes present in patients of type-2 diabetes who do not have any symptoms relating to cardiovascular system by Resting ECG & Treadmill test. To demonstrate increased presence of silent myocardial ischemia in asymptomatic patients of Type-2 diabetes mellitus.

Background

Existence of two types of diabetics was noted in ancient Hindu Medical texts by charaka and sushruta.³

- The term diabetes was coined in the 2nd century A.D. by arataeus of Cappadocia.
- Hyperglycaemia as a cardinal feature of diabetes was noted in 1850 by Bernard.
- The high prevalence of asymptomatic myocardial ischemia in diabetes was confirmed in 1990 by M.J.Koistinen.
- It was found that the prevalence of Micro and Macro vascular complications tend to increase with increasing urinary albumin excretion.
- A study concluded that silent myocardial ischemia in asymptomatic diabetes patients occurs frequently and in association with autonomic dysfunction suggesting that diabetic neuropathy may be implicated in the mechanism of silent myocardial ischaemia.⁴
- It was found that silent myocardial ischaemia was more frequent in diabetic patients than in non diabetic control subjects.⁵
- The high prevalence of asymptomatic myocardial ischaemia in diabetes was confirmed in 1992.⁶

Epidemiology of Type-2 Diabetes

Type 2 diabetes is by far the most common form of diabetes on a global scale (~95% of all cases) during the past few decades, type 2 diabetes has reached epidemic proportions in many parts of the world, the increase is closely associated with the development of obesity. The World Health Organization (WHO) has predicted that the global prevalence of all diabetes will increase from 194 million in 2003 to 330 million in 2005 and that this increase will affect both industrialized and developing countries. The impact on less developed countries will be disproportionately high. Some of the countries expecting the greatest increase, such as India (up 38 million to

73 million), china (up 22 million to 46),⁷ Pakistan, Indonesia and Mexico, are also some of the poorest.

Ethnicity

The prevalence of type 2 diabetes varies more than tenfold between the highest and lowest risk populations. The lowest prevalence rates (>3%) have been reported in less-developed countries, by contrast the highest prevalence (30-50% of adults) is observed in populations such as north American Indian, pacific Islands and Australian Aborigines that have experienced radical changes from traditional to westernized life styles during the course of the 20th century. Social and behavioural changes are regarded as key factory in the recent explosion of type 2 diabetes of these the most important appear to be

1. Decreased levels of physical activity
2. Over consumption of energy- dense foods.

Table 1 Ethnic variation in Type-2 diabetes prevalence in individuals aged 30- 64 years (WHO).

Particular	Prevalence (%)	Risk ratio
Pima Indians (Arizona, USA)	50	12
Nauruan s (South Pacific)	40	10
Native Australians	25	6
Peninsular Arabs	25	6
South Asians	20	5
West Africans	12	3
Northern Europeans	4	1

Ethnicity is an important determinant of susceptibility to insulin resistance, obesity, type 2 diabetes and other cardiovascular risk factors such as dyslipidemia. Different patterns of plasma lipids that exist independently of obesity and insulin resistance may be seen between some of the ethnic groups.⁸

Other genetic factors: A life time concordance of approximately 90% for identical twins is strongly suggestive of a genetic component to type 2 diabetes. Commonly type 2 patients report a family history of the condition the lifetime risk associated with having a single parent with type 2 diabetes is approximately 40%, it is 50% or more if both parents are affected. However due to the multiplicity of factors involved unraveling the genetics of type 2 diabetes has proved highly problematic.

Age- related prevalence: The prevalence of type 2 diabetes increase with age up to 20% of those over 80 years old develop diabetes. The ageing populations of many societies have contributed substantially to the overall increase in the number of patients with diabetes. Glucose tolerance decreases with age, but the extent of the natural deterioration in insulin sensitivity with age remains uncertain. The weight gain that common occurs between the fourth and seventh decades of life creates its own state of insulin resistance, particularly if this adiposity is of central distribution.

Cardinal clinical and metabolic features of Type 2 diabetes

- Presentation usually in middle-age or later life
- Overweight / obesity common (present in >75%)
- Symptoms often mild, absent or unrecognized
- Relative rather than absolute insulin deficiency
- Insulin resistance commonly present
- Ketosis- resistant
- Progressive hyperglycaemia- even with anti diabetic therapy
- Insulin treatment frequently required to maintain long-term glycaemia control.

Other features of the insulin resistance syndrome –eg hypertension, dyslipidaemia present.

High risk of macro vascular complications which are the main cause of premature mortality.

Insulin resistance and cardiovascular Risk

Classic risk factors for cardiovascular disease are after already present when type 2 diabetes is diagnosed. The collective impact of these risk factors has been referred to as a ticking clock for atherosclerosis. The presence of diabetes accelerates these adverse effects. Hypertension and dyslipidaemia are more frequently encountered in patients with type 2 diabetes than in age- matched non-diabetic controls. It has been proposed that insulin resistance defined as a reduced biological effect of insulin is a fundamental metabolic defect that links these (and other) risk factors. Although insulin resistance is widely held to be an important, if not primary defect in type 2 diabetes, the development of significant glucose intolerance implies an additional defect-impaired insulin secretion. While type 2 diabetes is a metabolically heterogeneous condition, insulin resistance and relative insulin deficiency are prominent defects and both present in most patients.⁹

Impaired glucose tolerance: Insulin resistance is also present in subjects with lesser degrees of glucose intolerance most patients with type 2 diabetes will have passed from normality through an intermediate stage of impaired glucose tolerance. The latter stage, although not directly associated with a risk of Microvascular Complication, but shares some of the increased risk of atherosclerotic Cardio Vascular disease that is a feature of type 2 diabetes. In Western Societies, more than 5% of younger adults and 20% of those over 65 years of age have impaired glucose tolerance. Since the later is asymptomatic, most cases remain undiagnosed. But approximately 1 – 10% of cases will progress to type 2 diabetes each year the risk is further influenced by factors such as ethnically obesity, family history of type 2 diabetes, history of glucose intolerance during frequency and the influence of certain drugs with diabetogenic effects.

METHODOLOGY

This study was done at SAIMS Hospital-Indore at those patients attended OPD and IPD between December 2017 to September 2019 were included in this study. This study included 60 NIDDM Patients. The initial evaluation included a medical history taking, physical and systemic examinations. After the above procedures, routine and specific investigations were done. The patients with type 2 diabetes mellitus for more than one year, who do not have any complaints relating to the cardiovascular system, were included. Specific Investigations done were Routine investigations. Urine examination. Fasting and Post Prandial blood sugar. Serum total cholesterol. Serum HDL Cholesterol. Serum Triglycerides. Serum Creatinine. Fundus examination. ECG. Echo Cardiogram and Trendmill stress test.

Inclusion criteria: NIDDM of > 1 yr who do not have any complaints relating to the Cardiovascular System. Age 30-75 years.

Exclusion criteria: Patients with any of the following-NIDDM <1Yr. History of MI, Angina, Heart failure, Arrhythmias, LBBB, uncontrolled BP, significant Aortic Stenosis, Cardiomyopathy, Previous coronary artery bypass surgery, Treatment with Digoxin, Severe Chronic disease, Insulin

treated then duration from diagnosis to insulin therapy <2Yrs, CVA with Neurological deficit.

RESULTS

Table 2 Distribution according to sex of the study group

Sex	No	%
Male	32	53.33
Female	28	46.67
Total	60	100

Sex	Mean Age	S.D
Male	48.84	9.88
Female	54.33	7.36

Table 3 Age Distribution of Study Group at The Onset of Diabetes

Age group	No	%
31-40	12	20
41-50	40	66.67
>51	8	13.33
Total	60	100

Table 4 Distribution of study group by duration of Diabetes

Duration in years	No	%
<5 years	30	50
5-10 years	20	33.33
11-15 years	6	10
>15 years	4	6.67
Total	60	100

Table 5 Distribution of FBS in the study group

FBS in mg %	No	%
≤130	6	10
131-150	15	25
151-170	10	16.67
171-190	9	15
>191	20	33.33
Total	60	100

Table 6 Distribution of serum total cholesterol in the study group

S. total cholesterol in mg %	No	%
<200	48	80
≥200	12	20
Total	60	100

Table 7 Distribution systolic BP in the study group

Systolic BP in mm of Hg	No	%
≤140	45	75
140-160	10	16.67
>161	5	8.33
Total	60	100

Table 8 Distribution according to incidence of silent Myocardial Ischemia in the study group

Stress test	No	%	Mean Age	S.D
Positive	11	18.33	55.63	10.99
Negative	49	81.67	50.42	8.62
Total	60	100		

Table 9 Severity of Diabetes by fasting blood sugar in stress test positive patients

FBS in mg %	No. of Patients	Percentage
≤140	4	36.36
>140	7	63.64
Total	11	100

Table 10 Duration of Diabetes in stress test positive patients (in Years).

Duration	No. of Patients	Percentage
<10 yrs	7	63.64
≥10	4	36.36
Total	11	100

Table 11 Duration of diabetes in total number of patients in study group Vs stress test positive patients

Duration in years	Total Patients		Stress Test Positive Patients	
	Number	%	Number	%
<5	30	50	5	45.56
5-10	20	33.33	2	18.18
>10	10	16.67	4	36.36
Total	60	100	11	100

Total Mean Duration – 6.78 yrs, S.D- 5.49 yrs

DISCUSSION

This study “Asymptomatic cardiac changes in Type 2 Diabetic Mellitus” was undertaken at SAIMS Hospital Indore at those patients attended OPD and IPD between December 2017 to September 2019 were included in this study. This study included 60 NIDDM patients. The initial evaluation included a medical history taking, physical and systemic examinations. Even though Males were more, not much sex difference observed in the incidence of type 2 diabetes in this study (32 Males and 28 Females) This coincides with Majority of studies done outside which points out that there is no sex difference in the incidence of Diabetes. Majority of the patients in our study, 40 patients (66.67%) belong to 5th decade. 50% patients In this study (30 out of 60) had diabetes less than 5 years. 20 patients (33.33%) had diabetes of 5-10 year duration and 10 patients (16.67%) had diabetes more than 10 years.

Lipid abnormalities are associated with higher incidence of ischemic heart diseases, particularly more so in diabetes. The most evident lipid abnormalities noted in our study was hypertriglyceridemia and Low HDL levels. 31 patients (51.66%) showed high triglycerides and 29 out of 60 (48.33%) showed low HDL. only 12 (20%) showed high total cholesterol and 9 patients (15%) showed high LDL above 130 mg%. None of our patients showed any cardiac abnormality at rest. (in Resting ECG and 2D ECHO) Treadmill test was undertaken in all the 60 patients out of whom 11 patients showed inducible ischemia without angina. This study coincides with majority of studies done previously. This study coincides with the study done by “Shaltout AK El Sheikh Mr,” and Ashmawy MM” who in their study demonstrated inducible ischemia in 16% of cases (10 out of 62 cases) by TMT. This study also coincides with the recent study in New-onset middle aged type 2 diabetic patients to see the prevalence of silent myocardial ischemia by ‘AU Fornengo P’, Bosio A, Epifani G in 2006.¹⁰ In that study, 19 patients showed (17.1%) showed inducible ischemia in treadmill test. Among these 11 patients in our study (18.33%) those showed inducible ischemia in Exercise test, 8 patients (72.73%) were above 50 years of age and remaining 3 (27.27%) were below 50 years which tells us that ischemia develops as age advances even without prominent symptoms.

All these 11 patients who had inducible ischemia in exercise test showed ST depression of more than 1mm without angina In our study, autonomic neuropathy was detected in 4 out of 11 asymptomatic diabetics those showed inducible ischemia on TMT. In diabetic patients, autonomic neuropathy was blamed for absent anginal pain during ischemic episodes. In a recent study to correlate the incidence of autonomic neuropathy and silent myocardial ischemia in type 2 diabetic patients by “AU Alhayali J.MT” and “Alnuemi A.A”, silent myocardial ischemia was detected in 12 (26.6%) diabetic patients in general. 8 (66.7%) of them had autonomic neuropathy.¹¹ It

tells us the need of screening of diabetic patients with autonomic neuropathy which is also evident in our study. Paradoxically only 4% of our patients showed family H/O of diabetes. All the patients who had family H/o of diabetes (2 patients) also showed silent myocardial ischemia. Thus the importance of family H/O in asymptomatic diabetics cannot be ruled out. Our study shows BMI (body mass index) of less than 25 in 28 patients (46.67%) and more than 25 in 32 patients (53.33%). Thus our study coincides with majority of studies which say higher incidence of weight in diabetics. In our study waist/hip ratio is more than normal levels (>0.95(M) and >0.90(F) in 51 patients (85%) out of 60 patients. In 11 patients who had inducible ischemia, 9 (81.82%) had W/H ratio above normal levels. So W/H ratio in above normal levels is a proxy marker for cardiac risk. This finding coincides with majority of the studies worldwide.

CONCLUSION

Even though Males were more, not much sex difference observed in the incidence of type 2 diabetes mellitus. Most number of the patients belong to 5th decade. Commonest lipid abnormality observed in our patients is hypertriglyceridemia. None of our patients had resting ECG changes and 2D ECHO cardiac abnormalities. 18.33% (11 out of 60) of Asymptomatic diabetics showed inducible ischemia on TMT without symptoms of angina. We had low incidence of family history of diabetes (4%). All the patients who had family history showed inducible ischemia. Truncal obesity which is measured as waist/hip ratio is better indicator of silent ischemia in diabetes than BMI. Autonomic neuropathy was detected in 4 out of 11 asymptomatic diabetics those showed inducible ischemia on TMT. Thus the present study shows patients with type 2 diabetes of longer duration particularly after 4th decade should undergo evaluation for inducible ischemia even though they are asymptomatic.

References

1. Grundy SM, Brewer B, Cleeman JI *et al.* Definition of metabolic circulation 2004; 109:433-8.
2. Hattersley AT. maturity onset diabetes of the young; clinical heterogeneity explained by genetic heterogeneity *Diabetic med* 1998;15: 15:24.
3. Lawrence HB, Pancreas, Edinburgh. Chapter 12 in *Grays Anatomy*, Churchill Living stone, 1995, 1790 PP.
4. Silent myocardial ischemia in asymptomatic diabetes occur frequently and in association with autonomic dysfunction, suggesting that diabetic neuropathy may be implicated in the mechanism of silent myocardial ischemia – Donald A. Weiner, MD, *et al* 1991 – *Diabetic Care*.
5. Silent Myocardial ischemia was more frequent in diabetic patients than none diabetics. *Anatoly Langer, MD, et al* 1991 – *Diabetic Medicine*.
6. Study confirming the prevalence of asymptomatic myocardial ischemia in diabetics – Mutaji naka MD, *et al*; 1992 pg: 130-160.
7. National centre for Health Statistics 1998 by Mckinaly, Marceall L. *Lancet* 2000; 356; 757-61.
8. Mc Keigne Pm. Ethnic variation in insulin resistance and risk of type of diabetes. In Reaven G, Laws A (Eds). *Insulin resistance the Metabolic syndrome X* Totowa, NJ: Humana press, 1999, 19-33.
9. Reaven GM, Role of insulin resistance in human disease *Diabetes* 1988; 37; 1595-601.
10. *Diabetic Medicine* – 23 (7) (PP 775-779) 2006.
11. *Middle East Journal of Emergency Medicine*; 6 (1) (PP 25-31), 2006.