PREVALENCE OF TYPE II DIABETES MELLITUS IN HEALTHCARE RESOURCE LIMITED SETTINGS OF SOUTH INDIA

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ABSTRACT
India is a vast country with populations differing in racial admixture as well as in social and cultural habits. It is likely that the prevalence of non insulin dependent diabetes mellitus (type 2 diabetes) could also be different in various races due to genetic and environmental differences. The current retrospective study of six month duration was designed to assess the prevalence of diabetes mellitus in a secondary care referral hospital of south India, carried both in out-patients and in-patients in whom blood glucose test was suggested by physicians. Among 300 study population, total number of cases diagnosed with diabetes mellitus was 36 (58.67%) and 152 cases (50.67%) have been diagnosed as prediabetic (impaired blood sugar level). The prevalence rate of diabetes mellitus in our study population was found to be 12%. In conclusion, there is a need for a large well planned national study to know the prevalence of diabetes and pre-diabetes and the complications of diabetes in India. It will help in proper policy making & take action against diabetes in India.

KEYWORDS: Epidemiology, endocrine disorder, non insulin dependent diabetes mellitus, retrospective study.

INTRODUCTION

Epidemiology is the study of the distribution and determinants of disease frequency in man. The application of epidemiology to the study of Noninsulin Dependent Diabetes Mellitus (NIDDM) has provided valuable information on several aspects of this disease such as its natural history, prevalence, incidence, morbidity and mortality in diverse populations around the world. [1] In addition, it has led to the identification of the cause of the disease and the possible preventive measures that could be instituted to arrest or delay the onset of this disease which has reached epidemic proportions in both the developed and the developing nations. [2]

The prevalence of NIDDM varies in different geographic regions and also in different ethnic groups. [3] The first authentic data on the prevalence of diabetes in India came from the multicentric study conducted by the Indian Council of Medical Research (ICMR) in the early seventies. [4] This study reported a prevalence of 2.3% in the urban and 1.5% in the rural areas. The criteria used in this study were different from those set by the WHO Expert Committee on Diabetes Mellitus.

Many epidemiological studies carried out in different parts of the world reported an interesting finding that Indian migrants settled abroad had a high prevalence of NIDDM [5] which was believed to be due to greater affluence and a change to a more sedentary life style as compared to the native Indian population.

However, the local host populations living in identical environment in these countries still had only a low prevalence rate of diabetes. Assuming that Indians as an ethnic group have a high degree of genetic predisposition to develop diabetes, one could expect higher prevalence of diabetes among the native urban populations with a comparable affluent life style.

Recent studies by Verma et al [6] using a questionnaire method reported a prevalence of 3.1% in an affluent area in Darya Ganj, New Delhi. Our own studies using the WHO criteria showed a prevalence of 5% in an urban township in south India. [5], [7]

"Today on the eve of the twenty first century, we see that the world health situation is no longer that clear cut and simple. Many developing countries have made great

progress in combating infectious diseases and malnutrition, thereby improving the length and quality of life of their people. But rapid urbanization and industrialization in those same countries, together with the adoption of modern life style that adversely affect health have brought new problems in the form of chronic non-communicable diseases. [8]

In many developing countries these new problems are arriving before the old one's are resolved leading to a double burden of the disease," Nakajima H, Director General, WHO 1991. [9]

"Diabetes Mellitus (DM) can no longer be considered a disease of affluent nation alone, it has become a global problem, a major epidemic of the twentieth century, and one which shows no sign of abating". [10] DM now affects a higher proportion of persons in many developing countries than it does in Western countries where two or three percent of the population is affected. This trend has been linked with the increasing life expectancy, rural urban shifts, moves from traditional to modern life style, change in diet and physical inactivity and obesity. [11] DM today affects over 50 million people in the world and about one half of them are living in the developing world.

Diabetes mellitus is a group of chronic metabolic conditions with elevated blood glucose levels due to the body's inability to produce insulin (or) resistance to insulin action (or) both. [12] The etiology of the disease is multi-factorial in nature. Some of the prime risk factors for the onset of diabetes and its associated complications include body mass index (BMI), [13], [14] age, [15], [16] ethnicity, [17] family history, [17], [18] sedentary life style and lack of physical activity, [19], [20] sex. [16], [21] many set of genes, [22] socio-economic status, [23] waist-hip ratio, [24] and systolic blood pressure. [25] Studies on diabetes prevalence show that around 6-12% in urban and 2-3% in rural Indian populations is recorded. [26], [27] An accelerated increase of diabetes is noticed in tribal (or) aboriginal populations worldwide. [28] Developing nations especially south east Asian countries show increasing level of Type-2 diabetes. [29]

Causes of the rise in prevalence of diabetes
Genetic predisposition: Several studies on migrant Indians across the globe have shown that Asian Indians have an increased risk for developing type 2 diabetes and related metabolic abnormalities compared to other ethnic groups. [30], [31], [32] Although the exact reasons are still not clear, certain unique clinical and biochemical characteristics of this ethnic group collectively called as the "Asian Indian phenotype" is considered to be one of the major factors contributing to the increased predilection towards diabetes. [33], [34] Despite having lower prevalence of obesity as defined by body mass index (BMI), Asian Indians tend to have greater waist circumference and waist to hip ratios [35] thus having a greater degree of central obesity. Again, Asian Indians

have more total abdominal and visceral fat for any given BMI [36] and for any given body fat they have increased insulin resistance [37]. Moreover, they have lower levels of the protective adipokine adiponectin and have increased levels of adipose tissue metabolites [38]. Studies on neonates suggested that Indian babies are born smaller but relatively fatter compared to Caucasian babies and are referred to as "the thin fat Indian baby" [39], [40] A recent study confirmed this finding and suggested that the "thin fat phenotype" in neonates persisted in childhood and could be a forerunner of the diabetogenic adult phenotype. [41]. These findings suggest that Asian Indians are more prone to diabetes and related metabolic abnormalities. Genetic factors that determine body fat distribution and glucose metabolism have to be fully elucidated for the better understanding of the biochemical and molecular mechanisms behind the etiopathogenesis of diabetes.

Our studies have shown that while some genes seem to confer increased susceptibility to diabetes in Indians [42],[43], some protective genes in Europeans do not appear to protect Indians.[44] These genetic issues are discussed elsewhere in the same issue. [45]

The epidemiological transition
The dramatic rise in the prevalence of type 2 diabetes and related disorders like obesity, hypertension and the metabolic syndrome could be related to the rapid changes in life style that has occurred during the last 50 yr. Although this "epidemiological transition", which includes improved nutrition, better hygiene, control of many communicable diseases and improved access to quality healthcare have resulted in increased longevity, it has also led to the rapid rise of the new-age diseases like obesity, diabetes and heart disease. Another way to explain the diabetes epidemic in these and other ethnic groups like Africans and Asian Indians is through Neel's 'thrifty genotype' hypothesis. [46] This hypothesis proposes that some genes are selected over previous millennia to allow survival in times of famine by efficiently storing all available energy during times of feast. However, these very genes lead to obesity and type 2 diabetes when exposed to a constant high energy diet. In virtually all populations, higher fat diets and decreased physical activity and sedentary occupational habits have accompanied the process of modernization which has resulted in the doubling of the prevalence of obesity and type 2 diabetes in less than a generation. Misra et al [47] reported that migration from rural areas to urban slums in a metropolitan city in India led to obesity, glucose intolerance, and dyslipidaemia. Many epidemiological studies on diabetes in migrant populations, mostly in people originating from developing countries, have reported a higher prevalence of diabetes than the host populations of those countries. Hence, our study was designed to assess the prevalence of non insulin dependent diabetes mellitus in a rural population and healthcare resource limited settings of south India.

MATERIALS AND METHODS

Study site: Department of General Medicine of a secondary care referral hospital in Andhra Pradesh, South India

Study design: Retrospective Analysis

Study duration: Six month duration (May – October 2016)

Study sample: 300 patients, the sample were taken from the patients (outdoor patients as well as admitted patients).

Inclusion criteria: Documents of patients who have been advised by clinicians for blood sugar investigations. Patients have been advised for blood sugar investigations on the basis of symptoms and signs.

Study procedure

The present study of diabetes was carried out in department of General Medicine of a secondary care referral hospital (RDT Hospitals Bathalapalli, Anantapuramu, A. P). The sample were taken from the patients (outdoor patients as well as admitted patients), who have been advised by clinicians for blood sugar investigations. Patients have been advised for blood sugar investigations on the basis of symptoms and signs. The total numbers of samples were 300 in the early 2015. These samples are tested for fasting, post prandial & random blood sugar according to requisition.

Sample Collection

1. For fasting blood sugar - 2ml blood sample has been taken in fluoride vial after overnight fasting.

2. For postprandial blood sugar - 2 ml of blood sample has been taken in fluoride vial after 2hrs of intake of 75gms of glucose.

3. For random blood sugar - 2 ml of blood sample has been taken in fluoride vial any time in a day.

Procedure

Glucose oxidase/ Peroxidase (GOD/POD) method is used for estimation of blood glucose level. In which Glucose is oxidized by glucose oxidase to gluconic acid and hydrogen peroxide. In a subsequent peroxidase catalyze a reaction, the oxygen liberated is accepted by the chromogen system to give a red coloured quinoneimine compound. The red colour so developed is measured at 505 mm & is directly proportional to glucose concentration.

Diagnostic Criteria

PG – Plasma Glucose, IFG – Impaired fasting glucose; IFG – Impaired fasting glucose; IGT Impaired glucose tolerance; FPG – Fasting plasma glucose.

RESULTS

In our study, during the study period 300 participants were assessed (both in patients and out patients) Demographic details of the participants involved in the study was categorized based on gender distribution, age distribution and nature of admission of patients in hospital the results of which were thoroughly analyzed and reported in Table No.1

Table No.1 Demographic details of the study participants (n = 300)

Sr. No	Demographic details	No. of Participants		
01	Gender Distribution			
	Male	185 (61.67%)		
	Female	115 (38.33)		
02	Age Distribution (Years)		Male	Female
	41 – 50	90	66	24
	51 – 60	120	72	48
	61 – 70	60	36	24
	71 – 80	16	10	6
	> 80	04	01	03
03	Nature of admission in Hospital		Male	Female
	In Patients	60	38	22
	Out Patients	240	130	110

In our study, out of 300 patients 61.67% (185) were male and 38.33% (115) were female and most of the patients fall in the age group of 51 - 60 years of age group, in which 72 were male and 48 were female. Based on the nature of admission of patients 60 were inpatients and 240 were out patients, following interpretation the results of which were thoroughly analyzed and reported in Table No.2

Table No.2 Participants responses to Blood Glucose Analysis

Sr. No	Diagnostic tests	Reference range	No. of Cases	Percentage
1	Normal	< 110 mg / dl for fasting cases < 140 mg / dl for PP cases < 200 mg / dl for random	112	17.33
2	Fasting impaired	110 – 126 mg / dl	78	15.33
3	Fasting diabetic	> 126 mg / dl	14	22.67

4	PP impaired	140 – 200 mg / dl	74	8.67
5	PP diabetic	> 200 mg / dl	12	20
6	Random	> 200 mg / dl	10	16

Cases with confirmed diabetes are 36 (12%) in the early 2015 during the study period respectively. Cases with impaired glucose level are 152 (50.67%) respectively.

In our study 300 cases in the early 2015 have been investigated in the department of general medicine. Total number of cases diagnosed with diabetes mellitus was 36 (58.67%) and 152 cases (50.67%) have been diagnosed as prediabetic (impaired blood sugar level). The prevalence rate of diabetes mellitus in our study population was found to be 12%.

DISCUSSION
The global figure of people with diabetes is projected to rise from the current estimates of 150 million to 220 million in 2010 and 300 million in 2015. Most cases will be of type 2 diabetes, which is characterised by insulin resistance and / or abnormal Insulin secretion. People with type II diabetes are not dependent on exogenous Insulin, but may require it for control of blood glucose levels if this is not achieved with diet alone or along with oral hypoglycaemic agent.

India has nearly 33 million diabetic subjects today; the scenario is changing rapidly due to socio – economic transition occurring both in rural and urban area also. Availability of improved mode of transport & less strenuously as in the vicinity have resulted in decreased physical activity. Better economic conditions have produced changes in diet habits. Prediabetic conditions like impaired glucose tolerance and impaired fasting glucose are also on the rise[48] indicating the possibility of further rise in the prevalence of diabetes. Several studies have shown that these prediabetic states are also high risk stages for cardiovascular disease.[49], [50]

The present study found that T2DM is a major burden in Anantapuramu, Andhra Pradesh, which is consistent with findings of Simon.[51] The main findings of the study were: 36 (12%) of cases found to be Diabetic and impaired glucose level are 152 (50.67%) prediabetic cases respectively.

Achieving good glycaemic control in diabetic subjects has proven a real challenge to healthcare providers.

CONCLUSION
In conclusion, the present study has shown the prevalence of diabetes during the study period was found to be 12% and of prediabetic 50.67% respectively which is quiet correspondent with urban prevalence of diabetes in India. Therefore, there is an need for a large well planned national study to know the prevalence of diabetes and pre-diabetes and the complications of diabetes in India. It will help in proper policy making & take action against diabetes in India.

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