Comparison of Comorbidities in Patients with Pre-Diabetes to Those with Diabetes Mellitus Type 2

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A cross-sectional study performed on 309 pre-diabetes and 309 type 2 diabetes patients, selected from General Practices in Cork. The prevalence of complications was calculated and the data analysed to determine if there is a statistically significant difference in prevalence of complications. The prevalence of co-morbidities in the type 2 diabetic group are Ischaemic Heart Disease 55 (17.8%), Chronic Kidney Disease 17 (5.5%), cerebrovascular disease 16 (5.2%), peripheral vascular disease 40 (12.8%), eye disease 20 (6.5%), peripheral neuropathy 27 (8.7%) and autonomic neuropathy 11 (3.6%). The prevalence of co-morbidities in the pre-diabetic group are Ischaemic Heart Disease 64 (20.6%), Chronic Kidney Disease 12(3.9%), cerebrovascular disease 11 (3.5%), PVD 24 (7.7%), eye disease 1 (0.3%), peripheral neuropathy 8 (2.6%) and autonomic neuropathy 17 (5.8%). The prevalence of many of the co-morbidities assessed is statistically the same in the type 2 diabetic and pre-diabetic population. For peripheral vascular disease and eye disease the p-value are 0.034 and < 0.001 respectively. This result indicates that there is a statistically significant difference in the prevalence of peripheral vascular disease and eye disease between pre-diabetic and type 2 diabetic population.

Introduction

Pre-diabetes is defined as Impaired Glucose Tolerance (glucose values post OGTT between 7.8 to 11.0 mmol/L) and/or Impaired Fasting Glucose (fasting glucose between 6.1 to 6.9 mmol/L). There is very little research on the prevalence of diabetes related complications in pre-diabetes patients and none comparing this to that of type 2 diabetes patients in Ireland. Pre-diabetes and type 2 diabetes are extremely common and their prevalence is expected to increase rapidly as a result of an aging population (IDF data) and a continuing change in human behavior and lifestyle. Previous studies have demonstrated that poor glucose control is associated with increased microvascular complications, for example, retinopathy and nephropathy [5]. In pre-diabetes patients, even without metabolic syndrome, there is an increased incidence of ischaemic heart disease. [6]

Methods

This is a cross-sectional study in which the patients were selected using stratified sampling (age, gender). Sample size was calculated using the formula for the prevalence of the comorbidities of interest in the literature for Pre-diabetic and type 2 diabetic population the minimum sample size was calculated for each individual complication to show that there is a statistically significant difference in the prevalence of that particular complication between a pre-diabetic patient and a type 2 diabetes patient. The prevalence data used is in the literature review. Patients were selected from the diabetes interest group database which is a database of all the diabetic patients in approximately 30 general practices in Cork city and county. 309 pre-diabetes patients were selected and 309 type 2 diabetes patients were selected using stratified sampling by age and gender i.e. the first 309 pre-diabetes patients and the first 309 type 2 diabetes patients in approximately 30 general practices in Cork city and county. 309 pre-diabetes patients and 309 type 2 diabetes patients were selected by stratified sampling. Having contacted each individual general practice and obtaining their permission to access patient information I visited the practice and completed the questionnaire or gave it to the doctor / practice nurse to be completed. The questionnaire helped obtaining the prevalence of the following comorbidities: ischaemic heart disease, renal disease, cerebrovascular disease, peripheral vascular disease, eye disease, peripheral neuropathy, autonomic neuropathy. The parameters which determined whether a patient has each disease are as follows: Ischaemic Heart Disease: Angina, Infarct, Stent, CABG; Renal Disease: Microalbuminuria or Chronic Renal Disease; Cerebrovascular Disease: TIA or Stroke; Peripheral Vascular Disease: Pain, Ulcers, Amputation; Eye Disease: Diabetic Retinopathy; Peripheral Neuropathy: Sensory loss, neuropathic pain; Autonomic Neuropathy: Gait and cardiovascular (e.g. dizziness on standing up and sexual dysfunction).

Results

Summary

For ischaemic heart disease, renal disease, cerebrovascular disease and autonomic neuropathy the p-values are 0.369, 0.337, 0.521 and 0.249 respectively. These results indicate that the prevalence of ischaemic heart disease, renal disease, cerebrovascular disease and autonomic neuropathy is statistically the same in the pre-diabetic population and the type 2 diabetic population. For peripheral vascular disease and eye disease the p-value are 0.034 and < 0.001 respectively. These results indicate that the prevalence of peripheral vascular disease and eye disease between pre-diabetic population and type 2 diabetic population.
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Ischaemic Heart Disease prevalence

The prevalence of ischaemic heart disease is higher in pre-diabetes with a prevalence of 20.6% compared to 17.8% in type 2 diabetes with a p-value of 0.369 indicating that in this study there is not a statistically significant difference in the prevalence of ischaemic heart disease.

Chronic Renal Disease prevalence

The prevalence of renal disease is higher in type 2 diabetes with a prevalence of 5.5% compared to 3.9% in pre-diabetes with a p-value of 0.337 indicating that in this study there is not a statistically significant difference in the prevalence of chronic renal disease.

Cerebrovascular Disease prevalence

The prevalence of cerebrovascular disease is higher in type 2 diabetes with a prevalence of 5.2% to 3.5% in pre-diabetes. The P-value is 0.321 indicating that in this study there is not a statistically significant difference in the prevalence of cerebrovascular disease between pre-diabetes patients and type 2 diabetes patients.

Peripheral Vascular Disease prevalence

The prevalence of peripheral vascular disease is higher in type 2 diabetes with a prevalence of 12.9% compared to 7.7% in pre-diabetes. The P-value is 0.034 indicating that in this study there is a statistically significant difference in the prevalence of peripheral vascular disease.

Eye Disease prevalence

Eye disease has been defined in this study as diabetic retinopathy. The prevalence of diabetic retinopathy is higher in type 2 diabetes with a prevalence of 6.5% compared to 0.3% (only one patient out of 310 has diagnosed diabetic retinopathy) in pre-diabetes. The P-value calculated is < .001 indicating that in this study there is a statistically significant difference in the prevalence of diabetic retinopathy between type 2 diabetes patients and pre-diabetes patients.

Peripheral Neuropathy prevalence

The prevalence of peripheral neuropathy is higher in type 2 diabetes with a prevalence of 8.7% compared to 2.6% in pre-diabetes. The P-value calculated by the Pearson chi-square test is .001 indicating that in this study there is a statistically significant difference in the prevalence of peripheral neuropathy between pre-diabetes patients and type 2 diabetes patients. As expected it can be stated that the prevalence of peripheral neuropathy is higher in type 2 diabetes than pre-diabetes.

Autonomic Neuropathy prevalence

The prevalence of autonomic neuropathy is actually higher in pre-diabetes with a prevalence of 5.5% compared to 3.6% in type 2 diabetes. The P-value is .249 indicating that in this study there is not a statistically significant difference in the prevalence of autonomic neuropathy.

Discussion

This is the first study performed in Ireland which looks at the prevalence of complications in pre-diabetes and compares this rate to that in type 2 diabetes. It highlights the fact that the prevalence of many diabetic complications is statistically the same in the pre-diabetic and type 2 diabetic population. The prevalence of ischaemic heart disease, renal disease, cerebrovascular disease and autonomic neuropathy is statistically the same in both groups and active management of these co-morbidities is required.

This study is representative of Cork city and county as the patients are selected from general practices across this region. There are no exclusion criteria and patients are selected based on which general practitioner they attend. Stratified sampling (by age, gender and demographics) is the sampling method used which reduces the effect which confounders such as age and gender may have.

As this project is a chart review it is reliant on the appropriate data entry of others notably the general practitioner. Peripheral neuropathy in this study is much lower than that found in the literature. The lower prevalence of peripheral neuropathy in this study may be due to findings of clinical examination not being recorded at all or inadequately. Another weakness is the potential for measurement bias in the completion of the questionnaires. The sequence of events cannot be established in this study.

A future study could be performed comparing nondiabetic population with a pre-diabetes patient sample. A study on the introduction of screening for hyperglycaemia for certain high risk groups, such as age > 50 and obese individuals need to be looked at as well as research on the cost effectiveness of pharmacological management in pre-diabetes. The fact that the prevalence of many of the complications in pre-diabetes is statistically the same as in diabetes indicates the importance of early detection and management of the condition. It is important to identify and manage each individual risk factor (smoking, hypertension and obesity). It is necessary to identify and manage each complication. Even simple lifestyle modification can help prevent the progression to type 2 diabetes and patients could revert back to normoglycaemia.

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