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Clinical Profile and Carotid Intima thickness of Patients with Diabetes Mellitus

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Abstract

Under normal physiological conditions plasma glucose concentrations are maintained within a narrow range despite wide fluctuations in supply and demand through a tightly regulated and dynamic interaction between tissue sensitivity to insulin (especially in liver) and insulin secretion. After initial screening, demographic details of the patient like patient identifier, age, gender, height, weight, smoking history, alcoholism history were recorded in case record form (CRF). Other relevant history like history of coronary artery disease (CAD), history of stroke or transient ischemic attacks (TIAs), history of peripheral arterial disease, autonomic neuropathy, retinopathy and renal disease was also noted in CRF. Mean values of fasting and post prandial blood sugar levels were 128.20±19.80 and 172.82±14.85 respectively. Glycated hemoglobin (HbA1c) mean level was 8.36±0.28. Mean duration of Diabetes was 11.16±2.12 years.

Keywords: Carotid Intima Thickness; Diabetes Mellitus; HbA1c.

Introduction

According to the Indian Council of Medical Research-Indian Diabetes study (ICMR-INDIAB), a national Diabetes study, India currently has 62.4 million people with Diabetes. This is set to increase to over 100 million by 2030. The majority of people with diabetes (90%) have Type 2 diabetes (T2DM). While T2DM predominantly affects older individuals in developed countries, in developing nations like India, it affects the younger population in the prime of their working lives and thus poses an even greater threat to the health of these individuals. This epidemic of Diabetes is unfortunately paralleled by a corresponding increase in the prevalence of its complications, both microvascular and macrovascular, which account for much of the premature morbidity and mortality due to Diabetes in India [1].

Given the rapid escalation of the Diabetes epidemic, all levels of prevention (primary, secondary and tertiary Diabetes prevention) need to be put into action simultaneously. Unfortunately, more than 50% of people with T2DM remain undiagnosed. Thus the priority is to screen, diagnose and treat as many people with T2DM as possible. In a hugely populated country like India with over 1.2 billion people with diverse cultures, the screening and diagnosing methods for Diabetes should be simple, cost-effective and less time - consuming and should also take into consideration the unique risk factors for and increased susceptibility to, T2DM that the Asian Indians have. The latter is referred to as the "Asian Indian Phenotype" [2].

Under normal physiological conditions plasma glucose concentrations are maintained within a narrow range despite wide fluctuations in supply and demand through a tightly regulated and dynamic interaction between tissue sensitivity to insulin (especially in liver) and insulin secretion. In type 2 Diabetes these mechanisms break down with the consequence that the two main pathological defects in type 2 Diabetes are impaired insulin secretion through a dysfunction of the pancreatic β-cell and impaired insulin action through insulin resistance. Type 2 Diabetes Mellitus has a greater genetic association than type 1 DM.

The pathogenesis of type 2 Diabetes Mellitus is

characterized by impaired insulin secretion and insulin resistance. The 100% concordance rate in identical twins is thought to be over-estimated due to a selection or reporting bias. A population based twin study in Finland has shown a concordance rate of 40% and environmental effect may be a possible reason for the higher concordance rate for type 2 Diabetes Mellitus than for type 1 Diabetes Mellitus [3].

T2DM is a complex polygenic disorder in which common genetic variants interact with environmental factors to unmask the disease. Genetic factors are known to play an important part in the development of T2DM as exemplified by rare monogenic subtypes, the high prevalence in particular ethnic groups and its modification by genetic admixture and the difference in concordance rates between monozygotic and dizygotic twins. However, the role genetics plays in the development of Diabetes is poorly understood. Among all T2DM susceptibility genes studied before 2006 only two were found to be convincingly associated, P12A variant in Peroxisome Proliferator Activated Receptor Gamma (PPARG**)** gene (encoding the target for the Thiazolidinedione class of drugs used to treat T2DM**)** and E23K in potassium inwardly rectifying channel, subfamily J, member 11 (KCNJ11) (which encodes part of the target for another class of Diabetes drug, the Sulphonylureas). But these have only modest effect on disease risk (odds ratio~1.2) [4].

Replication of significant associations of ENPPI with risk of obesity and T2DM in some but not all is intriguing. The basis of such heterogeneity is poorly understood. Recently, the first GWA scans for T2DM in East Asian subjects have revealed novel susceptibility loci, the potassium voltage-gated channel, KQT like subfamily, member 1 gene (KCNQ1). Variants in KCNQ1 have been shown to influence Diabetes risk. This new discovery, using samples of East Asian origin, highlights the importance of extending these studies to a wider range of populations. Variants in another new gene, Melatonin Receptor 2 (MTNR1B) have been shown to be associated with increased risk of type 2 Diabetes and impaired early insulin secretion [5].

Type A insulin resistance is hereditary and type B is an autoimmune disorder. Insulin resistance is insufficient to cause overt glucose intolerance but may play a significant role in cases of obesity where there is known impairment of insulin action. Insulin resistance by itself may be a secondary event in type 2 DM, since it is also found in non-Diabetic obese individuals. Insulin secretion defect may be the primary event presenting as impaired pulsatile secretion of insulin. Hence, hyperglycemia is an inducer as well as a consequence of impaired Islet cell function and insulin resistance. Many factors contribute to the insulin insensitivity including obesity and its duration, age, lack of exercise, increased dietary fat and decreased fibres and genetic factors [3].

Methodology

After initial screening, demographic details of the patient like patient identifier, age, gender, height, weight, smoking history, alcoholism history were recorded in case record form (CRF). Other relevant history like history of coronary artery disease (CAD), history of stroke or transient ischemic attacks (TIAs), history of peripheral arterial disease, autonomic neuropathy, retinopathy and renal disease was also noted in CRF.

As a part of routine evaluation of patients suffering from T2DM, blood chemistry and other investigations are performed at this tertiary care centre. Blood investigations parameter values of hemoglobin (%), Fasting Blood Sugar (FBS) after minimum 10-hour overnight fast and Post-Prandial Blood Sugar (PPBS) after 2-hour of lunch (mg/dL), hemoglobin A1c level (%), serum lipid profile - Total cholesterol (TC), triglycerides (TG), renal parameters like serum creatinine, Urea (mg/dL) were noted in CRF. Urinalysis parameters studied were routine microscopy to rule out urinary infection and Urinary Albumin: Creatinine Ratios (UACR) were also noted in CRF.

Results

Of 100 patients enrolled in the study, majority of patients were in age groups 51 – 60 and 61 – 70 years with 39.00% patients in each group. From remaining 22, six were below 40 years, five were above 71 years and 11 were in age group of 41 – 50 years (Table 1).

Percentages of males and females were equal with 50.00% each being enrolled in the study (Table 2).

Mean (±SD) age of the patients was 58.67±7.07; mean body mass index was 26.34 ± 0.92, mean value of waist: hip ratio was 0.87 ± 0.03, mean systolic BP was 136.84±21.21 and diastolic BP was 81.62±12.73. Amongst blood investigation, mean hemoglobin was 10.34±1.41, mean cholesterol was 192.80 ± 0.00, mean triglyceride levels were 144.87±21.21, mean serum creatinine was 01.60±0.57 and mean value of carotid intima-media thickness was 0.91 ± 0.01 (Table 3).

Table 1: Age group wise distribution of patients in study

Age group (years) (N=100)	N	Percentage
≤ 40	6	6.0%
41 – 50	11	11.0%
51 – 60	39	39.0%
61 – 70	39	39.0%
≥ 71	5	5.0%

Table 2: Gender-wise distribution of patients in the study

Gender (N=100)	n (%)
Males	50 (50.0%)
Females	50 (50.0%)

Table 3: Baseline characteristics of patients

Characteristic (N=100)	Value (Mean ± Std. deviation)
Age (years)	58.67 ± 7.07
BMI (Kg/m^2)	26.34 ± 0.92
WHR	0.87 ± 0.03
SBP (mmHg)	136.84 ± 21.21
DBP (mmHg)	81.62 ± 12.73
Hb (gm %)	10.34 ± 1.41
Total cholesterol (mg/dL)	192.80 ± 0.00
Serum Triglycerides (mg/dL)	144.87 ± 21.21
Serum Creatinine (mg/dL)	01.60 ± 0.57
Carotid intima-media thickness (CIMT) (mm)	0.91 ± 0.01

Table 4: Diabetes parameters in study patients

Parameters	Value (Mean ± SD)
Fasting Blood Sugar (mg %)	128.20 ± 19.80
Post-Prandial Blood Sugar (mg %)	172.82 ± 14.85
Glycated Hemoglobin (%)	8.36 ± 0.28
Duration of Diabetes (years)	11.16 ± 2.12

Table 5: Carotid intima thickness levels in study patients

CIMT (mm)	n (%)
≤ 0.90 (Normal)	29 (29.00%)
> 0.90 (increased)	71 (71.00%)

Mean values of fasting and post prandial blood sugar levels were 128.20 ± 19.80 and 172.82 ± 14.85 respectively. Glycated hemoglobin (HbA1c) mean level was 8.36 ± 0.28. Mean duration of Diabetes was 11.16 ± 2.12 years (Table 4).

There were 29.00% patients who had normal CIMT (≤ 0.90 mm) and 71.00% patients had increased CIMT (> 0.90 mm) (Table 5).

Discussion

Diabetes Mellitus is one of major growing pandemic of the century. Today, there are 382 million people living with Diabetes. A further 316 million with impaired glucose tolerance are at high risk from the disease – an alarming number that is set to reach 471 million by 2035. Diabetes is on the rise all over the world and countries are struggling to keep pace. A staggering 80% of people with Diabetes live in low and middle income countries and the socially disadvantaged in any country are the most vulnerable to the disease. Today's emerging Diabetes hotspots include countries in the Middle East, Western Pacific, sub-Saharan Africa and South-East Asia where economic development has

transformed lifestyles. These rapid transitions are bringing previously unheard of rates of obesity and Diabetes. Developing countries are facing a firestorm of ill health with inadequate resources to protect their population. Without concerted action to prevent Diabetes in less than 25 years time there will be 592 million people living with the disease. Diabetes is now become prominent global health agenda with specific targets for access to essential medicines and for halting the growth of obesity and Diabetes [6].

Diabetes is associated with a number of complications. Acute metabolic complications associated with mortality include Diabetic ketoacidosis, hyperosmolar coma. But arguably the most devastating consequence of Diabetes are its long term vascular complications. These complications are wide ranging and are due at least in part to chronic elevation of blood glucose levels which leads to damage of blood vessels and the resulting complications are grouped under "Microvascular disease" and "Macrovascular disease" [7].

Cardiovascular disorders in Diabetes include premature atherosclerosis, manifest as myocardial infarction and stroke as well as impaired cardiac function, predominantly diastolic dysfunction [8]. Diabetes Mellitus is also one of the major risk factor for peripheral arterial disease especially important in the development of Lower Extremity Artery Disease (LEAD). This is certainly true for severe disease notably gangrene and ulceration but for intermittent claudication the strength of the association with Diabetes may be comparable with that for coronary heart disease. The association of Diabetes with LEAD is inconsistent on multivariable analysis which includes other risk factors but it appears that the duration and severity of Diabetes affect the level of risk [9].

Diabetic nephropathy represents the major cause of end-stage renal failure. Diabetic retinopathy is characterized by a spectrum of lesions within the retina and is the leading cause of blindness among adults aged 20–74 years. More than half of all individuals with Diabetes eventually develop neuropathy with a lifetime risk of one or more lower extremity amputations estimated in some populations to be up to 15% [10].

Conclusion

In this prospective study, we studied 100 patients of type 2 Diabetes Mellitus. Of 100 patients, maximum numbers of patients were in age range of 51 to 70 years with equal numbers of males and females. BMI of patients was in overweight range. Diabetes was found to be in uncontrolled state as suggested by mean HbA1c levels of 8.36. Mean duration of Diabetes was 11.16 years reflecting long-standing disease status.

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