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PREVALENCE OF IMPAIRED GLUCOSE TOLERANCE TEST IN FIRST DEGREE RELATIVES (>30YRS) OF TYPE II DIABETES MELLITUS PATIENTS: ORIGINAL REPORT

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ABSTRACT: CONTEXT: Patients with impaired glucose tolerance are diagnosed with difficulty in the clinical setting because of the absence of classical symptoms of the disease. Due to recent introduction of this class of glucose intolerance, and relative lack of knowledge of its clinical significance impaired glucose tolerance is still the subject of research to determine its course and prognostic implications. **AIMS:** To study the prevalence of impaired glucose tolerance in first degree relatives of type II diabetic patients, above 30 years of age. **SETTINGS AND DESIGN:** Inclusion of persons above the age of 30 years who are first degree relatives of type II diabetic, admitted in indoor or attending as outpatients in Department of Medicine, Sanjay Gandhi Memorial Hospital, Rewa, Madhya Pradesh. **METHODS AND MATERIAL:** A complete general and systemic examination and Oral GTT to be carried out on selected subjects. **RESULTS:** More than one-fourth of the subjects were found to have an impaired Oral Glucose tolerance test. None of them previously knew their oral glucose tolerance state. Total prevalence of impaired glucose tolerance found in this study was 27.27%. **CONCLUSION:** Testing for impaired glucose tolerance should be considered in all individuals at age 45 years and above and if normal it should be repeated at three year interval. Keeping in mind the results of this study, this testing should be carried out at an earlier age group, especially for the 'at risk' population

KEYWORDS: Diabetes Mellitus, Oral Glucose Tolerance Test, Impaired Glucose Tolerance.

MESH HEADING: Glucose Tolerance Test, Diabetes Mellitus.

INTRODUCTION: Diabetes mellitus afflicts a large number of people of all social strata throughout the world. The personal and public health problems of diabetes have assumed vast proportions and continue to grow despite exciting advances in the field of diabetes treatment and patient care.

The term "Impaired glucose tolerance" was introduced in 1979 by National Diabetes Data Group¹ as an intermediate category covering the grey area between unequivocal diabetes mellitus and risk free normal glucose tolerance. The impaired glucose tolerance group included those at high risk of subsequent development of diabetes mellitus but low risk of specific diabetes mellitus.

According to the criteria of the World Health Organization and the American Diabetes Association, impaired glucose tolerance is defined as two-hour glucose levels of 140 to 199 mg/dL on the 75-g oral glucose tolerance test. A patient is said to be under the condition of IGT when he/she has an intermediately raised glucose level after 2 hours, but less than would qualify for type 2 diabetes mellitus. The fasting glucose may be either normal or mildly elevated.²

Impaired glucose tolerance represents a stage in the natural history of diabetes. The annualized relative risk of a person with IGT progressing to overt diabetes is six times greater than

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people with normal glucose tolerance.³ However, many return to normal glucose tolerance spontaneously while some proportion remain in this group for many years.

Being more prevalent in obese than in non-obese persons, it is frequently, but not always associated with hyperinsulinaemia and insulin resistance. Impaired glucose tolerance may be attributable to a wide variety of causes, including certain medications. Many of these causes are specific genetic syndromes and other conditions that are also associated with diabetes mellitus.

The present study was conducted to ascertain the “Prevalence of Impaired Glucose Tolerance in First Degree Relatives (≥ 30 years of age) of Type II DM Patients” and to correlate it with various factors. This will not only lead to the earlier detection of Diabetes, but also help in the better management and prevention of complications of diabetes.

MATERIAL AND METHODS:

AIMS & OBJECTIVES:

1. To study the prevalence of impaired glucose tolerance in first degree relatives of type II diabetic patients, above 30 years of age.
2. To study the clinical profile of those who are detected to have impaired glucose tolerance.
3. Proposed counseling of newly detected diabetic patients by screening.

METHODOLOGY:

Inclusion Criteria: This study shall include persons above the age of 30 years who are first degree relatives of type II diabetic, admitted in indoor or attending on outpatient basis.

Exclusion Criteria:

1. First degree relatives of type II diabetics who are already known diabetics themselves.
2. First degree relatives of type II diabetics who are below the age of 30 years.

METHODS:

1. These persons will undergo detailed clinical evaluation.
2. A complete general and systemic examination shall be carried out including relevant anthropometric measurement such as height, weight, body mass index, waist hip ratio.
3. Oral glucose tolerance test.

ANALYSIS:

1. Prevalence of impaired GTT among first degree related of type II DM.
2. Relation of various parameters in impaired GTT.

OBSERVATIONS

| Sex | No. of Cases | Percentage (%) | Impaired GTT | Percentage (%) |
|--------------|--------------|----------------|--------------|----------------|
| Male | 74 | 61.15 | 19 | 25.67 |
| Female | 47 | 38.84 | 14 | 29.78 |
| Total | 121 | 100.0 | 33 | 27.27 |

Table 1: Prevalence of Impaired Glucose Tolerance Test (IGTT) in relation to Sex

p value 0.62

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From 121 subjects taken in present study, the total prevalence of impaired glucose tolerance was 27.27%.

| Age (in yrs) | No. of Cases (n=121) | | | IGTT (n=33) | | |
|-----------------|----------------------|-----------|------------|-------------|-------------|-------------------|
| | Male | Female | Total | Male | Female | Total |
| 30-39 | 44 | 23 | 67 | 09 (27.27%) | 06 (26.08%) | 15 (22.38%) |
| 40-49 | 18 | 13 | 31 | 04 (22.22%) | 05 (38.96%) | 09 (29.03%) |
| 50-59 | 10 | 08 | 18 | 06 (60.0%) | 03 (27.5%) | 09 (50.0%) |
| ≥60 | 03 | 02 | 05 | - | - | - |
| Total | 75 | 46 | 121 | 19 | 14 | 33 (27.27) |

Table 2: Age distribution among subjects with relation to IGTT

p value 0.26

Prevalence of impaired glucose tolerance was highest among the age group of 50-59 years (50.0%) and 40-49 years (29.03%).

| Occupation | No. of Subjects (n=121) | Percentage (%) | IGT (n=33) | Percentage (%) |
|---------------|-------------------------|----------------|------------|----------------|
| Student | 01 | 0.82 | - | - |
| Farmer | 14 | 11.57 | 02 | 14.28 |
| Laborer | 12 | 9.91 | 03 | 25.0 |
| Housewife | 33 | 27.27 | 09 | 27.27 |
| Business | 12 | 9.91 | 02 | 16.66 |
| Govt. Servant | 49 | 40.49 | 17 | 34.69 |
| Total | 121 | 100.0 | 33 | 27.27 |

Table 3: Occupational relationship of IGT among subject

p value 0.60

Government servants had highest prevalence (34.69%) of IGTT while farmers had the least prevalence of 14.28%. This could be attributed to the physical activity associated with the occupations. Thus, an occupation with a higher degree of exertion could minimize the risk of having impaired glucose tolerance.

| Residence | No. of Subjects (n=121) | Percentage (%) | IGT (n=33) | Percentage (%) |
|--------------|-------------------------|----------------|------------|----------------|
| Rural | 44 | 36.36 | 07 | 15.90 |
| Urban | 77 | 63.67 | 26 | 33.76 |
| Total | 121 | 100.0 | 33 | 27.27 |

Table 4: Relationship of IGT with residence

p value 0.03

An urban life style predisposes to a greater risk of IGTT (33.76%) compared to rural lifestyle (15.90%).

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| Diet | No. of Subjects (n=121) | Percentage (%) | IGT (n=33) | Percentage (%) |
|----------------|----------------------------|-------------------|---------------|-------------------|
| Non-vegetarian | 78 | 64.46 | 24 | 30.76 |
| Vegetarian | 43 | 35.53 | 09 | 20.93 |
| Total | 121 | 100.0 | 33 | 27.27 |

Table 5: Relationship of IGT with dietary habits among subjects

p value 0.24

Non-vegetarian diet (30.76%) was associated with a higher chance of IGTT development than a vegetarian diet (20.93%).

| Addiction | No. of Subjects (n=121) | Percentage (%) | IGT (n=33) | Percentage (%) |
|--------------|----------------------------|-------------------|---------------|-------------------|
| No addiction | 50 | 41.32 | 12 | 24.0 |
| Addiction | 71 | 58.67 | 21 | 29.57 |
| Total | 121 | 100.0 | 33 | 27.27 |

Table 6: Relationship of IGT with addiction among subject

p value 0.49

Patients with any addiction were found to have IGTT (29.57%) more than their non-addicted counterparts (24%).

| Waist Hip Ratio | No. of Subjects (n=121) | Percentage (%) | IGT (n=33) | Percentage (%) |
|-----------------|----------------------------|-------------------|---------------|-------------------|
| F < 0.85 | 02 | 1.65 | - | - |
| F ≥ 0.85 | 44 | 36.36 | 15 | 34.09 |
| M < 0.95 | 61 | 50.41 | 11 | 18.03 |
| M ≥ 0.95 | 14 | 11.57 | 07 | 50.0 |
| Total | 121 | 100.0 | 33 | 27.27 |

Table 7: Relationship of waist hip ratio and IGT among subject

p value 0.04

A high WHR in both sexes (≥ 0.95 in male and ≥ 0.85 in female) had greater risk of IGTT - 50% and 34.09% respectively. Those with normal WHR (< 0.95 in male and < 0.85 in female) had a prevalence of 18.03% and nil respectively.

| Presenting symptoms | No. of Subjects (n=121) | Percentage (%) | IGT (n=33) | Percentage (%) |
|-----------------------------------|----------------------------|-------------------|---------------|-------------------|
| Asymptomatic | 100 | 82.64 | 26 | 78.78 |
| Symptomatic | 21 | 17.36 | 07 | 21.22 |
| Increased appetite | 01 | 0.80 | 0 | 0 |
| Increased thirst | 05 | 4.13 | 02 | 6.06 |
| Increase frequency of micturition | 02 | 1.6 | 01 | 3.03 |

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|--------------------|------------|--------------|-----------|--------------|
| Weakness | 19 | 15.7 | 07 | 21.21 |
| Tingling sensation | 10 | 8.26 | 05 | 15.15 |
| Total | 121 | 100.0 | 33 | 27.27 |

Table 8: Relationship of IGT with presenting symptoms among subject

p value 0.49

Most common symptoms among impaired glucose tolerance subjects were weakness (21.21%), tingling sensation (15.15%). and increased thirst (6.06%) respectively.

DISCUSSION: In this study 121 non-diabetic first degree relatives of Type II diabetic patients were selected. None of them previously knew their oral glucose tolerance state. Total prevalence of impaired glucose tolerance found in this study was 27.27%. Feskens⁴ et al (1995) also reported that 15-25% of the first degree relatives of diabetics may develop impaired glucose tolerance. In a similar study, Department of Health and Social Safety, Catalunya⁵ (1997) reported prevalence of more than 30%.

While 25.67% males and 29.78% females had impaired glucose tolerance; Costa's 1998 study⁶ also suggested that no difference in terms of sex distribution was found in any glucose tolerant categories.

The present series showed that the risk of prevalence of impaired glucose tolerance increases with age; being least (22.38%) in the age group of > 30-39 years and most prevalent (50%) in the age group of 50-59 years. This observation is similar to Stewart⁷ (1994) et al, who reported that the increasing risk of impaired glucose tolerance or to develop diabetes with increasing age of the subjects were mainly due to altered insulin resistance.

Among different occupations, the highest prevalence of impaired glucose tolerance (34.69%) was found among government servants who had a desk job. The least prevalence was among farmers (14.28%). This highlights that physical activity in the work area has an inverse relation with prevalence of impaired glucose tolerance. Similarly, Lynch⁸ et al (1996) found that physical activities with an intensity of 5.5 metabolic units or greater and a duration of 40 minutes or greater per week protected against the development of NIDDM. These protective effects were even more pronounced in a subgroup of men who were at high risk for the development of the disease.

Prevalence of impaired glucose tolerance in 33.76% urban dwellers was found to be significant (p value = 0.03) compared to only 15.90% of rural subjects. The comparatively lower physical activity, variation in diet and higher levels of stress in an urban lifestyle could be few of the incriminating factors associated with this significant finding. McCance⁹ et al (1994) has also reported that the environmental factors such as rural/urban lifestyle play a strong role in the development of impaired glucose tolerance or Type II DM.

Fesken¹⁰ et al (1995) reported that increased dietary intake of saturated fats and decreased intake of dietary fibres lead to blunted insulin sensitivity which is an important predictor of conversion of impaired glucose tolerance to a diabetic state. Similarly in this study, 30.76% of non-vegetarians had impaired glucose tolerance whereas in vegetarian group it was seen in only 20.93%.

The present series showed higher prevalence of impaired glucose tolerance in subjects with addiction habits (29.5%) as compared to (24%) in non-addiction group. WHO reported that addiction, especially excessive alcohol can increase the risk of impaired glucose tolerance as well as diabetes by damaging the pancreas and liver and promoting obesity.

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In this study, 34.09% females who had WHR of > 0.85 and 50% of males whose WHR > 0.95 were found to have impaired glucose tolerance. The prevalence of IGT in this group was thus found to be significantly higher (p value = 0.04) compared to the group who had WHR within normal range.

This highlights the importance of truncal obesity in the pathogenesis of IGT.

Further evaluation should henceforth be carried out to specify whether the subcutaneous fat stores or visceral fat stores are more significantly implicated in this process. More importantly, it indicates that a simple intervention of daily exercise will help reduce the risk of IGT and consequently the disease burden as well.

Molarius¹¹ et al (1999) similarly reported that subjects with abdominal obesity develop hyperinsulinemia, which may lead to impaired glucose tolerance or Type II DM. They also reported that there was significant correlation between WHR and visceral fat stores which might lead to development of impaired glucose tolerance or Type II DM.

With regards to symptomatology, we found 78.78% of the subjects were asymptomatic. Thus, the remainder of the patients that did present with symptoms, was a matter of pure chance (p value = 0.49). This portrays the old adage of diabetes being an 'iceberg disease'.

Therefore, it is imperative for the doctor to unmask the hidden proportion of diseased. Revelation of an impaired state, at a pre-diabetic stage will help inculcate lifestyle modifications to delay, if not prevent, the curse of diabetes.

RECOMMENDATIONS: Testing for impaired glucose tolerance should be considered in all individuals at age 45 years and above and if normal it should be repeated at three year interval. Keeping in mind the results of this study, this testing should be carried out at an earlier age group, especially for the 'at risk' population.

This population should include those who have a first degree relative of Type II diabetes, and are >30 yrs of age; those who have a positive family history of diabetes; those who are obese (BMI $> 27\text{kg/m}^2$ or WHR >0.95 in males and >0.85 in females); those who have delivered a baby weighing more than 9 lbs (4.07 kg) or have been diagnosed with gestational diabetes mellitus; those who are hypertensive (B.P. $>140/90$); those who have an HDL cholesterol level < 35 mg/dl (0.90 mmol/L); those who have history of addiction and non-vegetarian dietary habits; those have history of urban life styles indulged in sedentary jobs.

This approach will help diagnose impaired glucose tolerance/pre-diabetes at a time when lifestyle modifications can prevent the development of overt diabetes. Secondly, progression of complications could also be detected at an earlier age, thereby reducing the healthcare burden of society. Thirdly, education regarding their glucose tolerance status will improve the well-being of the community as a whole.

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