



The prevalence of the long term complications of type 2 Diabetes Mellitus at the time of diagnosis.

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Abstract

Background and objectives: Diabetes mellitus is a significant health problem. The prevalence of diabetes in all age groups worldwide was 2.8% in 2000 (177million) and expected to rise 4.4% in 2030 (366 million). The natural history of diabetes leads to development of chronic complications that include macro vascular complications like coronary heart disease, cerebrovascular disease and peripheral vascular disease, micro vascular complications like nephropathy, neuropathy and retinopathy.

Studying the prevalence of complication of diabetes gives opportunity to screen for complications and earlier treatment and prevention of progression. This dissertation aims at studying prevalence of the long term complications of type 2 diabetes at the time of diagnosis.

Methods: 50 newly detected T2DM patients were included in the study. A through history was taken and clinical examination was done. Diabetes was diagnosed according to ADA criteria if FBS \geq 126 mg/dl. Investigations like CBC and peripheral smear, FBS, PPBS, HbA1C, ECG, Lipid profile, Urine examination, RFT, Microalbuminuria/24 hours urinary protein, Fundus examination, 2D-ECHO were done.

Results: 50 newly detected T2DM patients were studied out of which 58% were male and 42% were female. Out of 50 patients 44% had one or more diabetes related long term complication at the time of diagnosis. Out of 44% patients with complications 55% were males and 45% were females. 40-60 years age group comprised the largest group (52%) in this study who were newly detected and this group had highest complications. Macro vascular complications were 50% and Micro vascular complications were 50%. CAD prevalence was 16% in this study males were more affected then females. Hypertension was associated significantly with CAD ($p < 0.002$). Over weight/obesity (62.5%), hypertension (75%), hypercholesterolemia (37.5%) and Nephropathy (12.5%) were associated co morbid conditions.

The prevalence of CVD was 8%. Males and females were equally affected. The prevalence of PVD in this study was 6%. Males 67% and females 33%. Diabetic retinopathy was found in 8% of study group of which males and females were equally affected. The prevalence of diabetic neuropathy was 12%, males and females were equally affected. The prevalence of nephropathy was 10%.

Conclusion: Coronary artery disease was the most common long term complication present at the time of diagnosis. Diabetic neuropathy was the common micro vascular complication at the time of diagnosis followed by diabetic nephropathy.

The prevalence of hypertension and obesity was high in patients with long term complications at the time of diagnosis.

Keywords: Type 2 Diabetes mellitus, American Diabetes Association, Coronary Artery Disease, Cerebrovascular Disease and Peripheral Vascular Disease.

Introduction

Overview: Diabetes mellitus is a significant health problem. Diabetes has traditionally been divided into Insulin-dependent (type 1) and non-insulin-dependent (type 2) diabetes. An epidemic of type 2 diabetes is occurring across the world, particularly affecting developing countries. No where the diabetes epidemic more pronounced than in INDIA as WHO reports 35 million cases of diabetes in 2007, earning the name Diabetes capital of World.¹

The prevalence of diabetes in all age groups worldwide was 2.8% in 2000 (171 million) and expected to rise 4.4% in 2030 (366 million).² Urbanization, industrialization, westernization and sedentary life styles lead to many fold increase in prevalence in south India.

The natural history of diabetes leads to the development of chronic complications that include macro vascular complications like coronary heart disease, cerebrovascular disease and peripheral vascular disease; micro vascular complications like nephropathy, neuropathy and retinopathy.³ Diabetes as a single disease affects nearly all organ systems of the body. Chronic complications of diabetes develop from the cumulative effects of altered metabolic milieu and the resultant tissue toxicity.

Diabetic kidney disease is leading cause of end stage renal disease and diabetic eye disease is commonest cause of blindness in people below 65 years. The prevalence of chronic complications varies widely in different studies and in south India prevalence of macro vascular complications was high at time of diagnosis. This dissertation will focus on chronic complications of type 2 diabetes mellitus at the time of diagnosis.

Objectives of the study

Large scale morbidity, mortality, disability and health expenditure are attributable to diabetes, thus making it a major public health problem. The majority of diabetes burden is due to associated chronic complications that include retinopathy, nephropathy, neuropathy and cardiovascular disease. Studying prevalence of complications of diabetes gives opportunity to screen for complications and earlier treatment and prevention of progression. This study prevalence of the long term complications of type 2 diabetes at the time of diagnosis of diabetes.

Background

The risk of chronic complication increases as a function of the duration of hyperglycaemia, they usually become apparent in the second decade of hyperglycaemia. Since type 2 diabetes mellitus often has the long asymptomatic periods of hyperglycaemia, many individual with type 2 diabetes mellitus have complication at the time of diagnosis. The vascular complication of diabetes mellitus are further subdivided into micro vascular (retinopathy, neuropathy, nephropathy) and macro vascular complication (coronary artery disease, peripheral arterial disease, cerebrovascular disease). Non vascular complication includes problems such as gastro paresis, infections, and skin changes.²

In a study of diabetes and its long term complication in general practice by Reenders K, et al shown that the prevalence of long term complications at the time of presentations were greater in the previously unknown cases of diabetes mellitus than those on regular treatment. The complication detected in the 509 screened patients were retinopathy (14%), nephropathy

(57%), neuropathy (68%), microangiopathy (53%) proliferative retinopathy and neuropathy (57%), diabetic foot (2.6%) and renal failure (2.6%)⁴ 597 newly diagnosed diabetic patient (201) women mean +/- SD age 42.3 +/-6.2 years to determine the prevalence of diabetic complication. Neuropathy (25%) nephropathy (29%) retinopathy (15%) coronary vascular disease (21%) stroke (5.6%) peripheral vascular disease (4.8%) hypertension (23%) obesity (16%) hypercholesterolemia (11%) hypertriglyceridemia (14%) and low HDL (12%).⁵

Prospective study of newly diagnosed type 2 diabetes mellitus 292 patients macro vascular disease was more prevalent in south Asia (15.7% Vs 9.4% p<0.001) as was micro vascular disease (27.3% Vs 16.5% p<0.001) retinopathy (17.5% Vs 7.9% p<0.001) nephropathy (18.1% Vs 7.8% p<0.001). South Asia has trend towards waist hip ratio (95 Vs 90 and higher BP 127/80 Vs 123/76 mm Hg) HDL was lower (1 Vs 1.3mmol/l p<0.001) and fasting triglyceride higher (1.9 Vs 1.5mmol/l p<0.001) in south Asia.⁶

Occlusive coronary artery disease and concomitant congestive heart failure accounts for more than 70% of mortality in all patients with diabetes. Although this phenomenon is generally noted after 15 or more years of diabetes, it may be the initial finding in some patients with diabetes mellitus.

Risk Factors for Diabetes¹: The main risk factors for high prevalence of diabetes among Asian-Indians are:

Genetic predisposition: Certain unique clinical and biochemical characteristic of this ethnic group called as Asian Indian Phenotype is considered to be major factor contributing to increased predilection for Diabetes.

1. Abnormalities in Asian Indian Phenotype are:

1. Central Obesity: despite low body mass index Indians has high waist circumference and waist to hip ratio.
2. Low levels of protective adiponectin levels & increased adipose tissue metabolites.

3. High levels of high sensitive C-reactive protein levels

4. Familial Aggregation: Asian Indians have strong familial aggregation of diabetes with high prevalence among first degree relatives.

5. Epidemiological Transition includes Improved nutrition, better hygiene, control of many communicable diseases, improved access to quality health care resulted in increased longevity that led to rapid rise of Diabetes.

6. Migration and Urbanization

Chronic Complications

Type 2 diabetes is a disease that is associated with high mortality and morbidity from macro vascular and micro vascular complications. It is largely the complications associated with the disease which make it a major public health problem. The onset of type 2 diabetes is usually subtle and many years may elapse before the diagnosis. It is estimated that a gap of 9-12 yrs exists between the onset of type 2 diabetes and its diagnosis.

The first indication of presence of type 2 diabetes may actually be detected at the time of diagnosis of diabetic complication. One UK study showed that around 50% of newly diagnosed type 2 diabetes patients already had an indication of diabetes related complications. Mortality due to coronary heart disease in diabetics is 2 -4 times higher than non diabetics. Diabetes is the leading cause of end stage renal failure in developed and developing countries.

Lower extremity amputations are 10 times more common in diabetics than in non diabetics and more than half of non traumatic lower limb amputations are due to diabetes. In developed countries diabetes is the leading cause of visual impairment and blindness.

Natural history:

The natural course of diabetic nephropathy is characterized by a mean rate of decline in GFR of 10-15 ml/min/year ranging from 0-25 ml/min/year.

Table: 1. Definitions of Abnormal Urinary Albumin Excretion

	Albumin: creatinine ratio (Mg/mmol)	Overnight urine collection ($\mu\text{g}/\text{min}$)	24-hurine collection (Mg/24h)
Normoalbuminuria Female Male	<2.5 <3.5	<20	<30
Microalbuminuria Female Male	2.5-30 3.5-30	20-200	30-300
Macroalbuminuria Female Male	>30 >30	>200	>300

Screening: Screening for diabetic nephropathy must be initiated at the time of diagnosis in patients with type 2 diabetes, since 7% of them already have microalbuminuria at that time.

If microalbuminuria is absent, the screening must be repeated annually

Macrovascular Complications: The prevalence of macro vascular disease is markedly increased amongst individuals with diabetes. Its major clinical manifestations are the consequences of atherosclerosis of coronary arteries, cerebral arteries, and large arteries of extremities. The deadly triangle of coronary artery disease (CAD), cerebrovascular disease, and peripheral vascular disease is the major cause of mortality and morbidity in diabetic population. Epidemiological data shows that diabetes is an independent risk factor for macro vascular disease.

Risk Factors-Conventional risk factors like smoking, hypertension, obesity play minor role in Asian Indian diabetics and the following factors play major role: Decreased physical activity Increased central obesity Increased insulin resistance Increased lipoprotein (a) levels Increased triglycerides Decreased HDL cholesterol.

Increased plasminogen activator inhibitor-1
Decreased tissue plasminogen activator.

Materials and Methods

Source of population: This study was conducted at SAIMS Hospital in Department of General Medicine during period of 1 January 2018, 31 January 2019.

50 newly detected type 2 diabetes patients were recruited from those attending medical outpatient department and emergency department were included in this study.

These patients presented with various complaints, few with classical symptoms of diabetes and few with symptoms of diabetes related complications and others with inter current illnesses.

Inclusion criteria: Newly detected type 2 diabetes mellitus

Exclusion criteria: Type 1 diabetes mellitus
Gestational diabetes mellitus

Type 2 diabetes patients already on treatment.

Methodology: All 50 members that participated in the study were enquired for the presence of symptoms of diabetes related long term complications, with the help of predesigned proforma that contained symptom questionnaire validated in previous studies (WHO).

Family history obtained regarding Diabetes, hypertension, obesity, CAD General examination to detect signs of insulin resistance (acanthosis), hyperlipidemia (xanthelesmas) was conducted.

Assessment of complications: Retinopathy, Neuropathy, Nephropathy, Coronary Heart Disease, Cerebro Vascular Disease, Peripheral Vascular Disease.

Results

Table 2: Age and Sex Distribution of study group.

	20-40 yrs	40-60 yrs	60 yrs
Males with complications	2	6	4
Males without complication	4	9	4
Females with complication	2	5	3
Females without complication	2	6	3
Total	10	26	14

Total numbers of patients were 50, out of which 29 were male and 21 were female patients.

age compromised largest group in the study also largest group with complications.

Out of 50 patients 44% had one or more diabetes related long term complications at time of diagnosis. 40-60 year age group occupied 52%, >60 year age group 28% and 20-40 year age group occupied 20% of population.

Sex: Out of 22 people who had complication 12 were male and 10 were female. Out of 28 people without complications 17 were male and 11 were female. Prevalence of complications was high in males (12) than in females (10).

Table 3: Prevalence of Associated Comorbidities.

	HTN	Overweight/obesity	High cholesterol	High triglycerides	smoking	alcohol	F h/o
Total	17	19	10	10	15	16	9
With Complications	9	10	6	4	8	9	4
Without complications	8	9	4	6	7	7	5

Out of 50 subjects hypertension was present in 34 % people. Hypertension was more common in patients with complications (18%) than in patients without complications (16%).

complications (20%), than in non-complication group. High Cholesterol levels and triglyceride levels were prevalent equally in both groups. The prevalence of smoking was high in group with complications (16% Vs14%). Family history of diabetes was present in 18% of people with diabetes.

The prevalence of overweight or obesity was 38%. It was more prevalent in group with

Table 4: Risk Factor Profile in Diabetic Nephropathy.

Category	Number (percentage)
Total prevalence	5/50 (10%)
SEX	
Male	3/5 (60%)
Female	2/5 (40%)
Hypertension	3/5 (60 %)
Smoking	3/5 (60 %)
HbA1C>6.5	3/5 (60%)
Alcohol	2/5 (40%)
Hypercholesterolemia	2/5 (40%)
Obesity	2/5 (40%)
Hypertriglyceridemia	1/5 (20%)

Table 5: Prevalence of Various Complications in the Group with Complications at Diagnosis

Complications	Prevalence
Macrovascular complications	50%
Coronary artery disease	27%
Cerebrovascular disease	13%
Peripheral vascular disease	10%
Microvascular complications	50%
Diabetic Neuropathy	20%
Diabetic Nephropathy	17%
Diabetic Retinopathy	13%

Macrovascular complications were 50% and Microvascular complications were 50%.

Most prevalent complication was coronary artery disease (27%) followed by diabetic neuropathy (20%) and diabetic nephropathy (17%).

Conclusion of Observations

Table 6: Comparison of the Study Group Characteristics

	Total study group (Mean with SD)	Group with Complications (Mean with SD)	Group without complications (Mean with SD)
SEX	50	22	28
AGE	52.10 ± 11.12	52.33 ± 10.95	52.02 ± 11.34
BMI	23.47 ± 3.31	22.98 ± 4.03	23.69 ± 2.89
WHR	0.91 ± 0.14	0.88 ± 0.15	0.92 ± 0.14
Systolic BP	130.84 ± 22.34	129.60 ± 19.48	131.37 ± 23.71
Diastolic BP	80.84 ± 12.86	78.53 ± 11.25	81.82 ± 13.52
FBS	162.90 ± 18.82	162.67 ± 19.17	163.00 ± 18.95
S. Cholesterol	168.25 ± 48.72	198.13 ± 52.11	155.46±41.72
S. Triglycerides	157.66 ± 116.72	217.00 ± 153.81	132.72 ± 87.61

Table 7: Comparison of Risk Factors Prevalence in Study Group

category	number	Group with complications	Group without complications
total	50	22	28
Sex	50		
Males	29	12	17
Females	21	10	11
hypertension	17	9	8
Overweight	19	10	9
Smoking	15	8	7
Alcohol	16	9	7
S. cholesterol	10	6	4
S. triglyceride	10	4	6
FH/O diabetes	9	4	5

Table 8: Complications of Risk Factors Prevalence in Study Group

CAD	8	8
CVD	4	4
PVD	3	3
Neuropathy	6	6
Nephropathy	5	5
Retinopathy	4	4

Discussion

Diabetes mellitus a chronic disease affecting many individuals in India, has increased over the past two decades and expected to continue in epidemic proportions.

This increase has been attributed to the rapid economic, demographic and nutritional transition experienced in India. Diabetes is a significant public health issue with many types of adverse outcomes and disability. The overwhelming majority of diabetes morbidity and mortality is associated with chronic complications including retinopathy, neuropathy, nephropathy, peripheral vascular disease and cardiovascular disease. Type 2 diabetes mellitus is an insidious illness with a long preclinical asymptomatic phase. Patients may be exposed to the ill effects of asymptomatic hyperglycemia for many years before they are diagnosed. Patients with type 2 diabetes have evidence of diabetic tissue damage at the time of diagnosis.

In this study 50 newly detected type 2 diabetes patients were evaluated for presence of chronic complications using screening tests that were validated in previous studies at the time of diagnosis. Comorbid conditions like hypertension, obesity, and dyslipidemias were also noted. In this study out of 50 members 58% were male and 42% were female. 44% had complications related to diabetes at the time of diagnosis. (many studies have shown up to 50% people have chronic complications at time of diagnosis.⁷

Out of 44% with complications 55% were males and 45% were females. 40-60 year age group comprised the largest group (52%) in this study who were newly detected and this group had highest complications. This is in accordance with WHO report that type 2 diabetes is detected a decade earlier in Asians compared to western countries.

This study showed high prevalence of diabetes related long term complications in this group comparable to other studies in southern India. Coronary artery disease, neuropathy and nephropathy accounted for majority of cases in this group.

While a genetic predisposition to develop complications cannot be discounted, exposure to longer period of asymptomatic hyperglycemia due to poor access to adequate health care facilities, lack of awareness and education and low socioeconomic status may be contributory to this high prevalence of complications at the time of presentation.

This study sample may not represent the whole population but it has shown high prevalence of complications and hence chance for primary prevention. Through early detection by proper screening and early treatment impact of these long term complications can be modulated.

Conclusion

The prevalence of the long term complications of type 2 diabetes was as high as 50% in both macrovascular and microvascular complications at the time of diagnosis.

Coronary artery disease was the most common long term complication present at the time of diagnosis. Diabetic neuropathy was the common micro vascular complication at the time of diagnosis followed by diabetic nephropathy.

The prevalence of hypertension and obesity was high in patients with long term complications at the time of diagnosis.

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