Age-Specific Prevalence and Risk Associations for Impaired Glucose Tolerance in Urban Southern Indian Population

C Snehalatha, A Ramchandran, A Kapur, V Vijay

Abstract

Objectives: A national survey of diabetes and impaired glucose tolerance (IGT) conducted in 2000 AD in six major cities of India showed a high prevalence of diabetes (12.1%) and IGT (14%). Prevalence of IGT was higher than that of diabetes in subjects with less than 40 years when compared with older subjects. This analysis was done to look for differences in the risk factors associated with IGT in the younger and older subjects.

Methods: Associations of body mass index (BMI), waist : hip ratio, physical activity, family history of diabetes and monthly income with IGT and with diabetes were tested in the age groups of < 40 and ≥ 40 years separately. Multiple logistic regression analyses were done to test the associations.

Results: Prevalence of IGT was higher than diabetes in the younger group (13.1% Vs 5%, P < 0.001). Prevalence of obesity was higher in the older IGT subjects (38% Vs 30.5%, p < 0.003). Presence of positive family history of diabetes was similar in both the groups. In the ≥ 40 year group age, BMI and family history of diabetes were common risk factors for diabetes and IGT. In the younger group, only BMI showed an association with IGT. The association of family history of diabetes with IGT was weaker than for diabetes even in the older subjects (Odds Ratio (OR) = 3.5 for diabetes, 1.33 for IGT).

Conclusions: Prevalence of IGT was higher than diabetes in the age group < 40 years. Only BMI showed an association with IGT in them while the risk associations were similar to diabetes in the older group. Prospective studies will throw more light on the implications of these findings.

INTRODUCTION

Risk of developing type 2 diabetes is high in subjects with impaired glucose tolerance (IGT). A great deal of heterogeneity exists in the conversion rate of IGT to diabetes. Diagnosis and intervention to prevent the progression of IGT to diabetes has been targeted as an important tool in primary prevention of type 2 diabetes. IGT is not only a risk factor for diabetes, but also for coronary heart disease.

In India, prevalence of type 2 diabetes and IGT are on the increase. In 2000 AD, a national survey of diabetes and IGT was conducted in six major cities of India which showed age-adjusted prevalence of 12.1% for diabetes and 14.0% for IGT. IGT to diabetes ratio was equal to or more than one in four out of six cities, which may be an indicator of further increase in the prevalence of diabetes in future. We also observed that the prevalence rates of IGT in the < 40 and ≥ 40 year age groups, did not differ as much as or diabetes which showed nearly a five-fold higher prevalence in the older group.

This analysis was done in the study subjects from the same survey, to look for differences in the risk factors associated with IGT in the younger and older groups. A comparative analysis with the risk factors for diabetes, in the two age groups was done.

MATERIAL AND METHODS

The study was conducted in adults aged ≥ 20 years from January to August 2000 AD in six metro cities in India. The details of the survey are published. Sample selection for each city was done by the Operation Research Group (ORG) an organization for Social Research, a division of Operation Research Group - Market and Research Group (ORG-MARG) Limited, India. In each city, the sample population was drawn to get a fair representation of all the socio economic strata.
(SES), the details of which were available from the Indian readership survey for each city which was based on the Indian Census. SES were determined based on the educational and occupational status. Multiple sampling procedure was used for sample selection.

The screening was done by a house to house visit. The proforma was filled by a trained personnel, and it contained the details of demography, anthropometry, medical history, educational and social details including monthly family income (in rupees), occupation, educational status and physical activity levels. Family history of diabetes was also recorded. Height and weight were measured and body mass index (BMI kg/m²) was calculated. Waist and hip measurements were made and waist to hip ratio (WHR) was calculated using standard procedures. The cut-off values for normal were derived from the non-diabetic, healthy southern Indians as mentioned in an earlier study.8

A scoring system was used to quantify the physical activity using the activity at work and during leisure time, as described earlier.7

The study subjects underwent an oral GTT, after an overnight fast. Fasting and 2h post-glucose blood levels of glucose (after 75 gms anhydrous glucose load) were measured in capillary blood using “one touch” glucose meter (Life Scan Inc. Johnson and Johnson, India). Quality control check on the blood glucose measurement was done by measuring the 2 hr plasma glucose values with glucose-oxidase peroxidase method in every 10th case, in a reference laboratory which adopted regular quality control measures. The correlation between the two glucose measurements was calculated using Pearson's correlation method. In all the cities, the correlation between the lab and glucometer values was 0.9 or higher. Glucose tolerance status was classified based on the 2 hr values obtained at the test site, using the WHO criteria.9

Statistical Analysis

Age and sex standardized prevalence of IGT and diabetes are reported using the direct standardization method. The stratified multiple sampling procedure has been considered in the statistical calculations. Prevalence of IGT and diabetes corrected for the BMI was also calculated. The proportions between the groups were tested by ‘z’ test. Multiple logistic regression analyses were done with IGT or diabetes as the dependent variable, to look for the associated risk variables, taking into consideration the stratified sampling procedure. The risk of IGT vs NGT and diabetes vs NGT conferred by increasing BMI was calculated using logistic regression equations. Categories of BMI (2 units) were used for the calculation. Stata version 7.0 (Stata Corp, 2001. Stata Statistical Software Release 7.0. College Station, Texas) was used for statistical calculations.

RESULTS

IGT was present in 1631 subjects out of a total of 11,216 subjects screened in the six cities. Age standardized prevalences of IGT and diabetes were 14.0% (95% Confidence Interval (CI) = 13.3 to 14.8%) and 12.1% (95% CI = 11.5 - 12.7%), respectively. Gender differences were non-significant.

Age specific prevalence of IGT and diabetes are shown in the Fig. 1. Prevalence of diabetes increased with age especially after 40 years. Increase in prevalence of IGT was not very marked till the age of 60 years and thereafter it showed a significant increase. The lines for diabetes and IGT intercepted at 40 years and therefore further analyses were done in the age groups < 40 (n=701) and ≥ 40 years (n=930) of age. The age-specific prevalences of IGT and diabetes when corrected for BMI were not significantly different from the values shown in the Fig. 1.

Table 1 shows the comparison of the prevalence and the risk factors for IGT in the two age groups (< 40 and ≥ 40 years). The prevalence increased from 13.1% in < 40 years to 15.7% in ≥ 40 years (p < 0.001). The corresponding values for diabetes were 5% and 24% (p < 0.001). In the younger group,
prevalence of IGT was higher (13.1 vs 5%, p < 0.001) while in the older group prevalence of diabetes was higher (24% Vs 15.7%, p < 0.001).

Multiple logistic regression analysis with IGT as the dependent variable (total group) showed that age (OR = 1.2, p < 0.001) BMI (OR = 1.07, p < 0.001) and family history of diabetes (OR = 1.2, p = 0.04) had independent associations. Separate analyses were done in age groups of < 40 and ≥ 40 years. Results are shown in Table 2. The results are compared with diabetes Vs IGT. IGT and diabetes occurring in the older group had age, BMI and family history of diabetes as common risk factors. Family history of diabetes showed the strongest association with diabetes in both the age groups. For IGT, an association with family history of diabetes was present only in the older group and it was weaker than for diabetes (OR 3.5 for diabetes 1.33 for IGT).

Risk of IGT increased with BMI and became significant at a BMI of 23 kg/m² (OR = 1.39, p = 0.02; Fig. 2). For diabetes, the risk was significant from a BMI of 22 kg/m².

**DISCUSSION**

An important observation made in the study was a high prevalence of IGT in the younger age group, which was nearly 2.5 fold higher than the prevalence of diabetes. In the NHANES II survey in USA, the prevalence of IGT was 6.4% in subjects of 20-44 years and 22% in subjects of 65-74 years. In India, the prevalence of IGT in < 40 years was 13.1%. IGT developed at a younger age in 43% of the cases. The effect of age was less marked on the prevalence of IGT than on diabetes. Moreover, differences were noted in the risk variables associated with IGT in the < 40 and ≥ 40 years age groups. It is generally believed that the risk factors for IGT are similar to those associated with diabetes. In the younger age group with IGT, we had expected to find a stronger associations with the conventional risk factors for diabetes such as BMI, positive family history of diabetes, higher income and physical inactivity. Interestingly, in this age group none of the risk variables, except BMI showed an independent association with IGT unlike in the older group where the risk variables were similar to that for diabetes. BMI of 23 kg/m² or more was found to be associated with higher odds ratio for IGT. Modan et al had reported a threshold effect of BMI ≥ 27 kg/m² for glucose intolerance in Israeli Jewish population. The threshold for risk of BMI appeared to be lower in Indian subjects. Obesity is considered to be a risk factor for conversion of IGT to diabetes. Harris et al had demonstrated that in the US population, the effect of age and BMI on IGT disappeared once plasma glucose and insulin were introduced in the multivariate analysis. It was suggested that obesity might be an important risk factor for moving from normal to IGT and it was probably reflecting insulin resistance.
resistance.

Strong association of family history of diabetes with IGT has been reported.\textsuperscript{12-14} In our study, an association of IGT with family history of diabetes was present only in the older group. The odds ratio for the same was very much lower than for diabetes even in that age group.

Only prospective studies can throw more light on the implications of different risk associations seen in the age groups studied. It also needs to be analysed whether the conversion rate of diabetes would be more in the older IGT cases, who seemed to have risk associations similar to diabetes.

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REFERENCES


Announcement

The office bearers of the Electious of API Gwalior Chapter Gwalior, held for the year 2003-04.

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