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Increased risk of diabetes in patients with anxiety disorders: A population-based study

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ABSTRACT

Objective: Few known studies have investigated the epidemiology of diabetes in patients with anxiety disorders. Therefore, the study aimed to determine the prevalence and incidence of diabetes in patients with anxiety disorders.
Methods: The National Health Research Institute provided a database of 1,000,000 random subjects for study. We obtained a random sample aged 18 years and over 766,427 subjects in 2005. Those study subjects who had at least two primary or secondary diagnoses of anxiety disorders were identified. We compared the prevalence of diabetes in anxiety patients with the general population in 2005. Furthermore, we investigated this cohort from 2006 to 2010 to detect the incident cases of diabetes in anxiety patients compared with the general population.
Results: The prevalence of diabetes in patients with anxiety disorders was higher than that in the general population (11.89% vs. 5.92%, odds ratio, 1.23; 95% confidence interval, 1.17–1.28) in 2005. The average annual incidence of diabetes in patients with anxiety disorders was also higher than that in the general population (2.25% vs. 1.11%, risk ratio 1.34; 95% confidence interval, 1.28–1.41) from 2006 to 2010. Compared with the general population, patients with anxiety disorders revealed a higher incidence of diabetes in all age groups among both females and males.
Conclusions: Patients with anxiety disorders had a much higher prevalence and incidence of diabetes in the younger adult age group than in the general population. The higher incidence of diabetes among anxiety patients was related to increased age, antipsychotic use, hypertension, and hyperlipidemia.

1. Introduction

Anxiety disorders and diabetes both cause substantial morbidity to patients and have a great impact on the health care system [1,2]. Several studies have reported that anxiety patients have a higher comorbidity of hypertension, cerebrovascular disease, ischemic heart disease, arthritis, asthma, and ulcers than the general population [3–5]. Studies that have also investigated comorbidity according to specific subtypes of anxiety and medical illness reveal the associations of panic disorder with seizure disorder, mitral valve prolapse, and respiratory disorders; of generalized anxiety disorder with chronic obstructive airway disease and cardiovascular and endocrine disorders; of social anxiety disorder with Parkinson's disease; of obsessive-compulsive disorder with striatal disorders; of posttraumatic stress disorder with head injury, pain, and metabolic syndrome; and of phobic anxiety symptoms with diabetes [6–8].

One population-based study revealed that the relationship between lifetime anxiety disorder and metabolic risk factors reached significance following adjustment for age, BMI, socioeconomic status, physical activity, alcohol consumption, and smoking status (odds ratio [OR], 2.20) [9]. Another study reported that symptoms of depression and anxiety were significant risk factors for type 2 diabetes independent of established risk factors for diabetes, such as socioeconomic factors, lifestyle factors, and markers of metabolic syndrome [10]. Yet another study revealed that women with persistent anxiety symptoms had a 1.85-fold greater risk for diabetes [11]. Depressive, but not anxiety, disorders and symptoms are associated with a greater prevalence rate of metabolic syndrome, which was reported in a study using a primary care community sample [12]. Overall, the disease pattern of anxiety disorders, psychotropic agents (e.g., antipsychotics, antidepressants, and mood stabilizers), lifestyle, substance use, and activity level all may contribute to the increased risk for diabetes. On the other hand, a systematic review and meta-analysis report found that diabetes is associated with an increased likelihood of having anxiety disorders and elevated anxiety symptoms [13]. Therefore, the relationship of anxiety disorders to the development of diabetes has still been a subject of controversy.

The World Health Organization estimated the prevalence rates for diabetes to vary widely across countries, ranging from 1.1% to 10.2% in 2000, and the estimated prevalence of diabetes in developed countries

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was higher than in developing countries [14]. A population-based epidemiologic study revealed that the prevalence of diabetes in people older than 30 years was 10.3% in Taiwan [15]. In Taiwan, only one community survey for anxiety disorders has been conducted; the lifetime prevalence rate was 7.75% [16]. To our knowledge, no comprehensive epidemiologic study of diabetes in patients with anxiety disorders has been conducted in Taiwan. Thus, we used nationwide health care data files to determine the prevalence of diabetes in patients with anxiety disorders, which provides important information for public health promotion efforts [17,18].

Taiwan implemented a National Health Insurance (NHI) program in March 1995, offering a comprehensive, unified, universal health insurance program to all citizens. All citizens who have established a registered domicile for at least four months in the Taiwan area should be enrolled in NHI. The coverage provides outpatient services, inpatient care, Chinese medicine, dental care, childbirth services, physical therapy, preventive health care, and home care, as well as rehabilitation for chronic mental illness. As much as 98% of the people in Taiwan have joined the NHI program as of 2005. The Bureau of NHI (BNHI) has contracted with 92% of medical institutions in Taiwan [17,18].

This study tests the hypothesis of a positive association between anxiety disorders and diabetes. We first compared the prevalence of diabetes between patients with anxiety disorders and the general population in 2005. Second, we detected factors associated with diabetes in patients with anxiety disorders. Third, we compared the incidence of diabetes in patients with anxiety disorders and the general population from 2006 to 2010. Finally, we investigated risk factors for diabetes in patients with anxiety disorders during this period.

2. Methods

2.1. Sample

The NHI medical claims database, which included data on outpatient care, hospital inpatient care, and prescription drugs, was provided by the National Health Research Institute (NHRI). The NHRI provided a database of 1,000,000 random subjects for study. There were no statistically significant differences in age, sex, or the average insured payroll-related amount between the sample group and all enrollees. In the current study, we obtained a random sample aged 18 and over of 766,427 subjects in 2005 [18]. This study was approved by the Institutional Review Board of Taoyuan Mental Hospital.

2.2. The definition of anxiety disorders

The National Health Insurance in Taiwan uses diagnostic coding that follows the International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM) diagnostic criteria [19]. We identified study subjects who had at least two service claims during 2005 for either outpatient or inpatient care with a primary or secondary diagnosis of anxiety disorders, which includes anxiety states, panic disorder, generalized anxiety disorder, phobic disorder, obsessive-compulsive disorder, acute stress disorder, and post-traumatic stress disorder (ICD-9-CM: 300.0, 300.2, 300.3, 308.3, and 309.81) [20].

2.3. The definition of diabetes

Study subjects who had at least one prescription (oral hypoglycemic agents or insulin) for treatment of diabetes during this year for either outpatient or inpatient care were identified [18,21].

2.4. The definition of hypertension

Study subjects who had a primary or secondary diagnosis of hypertension (ICD-9-CM: 401–405), combined with antihypertensive drug treatment, were identified as hypertension [22]. Generally, the typical criteria used to determine a diagnosis of hypertension for physicians in Taiwan is systolic pressure ≥ 140 mm Hg or diastolic pressure ≥ 90 mm Hg, which is the same as the definition used by the United States and the WHO.

2.5. The definition of hyperlipidemia

Study subjects who had a primary diagnosis of hyperlipidemia (ICD-9-CM: 272) identified in 2005 for either outpatient or inpatient care were considered to have a diagnosis of hyperlipidemia [23].

2.6. The prevalence of diabetes

With regard to the prevalence of diabetes in the general population, the denominator was the number of total study subjects in 2005, and the numerator was the number of prevalent cases of diabetes in 2005. With regard to the prevalence of diabetes in patients with anxiety disorders, the denominator was the number of total anxiety disorders subjects in 2005, and the numerator was the number of prevalent cases of diabetes in patients with anxiety disorders in 2005.

2.7. The incidence of diabetes

We detected new cases of diabetes from 2006 to 2010. Subjects with newly diagnosed diabetes and no diabetes diagnosis before 2006 formed the group for incident diabetes. The numerator was the number of incident diabetes cases and the denominator was the number of person-years contributed by the study subjects.

2.8. Measure

Information on demographic factors, including age, sex, antipsychotic use, antidepressant use, mood stabilizer use, insurance amount, region, and urbanicity, was obtained directly from the BNHI insured files. Age was classified into one of three categories: 18–39, 40–59, and ≥60. Antipsychotic use was divided into no antipsychotic use, first-generation antipsychotic use (butyrophenone, phenothiazine, thioxanthene, and miscellaneous antipsychotics such as pimozide, loxapine, and sulpyride), and second-generation antipsychotic use (clozapine, olanzapine, quetiapine, risperidone, ziprasidone, amisulpride, zotepine, and aripiprazole) [24]. Antidepressant use was divided into no antidepressant use, first-generation antidepressant use, and second-generation antidepressant use. Mood stabilizer use was defined as present or absent. The insurance amount was classified into one of five categories: fixed premium, dependent, less than US$640 (NTD20,000), US$640–1280 (NTD20,000–39,999), and US$1281 (NTD40,000) or more. With regard to geographical distribution, the study subjects were classified into one of four regions: northern, central, southern, and eastern. Urbanicity was divided into urban, suburban, and rural categories [17,18].

2.9. Statistical analysis

The differences in prevalence of diabetes between patients with anxiety disorders and the general population according to different age groups, sex, insurance amount, region, and urbanicity were tested by logistic regression adjusted for the other covariates, which include age, sex, insurance amount, region, and urbanicity. Multiple logistic regression was used to analyze the associated factors for the prevalent cases of diabetes in patients with anxiety disorders in 2005. The differences in the incidence of diabetes between patients with anxiety disorders and the general population according to age group and sex from 2006 to 2010 were tested by a Cox regression adjusted for the other covariates. Finally, we used a Cox regression model to analyze the risk factors of diabetes in patients with anxiety disorders from 2006 to 2010. SAS version 9.1 was used to link and analyze the data (SAS Institute, Inc.,