Body Mass Index and Incidence of Subarachnoid Hemorrhage in Japanese Community Residents: The Jichi Medical School Cohort Study

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Background: Whereas high body mass index (BMI) is reportedly a risk factor for cardiovascular events in Western countries, low BMI has been reported as a risk factor for cardiovascular death in Asia, including Japan. Although subarachnoid hemorrhage (SAH) is a highly fatal disease and common cause of disability, few cohort studies have examined the associations between BMI and SAH in Japan. This study investigated the associations between BMI and incidence of SAH using prospective data from Japanese community residents. *Methods:* Data were analyzed from 12,490 participants in the Jichi Medical School Cohort Study. Participants were categorized into 5 BMI groups: ≤18.5, 18.6-21.9, 22.0-24.9, 25.0-29.9, and ≥30.0 kg/m^2. Multivariate-adjusted hazard ratios (HR) and 95% confidence intervals (CI) were calculated using Cox proportional hazard model with BMI of 22.0-24.9 kg/m^2 as the reference category. *Results:* During the mean follow-up period of 10.8 years, 55 participants (13 men, 42 women) experienced SAH. BMI ≥30.0 kg/m^2 was associated with significantly higher risk for SAH (HR, 5.98; 95% CI, 2.25-15.87). BMI ≤18.5 kg/m^2 showed a nonsignificant tendency toward high risk of SAH (HR, 2.51; 95% CI, .81-7.79). *Conclusions:* High BMI was a significant risk factor for SAH. Lower BMI showed a nonsignificant tendency toward higher risk of SAH. Our results suggest a J-shaped association between BMI and risk of SAH incidence. **Key Words:** Body mass index—subarachnoid hemorrhage—community-based cohort study—Japanese population.

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Introduction

Subarachnoid hemorrhage (SAH) was responsible for the deaths of almost 12,476 people in 2015 in Japan,[1] and the estimated annual number of patients was 36,000 in 2011.[2] The rate of acute case fatality for SAH is very high (40%-60%),[3,4] particularly among the young.

Body mass index (BMI) is used as a measure of body fat metabolism and has been used to define obesity, overweight, and leanness in many epidemiologic studies. This index has been recognized as an important risk factor for the development of cardiovascular diseases (CVD). Nevertheless, limited information is available regarding the association between BMI and SAH in community-based cohort studies. Some European cohort studies have shown that subjects with high BMI had a low risk of SAH,[5,6] but the results were not statistically significant.

A meta-analysis of 26 Asian-Pacific cohorts suggested BMI had no significant association with SAH.[7]

To the best of our knowledge, only 2 cohort studies have reported on the association between BMI and SAH in Japan. The Japan Collaborative Cohort (JACC) study showed low BMI as a risk factor for SAH mortality.[8] However, another study reported a nonsignificant trend toward an association between BMI and incidence of SAH.[9] The significance of BMI as a risk factor for SAH incidence thus remains controversial.

This study examined the association between BMI and spontaneous SAH incidence in Japanese community residents using data from the Jichi Medical School Cohort Study.

Methods

Study Population

We used data from the Jichi Medical School Cohort Study, a population-based prospective study. The baseline survey administered in 12 Japanese municipalities between April 1992 and July 1995 collected data on sociodemographic characteristics, anthropometric measurements, and potential risk factors for CVD.[10] This survey was conducted in accordance with the Health and Medical Service Law for the Aged of 1982.

Study data were collected on the basis of these examination results. Participants for the baseline examinations were residents between 40 and 69 years old in 8 areas, and residents ≥19 years old in one other area. Participants from other age groups in the remaining 3 areas were also included.

In each community, a local government office mailed invitations to all residents who were eligible for the health mass screening based on the law, and 62.7% of them participated. Finally, 99% of the participants (12,490 participants; 4911 men and 7579 women) consented to be subjects of this study. Figure 1 shows the geographic location of the 12 municipalities and the number of participants.

Individuals who did not agree to be followed (n = 95), those without BMI data (n = 504), and those with a history of stroke (n = 113), myocardial infarction (n = 65), angina pectoris (n = 221), or malignant neoplasm (n = 142) were excluded. Finally, data from 11,404 participants (4444 men and 6960 women; age range, 19-90 years) were available for analysis.

Baseline Examinations

Body height was measured without shoes, and body weight was recorded while fully clothed and then adjusted by subtracting .5 kg (in the summer) or 1 kg (in other seasons) to account for clothing. BMI was calculated as weight (in kilograms) divided by the square of height (in meters). Systolic blood pressure (SBP) was measured with a fully automatic sphygmomanometer (BP203RV-II; Nippon Colin, Komaki, Japan). Serum lipids (total cholesterol [TC], high-density lipoprotein [HDL] cholesterol, and triglycerides [TG]) and blood glucose (BG) were also measured using standard methods, as reported previously. Trained interviewers using standardized questionnaires obtained information regarding medical history and sociodemographic characteristics. Smoking status was defined as current smoker, ex-smoker, or never smoker, and alcohol drinking status was classified as current drinker, ex-drinker, or never drinker.

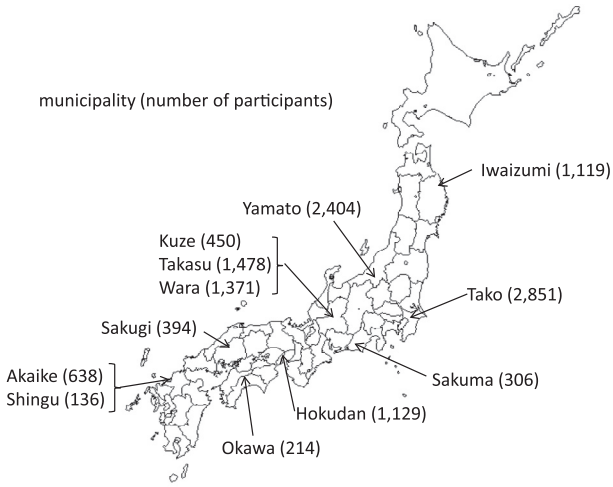

Figure 1. *The 12 municipalities participating in the Jichi Medical School Cohort Study and the number of participants.*

Follow-Up

We attempted annual follow-ups with all participants. Participants were asked directly whether they had experienced stroke or myocardial infarction after the baseline study. Participants who had not undergone annual screening examinations were contacted by mail or telephone, or received home visits by public health nurses. If an incident case was suspected, we reviewed the medical records to document symptoms and signs, images from computed tomography or magnetic resonance imaging as evidence of stroke, or electrocardiograms for evidence of myocardial infarction. Death certificates were collected at public health centers with permission from the Agency of General Affairs and the Ministry of Health, Labour and Welfare.

Based on data obtained annually from each municipal government, a total of 386 participants moved out of the study area during follow-up. Thus, follow-up of these participants was ceased on the day they moved out from their respective area. Follow-up was also discontinued for participants who died before the end of the study. Death caused by CVD was included in the CVD