The Obesity Paradox in Stroke: Impact on Mortality and Short-term Readmission

Raquel Barba, MD, PhD,* Javier Marco, MD, PhD,† Justo Ruiz, MD,‡ Jesús Canora, MD, PhD,‡ Juan Hinojosa, MD, PhD,‡ Susana Plaza, MD, PhD,§ and Antonio Zapatero-Gaviria, MD, PhD‡

Background: The aim of the present study was to assess the association of obesity with the mortality of hospitalized patients with acute stroke and the risk of readmission in less than 30 days. *Methods:* A retrospective chart review of a cohort of consecutive patients admitted with stroke as the primary reason for discharge in Spain between January 1, 2005, and December 31, 2011, was performed. Patients with a diagnosis of obesity were identified. The mortality and readmittance indexes of obese patients were compared against the subpopulation without theses diagnosis. *Results:* A total of 201,272 stroke admittances were analyzed, and 14,047 (7.0%) diagnosis of obesity were identified. In-hospital global mortality reached 14.9%, and readmittance risk was 5.9%. Obese patients showed a lower in-hospital mortality risk (odds ratio [OR], .71; 95% confidence interval [CI], .67-.76) and early readmittance risk (OR, .89; 95% CI, .82-.96) than the nonobese even after adjusting for possible confounding factors. *Conclusions:* Obesity in those hospitalized for stroke is associated with reduced in-hospital mortality risk and early readmittance. **Key Words:** Stroke—obesity—mortality—readmission.

Introduction

Obesity is related to increased risk for cardiovascular disease being recognized as an important risk factor for primary stroke in the general population.[1,2] This association has been documented in both genders and different ethnic populations[3]; based on these findings the American Heart Association and the American Stroke Association recommend the treatment of obesity for both primary and secondary stroke prevention.[4,5]

However, in patients with established cardiovascular diseases, obese patients tend to have a more favorable prognosis, which is called the obesity paradox.[6-8] The relation between obesity and survival in patients who have experienced an acute stroke has been sparsely investigated; some studies[9] report that mortality in obese patients is lower than in patient with normal weight; thus, it is unclear if recommendations derived from primary prevention should be extended to secondary prevention of cardiovascular disease.

Recent studies now report that the stroke obesity paradox may even be extended to include risk of stroke recurrence; compared with normal-weight patients, the risk of readmission for recurrent stroke was also lower in obese stroke patients.[10,11]

The present study aims to investigate the association between obesity and mortality in patients hospitalized with acute stroke and the risk of readmission for recurrence of stroke in the next 30 days after discharge.

From the *Servicio de Medicina Interna, Hospital Rey Juan Carlos, Móstoles; †Servicio de Medicina Interna, Hospital Clínico Universitario San Carlos, Madrid; ‡Servicio de Medicina Interna, Hospital Universitario Fuenlabrada, Madrid; and §Servicio de Medicina Interna, Hospital Severo Ochoa, Leganés, Spain.

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Address correspondence to Antonio Zapatero-Gaviria, MD, PhD, Servicio de Medicina Interna, Hospital Universitario de Fuenlabrada, Madrid, Spain. E-mail: antonio.zapatero@salud.madrid.org.

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Material and Methods

We identified every patient discharged from an Internal Medicine Department from hospitals of the Spanish Public Health Service between January 1, 2005, and December 31, 2011. Hospitals discharge data were obtained from the Basic Minimum Data Set. Basic Minimum Data Set contains sociodemographic and clinical data for each documented hospital admission including the following: gender and age, primary and secondary diagnoses (according to the International Classification of Diseases, Ninth Revision, Clinical Modification [ICD-9-CM] code), primary and secondary procedures, admission and discharge status, length of stay, and hospital characteristics (group 1, <150 beds; group 2, 150-200 beds; group 3, 200-500 beds; group 4, 500-1000 beds; group 5, >1000 beds). For every patient, a diagnosis-related group was identified. Diagnosis-related groups are a method of classifying patient hospitalizations by diagnosis and procedures on the assumption that similar costs are expended on patients by using similar resources. The Basic Minimum Data Set registry is compulsory for every patient admitted to a hospital of the Spanish National Health Service, a system that cares for more than 90% of the country's population.

Cases were selected if they were discharged with the diagnosis of cerebrovascular disease. The diagnosis of cerebrovascular disease was identified using ICD-9-CM codes 430.00-438.99 in the diagnosis field (except 432.10).

The standardized definition of the variable readmission in the Spanish Basic Minimum Data Set has been defined as a new hospitalization in the following month with the same Major Diagnostic Category in the main diagnosis.

Patients who had a secondary diagnosis of obesity (ICD-9-CM, 278.00-278.02) were analyzed. The diagnosis of obesity is introduced by the internist responsible for the patient with stroke during admission, and is the same, who makes the hospital discharge report.

The age adjusted Charlson Comorbidity Index (CCI) was computed for each patient. This index reflects the number and importance of comorbid diseases, relies on ICD-9-CM categories, and was used to adjust for severity of illness.[12,13]

The following risk factors were identified using ICD-9-CM codes in any primary or secondary diagnosis field: anemia: ICD-9-CM, 280.00-285.99; tobacco: ICD-9-CM, 305.10; atrial fibrillation: ICD-9-CM, 427.3-427.32; hypercholesterolemia: ICD-9-CM, 272.0, 272.2, 272.4; diabetes: ICD-9-CM, 250.00-250.99; hypertension: ICD-9-CM, 401.0, 401.1, 401.9; acute myocardial infarct: ICD-9-CM, 410.xx, 412; and heart failure: ICD-9-CM, 398.91, 404*, 402.11, 402.91,428-428.9.

Data Analysis

A descriptive analysis of these patients was carried out, and the demographic variables among the patients diagnosed with or without obesity were compared. We used the chi-square test for categorical variables with the Yates correction, the Fisher exact test for dichotomous variables when the expected value of a cell was less than 5, and the Student *t* test or analysis of variance for quantitative variables. The odds ratios (ORs) and 95% confidence intervals (CIs) were estimated from the regression coefficients.

As this is an administrative database, the control of the confounding variables is basic. For this reason, a multivariate logistic regression analysis was carried out with the aim of determining the excess of mortality attributable to obesity, after the correction of possible confounding variables such as the age of the patient (in years, as a continuous variable), Charlson index (in points, as a continuous variable), sex, and all variables that had demonstrated a statistically significant relation in the univariate analysis with mortality and are not included in the Charlson index. A logistic regression analysis with backward stepwise procedure and P more than .10 as the criterion for exclusion were used to find the best predictive models. All statistical analyses were carried out with the use of an SPSS Software, version 16 (SPSS Inc, Chicago, IL).

Results

We identified 201,272 discharges with acute stroke during the study period. Median age of patients was 77.09 years (standard deviation, 11.64); 49.2% of the patients were men. Median stay was 10.283 days (standard deviation, 14.55). A CCI of 2 or more was present in 11.9% of the cases. The subtypes of stroke were 91.6% ischemic stroke, 7.8% intracerebral hemorrhage, and .6% subarachnoid hemorrhage.

A total of 14,047 (7.0%) subjects were obese. The main characteristics in obese and nonobese patients of our series are listed in Table 1. Compared with nonobese, obese patients were more frequently women (60.1% versus 50.2%; $P < .001$), younger (72.2 versus 77.4; $P < .001$), and more frequently smokers (12.2% versus 9.0%; $P < .001$).

Comorbid conditions were common and are listed in Table 1.

Multivariable logistic regression analysis was performed. The main result was that obese patients had a 29% lower risk of mortality than nonobese patients, after adjusting for potential confounding factors (OR, .71; 95% CI, .67-.76; Table 2).

In addition, the risk of readmission was linked to increasing age, CCI, and gender, and obese patients were significantly less likely to be readmitted for stroke (OR, .89; 95% CI, .82-.96; Table 2).

Discussion

The present study shows that obese stroke patients had a significantly lower mortality during hospitalization and