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Original Research

Prevalence and risk factors of diabetic peripheral neuropathy in Type 2 diabetes mellitus patients with overweight/obese in Guangdong province, China

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ABSTRACT

Aims: To investigate the prevalence and risk factors of diabetic peripheral neuropathy (DPN) in Type 2 diabetes mellitus (T2DM) patients with overweight or obese in Guangdong province in China.

Methods: A cross-sectional study was carried out on T2DM patients with overweight/obese in 60 hospitals in Guangdong province. Methods of data collection included questionnaire, clinical examination, blood draw and clinical measurement. Demographic characteristics, diagnosis of diabetes and DPN, disease history, life styles and self-management, most recent laboratory test results and physical examination were collected. Binary logistic regression was used to assess risk factors of DPN.

Results: A total of 3359 T2DM patients (age range 20–90 years) were recruited. The overall prevalence of DPN was 33.1%. Binary logistic regression identified age (odds ratio [OR]: 1.016, 95% confidence interval [CI]: 1.008, 1.024), duration of diabetes mellitus (OR: 1.072, 95% CI: 1.056, 1.087) and HbA1c (OR: 1.053, 95% CI: 1.013, 1.095) as risk factors for the presence of DPN.

Conclusions: DPN is prevalent in T2DM patients with overweight or obese in Guangdong province in China and is significantly associated with age, HbA1c and duration of diabetes.

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1. Introduction

Diabetic neuropathy (DN) is defined as symptoms and/or signs of peripheral nerve dysfunction in people with diabetes after exclusion of other causes [1]. It is one of the most common complications of long term diabetes mellitus (DM) and cannot only result in pain, but also contribute mainly to foot ulceration and lower limb amputation [2]. Diabetic peripheral neuropathy (DPN) likely affects up to one-third of adults with diabetes [3]. Thus, investigating the prevalence of DPN and risk factors associated with DPN is of great importance.

Some previous studies have reported the prevalence of DN and the rates in various studies show considerable variation, from as low as 8.3% up to 75.1% [2,4–18]. These studies have investigated the prevalence of DN in countries such as the United Kingdom [5,11], the United States [14], Sweden [10], Iran [9,16], Bahrain [17], Turkey [15] and Mauritius [2]. Lu [19] conducted a survey of Chinese with Type 2 diabetes mellitus (T2DM) aged 30 years and older in downtown Shanghai and reported an overall prevalence of 61.8%.

Although China is the world's most populous nation with approximately 114 million patients with DM [20], studies regarding the prevalence of DN among Chinese are limited. With economic growth, increase of life expectancy and changes in lifestyle, the overweight and obese population is increasing rapidly in China. And, obese and weight gain are recognized causes of T2DM; approximately 63% of patients with T2DM are overweight or obese in China [21]. Located in southern China, Guangdong is a province with the largest population in China with a population of 104.3 million, accounting for 1/13th of the nation's population. However, prevalence data on the prevalence and risk factors of DN in overweight/obese T2DM are lacking. Therefore, this study was conducted to investigate the prevalence of diabetic peripheral neuropathy (DPN) and associated risk factors in a population of T2DM patients with overweight or obese in Guangdong province in China.

2. Subjects and methods

2.1. Patients and design

This study was part of a large cross-sectional study investigating prevalence of complications in overweight/obese T2DM patients in Guangdong Province. Participants were recruited from 60 hospitals in which the board members of the Diabetes Society of Guangdong Medical Association were working. Forty-six hospitals were in the Pearl River Delta, six in the east, three in the west and five in the north. All the patients were treated in hospitals, including inpatients or those attending clinics follow-up after discharge. Inclusion criteria were diagnosed with T2DM, aged ≥20 years, with body mass index (BMI) ≥25 kg/m^2, having lived in Guangdong province for ≥1 year, and willing and able to complete the questionnaire.

2.2. Data collection

Methods of data collection included questionnaire validated by seven experts from the Diabetes Society of Guangdong Medical Association, clinical examination, blood draw and clinical measurement. The following data were surveyed and measured: demographic characteristics (gender, age, marital status and education), diagnosis (diabetes and DPN) and disease history (family history of diabetes, hypertension and other chronic diseases), life styles and self-management (smoking, drinking and exercise), the most recent laboratory test results (blood glucose and blood lipids), the most recent physical examination results including height, weight, blood pressure and clinical treatment regimen. The diagnosis of DPN required a thorough medical history and careful clinical examination. The clinical examination included the normal physical examination, with examination of sensory nerve function by using a 10 g Semmes-Weinstein monofilament at the hallux of each foot.

This study was approved by the institutional review board of the hospitals and informed consent was obtained from all participants before data collection.

2.3. Anthropometric and laboratory measurements

All the participants had comprehensive physical check-up. After anthropometric data such as weight, height and blood pressure were obtained, venous blood sample was drawn from the right arm after 8 h of fasting to test the blood glucose, HbA1c and blood lipids, etc. Weight was measured using a balanced-beam scale with clothing. Height was measured using the clinic stadiometer. The formula for BMI is weight in kilograms divided by height in meters squared, i.e., weight (kg)/[height (m)]^2. Blood pressure was the average of three measurements obtained by a sphygmomanometer. Fasting plasma glucose (FPG) and 2-h postprandial plasma glucose (2hPG) were measured by the glucose oxidase method. Glycosylated hemoglobin A1c (HbA1c) was measured by high-performance liquid chromatography. Total cholesterol (TC), triglycerides (TG), high-density lipoprotein (HDL) cholesterol and low-density lipoprotein (LDL) cholesterol were measured by the enzymatic method.

2.4. Definitions of related factors

The diagnosis of DM was based on the 1999 WHO diagnostic criteria [22]. A patient with a BMI of 25–29.99 kg/m^2 was considered overweight and those with a BMI of 30 kg/m^2 or more obese [23]. Hypertension was diagnosed as systolic blood pressure (SBP) ≥140 mmHg or diastolic blood pressure (DBP) ≥90 mmHg. Dyslipidemia based on the recommendations for the prevention and treatment of dyslipidemia in China and the national cholesterol education program adult treatment panel III (ATP III) criteria [24,25], which was defined by one or more of the following conditions: TC ≥5.7 mmol/L, TG ≥1.7 mmol/L, LDL cholesterol ≥3.6 mmol/L, HDL cholesterol <1.29 mmol/L in females and <1.03 mmol/L in males. FPG 6.1–7.0 mmol/L was impaired fasting glucose and 2hPG 7.8–11.1 mmol/L was impaired glucose tolerance.

Alcohol drinking was defined as people who had drunk at least 30 g of hard liquor, or 360 g of beer, or 103 g of grape wine, or 103 g rice wine at least once a week for 6 months or more

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