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Original Article

Risk of meningioma in patients with head injury: A nationwide population-based study

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Abstract

Background: Head injury has been suggested to correlate with meningioma. However, results of studies investigating the relationship between head injury and meningioma were inconsistent. Therefore, we conducted this study to assess the association between head injury and meningioma, and to determine the possible risk factors.

Methods: Head injury patients aged 18 years and older, without antecedent diagnosis of brain tumor, and who were followed up for more than 30 days between January 1, 2001, and December 31, 2010, were recruited from the Taiwan National Health Insurance Research Database. Hazard ratios (HRs) of meningioma risk for head injury patients compared with an age- and sex-matched cohort were calculated by Cox proportional regression analysis. The difference in cumulative incidence between head injury patients and the matched cohort was analyzed using the Kaplan–Meier method and tested with the log-rank test.

Results: Each cohort (i.e., the head injury cohort and the matched cohort) consisted of 75,292 individuals with a mean age of 44.7 years, and 52.3% of these patients were male. The incidence rates of meningioma were $3.99/10^5$ person-years and $3.23/10^5$ person-years in the head injury cohort and the comparison cohort, respectively, with a Charlson Comorbidity Index score-adjusted HR of 1.27 ($p = 0.514$). There were no associations between head injury and risk of meningioma, neither overall nor in stratified analyses according to severity of head injury, age, and sex of patients.

Conclusion: Head injury, regardless of severity, patient sex, or age, is unlikely to be a cause of meningioma.

Keywords: head injury; meningioma; population-based study; Taiwan National Health Insurance Research Database

1. Introduction

Meningiomas are the most frequently diagnosed primary brain tumors.[1] Although most meningiomas are typically benign, a small number of such tumors could potentially cause a fatal outcome due to their close proximity to vital intracranial structures. The main risk factors for meningioma are genetic factors and high-dose radiation exposure while hormone and head trauma were also reported to be associated with elevated risk.[2]

Conflicts of interest: The authors declare that there are no conflicts of interest related to the subject matter or materials discussed in this article.

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Meningioma was first described to be associated with head trauma by Cushing and Eisenhardt in 1938.[3] An increased risk of meningioma in patients with a history of head trauma as well as in men whose head was ever boxed during sports activities was demonstrated in case–control studies.[4–6] A longer history of head trauma (10–19 years) and increased number of head traumas were reported to be related with higher risk.[7] However, traumatic brain injury was shown not to be associated with primary brain tumors, including meningioma, in a cohort study in Sweden.[8]

Because the result of these studies were inconsistent, it remains unclear whether brain injury patients exhibit an elevated risk of developing meningioma compared with the general population. Therefore, a population-based matched cohort study using the Taiwan National Health Insurance Research Database (NHIRD) was conducted to examine this issue.

2. Methods

2.1. Data source

In this current study, we used data from the Longitudinal Health Insurance Database (LHID) from 1995 to 2010 obtained from the NHIRD. The National Health Insurance (NHI) Program was launched in Taiwan in 1995, which now covers 99% of Taiwan's population of 23 million. The LHID information used consisted of 1 million beneficiaries randomly sampled from the original NHI beneficiaries. The LHID consists of deidentified secondary data released for research purposes. The database includes the entire registry and claims data from this health insurance system, ranging from demographic data to detailed orders from ambulatory and inpatient care. The accuracy of diagnoses in the NHIRD has been previously validated for several diseases.[9–12] Several published papers have used the NHIRD as the basis for their studies.[13–15] The diseases were coded according to the *International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM)* diagnosis codes, 2001 edition. Because the Taiwan NHIRD contains encrypted computerized data for research purposes, the Ethics Committee of Taipei Veterans General Hospital, Taipei, Taiwan informed us that this study was exempted from full review and that each patient's informed consent was not required.

2.2. Study design

This is a nationwide, population-based, observational retrospective cohort study in Taiwan to determine the association between the risks of meningioma in patients with head injury. Two cohorts, namely, the head injury cohort and the matched control cohort without head injury, were enrolled in our study (Fig. 1). The head injury cohort consisted of patients with new diagnosis of head injury with ambulatory visit or hospitalization coding ICD-9-CM 800-804 or 850-854 between January 1, 2000, and December 31, 2010. Patients with the following characteristics were excluded: age <18 years, history of meningioma, and follow-up period of <30 days. We extracted the baseline demographic data, which included age, sex, and urbanization level. Urbanization levels in Taiwan are divided into four strata with Level 1 for the highest urbanization according to the Taiwan National Health Research Institute publications. For each patient, the Charlson Comorbidity Index (CCI) score was used to determine overall systemic health.[16] With each increased level of CCI score, there were stepwise increases in the cumulative mortality: a score of 0 had a 10-year survival rate of 99%, and a score of 5 had a 10-

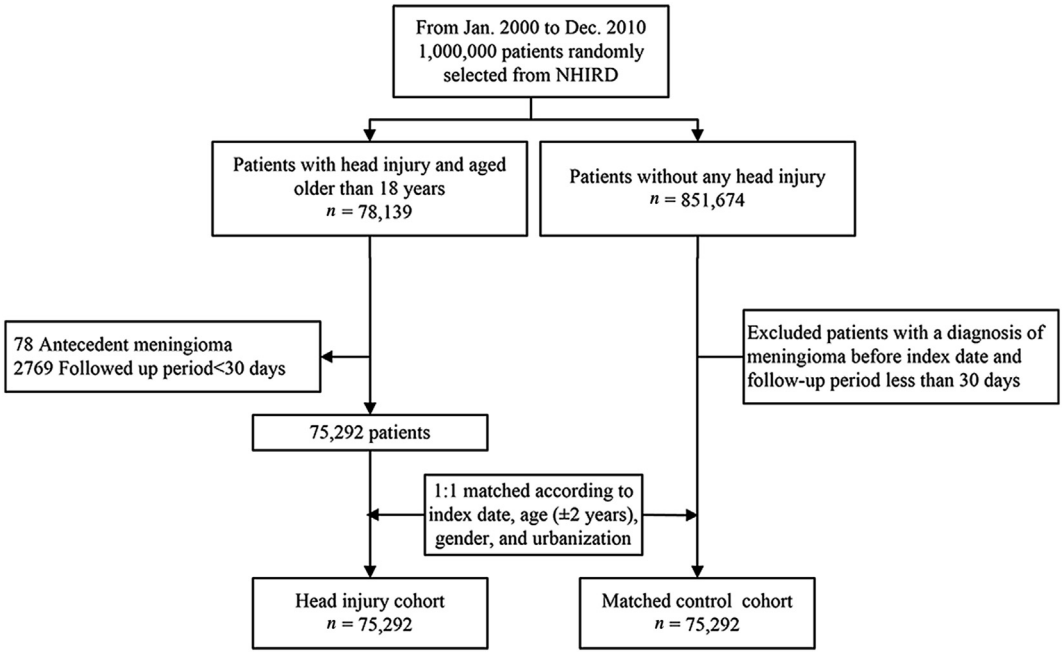

Fig. 1. Patient selection flowchart. NHIRD = National Health Insurance Research Database.