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Original Article

Uvulopalatopharyngoplasty reduces the incidence of cardiovascular complications caused by obstructive sleep apnea: results from the national insurance service survey 2007–2014

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ABSTRACT

Objective: Untreated obstructive sleep apnea (OSA) is a risk factor for cardiovascular disease including myocardial infarction (MI), congestive heart failure (CHF), and atrial fibrillation (AF). Continuous positive airway pressure (CPAP) is an effective treatment for OSA; however, compliance with CPAP can be challenging for some patients. The objective of this study was to investigate whether uvulopalatopharyngoplasty (UPPP) reduced the risk of cardiovascular complications for patients with OSA.
Methods: Data from Korea National Health Insurance Corporation, a national health care database in South Korea, were analyzed. All patients with a new diagnosis of OSA from 2007 to 2014 were identified. Propensity score matching by age and sex was used to identify a control group five times larger than the OSA group for comparison. Patient demographics and comorbidities were collected. The OSA group was further divided into patients who had an UPPP and patients who did not undergo surgery. The primary endpoints were newly diagnosed MI, CHF, and AF.
Results: Of 192,316 patients with a new diagnosis of OSA, 22,213 had undergone UPPP. For the control group, 961,590 individuals were selected. Patients with OSA had an increased risk of CHF and AF, compared to control patients. UPPP reduced the incidence of CHF and AF significantly. Age, gender, and hypertension were also found to be risk factors for cardiac complications for patients with OSA.
Conclusion: OSA increases the risk of CHF and AF. UPPP in this population can significantly reduce the risk of cardiac complications in patients with OSA.

1. Introduction

Obstructive sleep apnea (OSA) is characterized by repetitive upper airway collapse during sleep, which induces frequent arousals and oxygen desaturation [1]. It is a common disease worldwide. Using an apnea–hypopnea index (AHI) of 15 as a diagnostic criterion, the prevalence of OSA in the general adult population ranges from 6% to 17%, and can be as high as 49% with advanced age [2]. OSA is associated with a variety of symptoms including fatigue, daytime somnolence, and headache [1]. When untreated, OSA can also result in profound effects on quality of life, serious medical complications, and an increased risk of mortality [1–3].

Numerous studies have demonstrated that OSA can cause or exacerbate cardiovascular diseases such as myocardial infarction (MI) [3] congestive heart failure (CHF) [4], and atrial fibrillation (AF) [5]. Treatment with continuous positive airway pressure (CPAP) is believed to reduce the incidence of cardiovascular disease in patients with OSA [6–9]. However, no study has investigated the efficacy of surgical treatments for OSA to reduce cardiac complications.

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The most commonly performed surgical procedure for OSA by otolaryngologists is an uvulopalatopharyngoplasty (UPPP) [10,11]. Despite only partial reductions in the AHI and limited success as a stand-alone cure for OSA, UPPP remains an important therapeutic option for many patients refusing or intolerant of CPAP [11]. Prior studies have largely focused on determining efficacy and best patient selection for UPPP, and have not evaluated the effects of the surgery on reducing the incidence of cardiovascular complications.

Recently, the National Health Insurance Service (NHIS) database has been made available for research purposes in Korea [12]. The objective of this study was to investigate, using the NHIS database, whether the incidence of cardiovascular disease increased in patients with OSA. The effects of UPPP in patients with OSA on these cardiac complications, using the NHIS data, were also examined.

2. Methods

2.1. Data source

The NHIS is a national insurer database managed by the Korean government, which includes approximately 97% of the Korean population [12]. Both outpatient and inpatient claims are reviewed by the NHIS, which include data regarding diagnoses, procedures, prescription records, demographic information, and direct medical costs. The NHIS also reviews claims from the Medical Assistance Program and the Medical Care for Patriots and Veterans Affairs Scheme, which cover the medical expenses of the Korean population not insured by the NHIS. Therefore, the NHIS database covers almost the entire Korean population, and contains information about all medical claims made in Korea.

The NHIS identifies its members by their unique Korean Resident Registration Number, which removes the risk of duplication or omission when accessing the data. The NHIS database manages claims using the Korean Classification of Disease, sixth edition, a modified version of the International Classification of Diseases, 10th edition (ICD-10). Additionally, all NHIS subscribers are recommended to undergo a standardized health examination by primary care physicians biennially.

2.2. Study population and design

For the study, we defined the OSA group as all persons ≥20 years of age with a new diagnosis of OSA made from 2007 to 2014. The OSA group was further divided into patients who had undergone UPPP (Q2196 or Q2197) during the study period and patients who did not have surgery (No Surgery group). The primary endpoint of this study was newly diagnosed MI, CHF, or AF, which was defined and identified using NHIS insurance claim data (Table 1).

Patients who were diagnosed with MI, CHF, or AF prior to study enrollment were excluded. Propensity score matching by age and sex was used to select a control group (five times greater than the OSA group) for comparison. Propensity score matching will be described in detail in a subsequent section. A summary of the study population selection is provided in Fig. 1.

2.3. Data collection

We collected following baseline data from the NHIS database; age (years), sex, residency (rural or urban), and income level (lowest quintile or the remaining quintiles). In addition, patient data concerning comorbidities including diabetes, hypertension, and dyslipidemia were also collected (Table 1).

2.4. Statistical analysis

Data are presented as the mean ± standard deviation (SD) for age and as proportions for the remaining categorical variables. A Kaplan–Meier plot without covariance correction was presented to analyze the risk of cardiovascular disease according to the presence or absence of OSA and whether or not patients received UPPP. The incidence rates of MI, CHF, and AF were calculated by dividing the number of events by the person-time at risk. To determine the hazard ratio (HR) of OSA on the incidence of cardiovascular disease, a Cox proportional hazard model was used after stratifying covariates including age, sex, income level, diabetes, hypertension, and dyslipidemia.

Two different models were provided. Model 1 was adjusted by age and sex; model 2 was adjusted by all covariates for in model 1 plus income level, diabetes, hypertension, and dyslipidemia. Finally, the hazard ratio for the OSA group was further analyzed by sex, age, diabetes, hypertension, and dyslipidemia. Results are presented as mean and 95% confidence interval (95% CI). All statistical analyses were performed using SAS version 9.4 (SAS Institute, Cary, NC, USA) and R version 3.2.3 (The R Foundation for Statistical Computing, Vienna, Austria). The flow chart in Fig. 1 shows the enrollment process for this study.

2.5. Ethical approval

The study was exempted by the Institutional Review Board of Konkuk University Hospital because of the use of publicly available data.

3. Results

Using the NHIS database, 192,316 patients with OSA were identified. Of these patients, 22,213 subsequently underwent UPPP. For the control group, 961,590 individuals were selected without the diagnosis of OSA (Fig. 1). Demographic data for the study are summarized in Table 2.

Table 1
Working definition from the insurance claims data.

Disease	Working definition
Obstructive sleep apnea	At least one claim under ICD-10 codes G47.3
Myocardial infarction	At least two claims or one admission under ICD-10 codes I21 or I22
Congestive heart failure	At least one claim under ICD-10 code I50
Atrial fibrillation	At least two claims or one admission under ICD-10 code I48
Diabetes	At least one claim per year for the prescription of anti-diabetic medication under ICD-10 codes E11–14
Hypertension	At least one claim per year for the prescription of anti-hypertension medication under ICD-10 codes I10–13 or I15
Dyslipidemia	At least one claim per year for the prescription of anti-dyslipidemic medication under ICD-10 code E78

ICD-10, International Classification of Diseases, 10th edition.