Obesity and Abdominal Fat Markers in Patients with a History of Stroke and Transient Ischemic Attacks

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Background: Abdominal obesity is a well-recognized cardiovascular risk factor. Conflicting data concerning its significance with respect to stroke have been discussed in recent years. The objective of this study was to analyze the association between anthropometric parameters and the risk of stroke and transient ischemic attacks (TIAs) in German primary care. *Methods:* Patient recruitment in this large-scale epidemiological study was performed in 3188 representative primary care offices in Germany. Among 6980 study participants, 1745 patients with a history of stroke or TIA were identified and matched for age and gender with 5235 regional controls. Associations between standard anthropometric measures such as body mass index (BMI), waist-to-hip ratio, waist circumference, waist-to-height ratio, and cerebrovascular risk were investigated using logistic regression analysis with adjustment for age, gender, and vascular risk factors. *Results:* BMI showed no significant associations with the risk of stroke or TIA in any of the applied mathematical models. Markers of abdominal obesity were associated with an increased risk of stroke or TIA in the unadjusted model (waist circumference: odds ratio [OR] 1.15; 95% confidence interval [CI], 1.00-1.32; waist-to-hip ratio: OR 1.21; 95% CI, 1.05-1.38; waist-to-height ratio: OR 1.25; 95% CI, 1.09-1.44, comparisons between top and bottom tertiles). After adjustment for vascular risk factors, all associations were insignificant. *Conclusions:* Abdominal obesity is a stronger predictor of risk of stroke or TIA than BMI. However, the association between abdominal obesity and the risk of stroke or TIA is not independent of other vascular risk factors. Stroke-related weight changes should be considered in longitudinal studies examining the role of obesity in cerebrovascular disease. **Key Words:** Stroke—transient ischemic attack—abdominal obesity—body mass index—risk factors.

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Introduction

The prevalence of obesity is increasing. In industrial countries, more than 50% of the population is overweight (e.g., 65.7% in the United States), and 15%-30% meets the diagnostic criteria for obesity.[1] The role of obesity as a cardiovascular risk factor has consistently been documented in large-scale prospective studies.[2,3] However, the relationship between obesity, increased visceral fat measures, and stroke is not well defined in the medical literature. Some studies found a positive association between increased body mass index (BMI) and the risk of stroke.[4-6] In contrast, there is evidence from other studies indicating no association after adjustment for vascular risk factors such as physical inactivity, smoking, arterial hypertension, diabetes mellitus, and dyslipidemia.[7,8] The latest data indicate that it is not BMI but markers of abdominal obesity that are significantly associated with the risk of stroke or transient ischemic attacks (TIAs).[6] These associations persisted after adjustment for other vascular risk factors and tended to be higher in women.

With data from the large-scale epidemiological DETECT (Diabetes Cardiovascular Risk-Evaluation: Targets and Essential Data for Commitment of Treatment) study, we tried to replicate and expand Winter et al.[6] The aim was to analyze the association between anthropometric parameters and the risk of stroke or TIA in patients recruited in the German primary care setting.

Patients and Methods

DETECT is a large nationally representative epidemiological cross-sectional study of 55,518 unselected consecutive patients recruited in 3188 representative primary care offices in Germany.[9-11] For more information about the study, see Wittchen et al,[11] Schneider et al,[10] Bohler et al,[9] and the website http://www.detect-studie.de. In total, 1745 patients in this study had a history of stroke or TIA and were included in this analysis (806 patients having suffered a stroke and 939 patients with the diagnosis of TIA). Each index patient was matched with 3 controls without a history of cerebrovascular disease. Control subjects (n = 5235) were matched for age and gender from the database of the DETECT study using propensity scores.[12] The study was approved by the ethics committee of the TU Dresden (No. EK149092003), and all patients gave informed consent.

The diagnoses of stroke and TIA, arterial hypertension, diabetes mellitus, and dyslipidemia were obtained from physicians' records. Physical activity and smoking status were obtained from patients' interviews. The anthropometric measures (BMI, waist circumference [WC], waist-to-hip ratio [WHR], waist-to-height ratio [WHtR]) were documented for all study participants. According to international recommendations, BMI was defined as weight in kilograms divided by height in meters squared;[13] WHR was measured as waist divided by hip circumference;[14] and waist-to-stature ratio was measured as WC divided by body height.[15]

WHO (World Health Organization)[16] threshold categories were used for BMI (<25.0 kg/m^2 normal weight; 25.0 kg/m^2-29.9 kg/m^2 preobesity; ≥30.0 kg/m^2 obesity), WC (male: <94.0 cm normal weight; 94.0 cm-101.9 cm overweight; ≥102 cm obesity; female: <80.0 cm normal weight; 80.0 cm-87.9 cm overweight; ≥88 cm obesity), and WHR (≥.85 female; ≥1.0 male), as well as tertiles generated from the data for WC, WHtR, WHR, and BMI.

Statistical Analysis

Conditional logistic regression models were used to calculate odds ratios (ORs) and 95% confidence intervals (CIs) for WC, WHtR, WHR, and BMI. Adjustment was performed for the following vascular risk factors: arterial hypertension, diabetes mellitus, dyslipidemia, smoking during the previous 5 years, and physical inactivity (physical activity of less than 2 hours/week). Statistical analysis was performed with STATA version 10.1 (StataCorp, Stata Statistical Software, Release 10.1; College Station, Texas). We applied the following 4 approaches to assess the role of obesity markers in predicting the risk of stroke or TIA: (1) ORs across tertiles of BMI, WC, WHR, and WHtR using the bottom tertile as the reference category; (2) ORs across WHO categories for BMI, WC, and WHR using the bottom category as the reference; (3) ORs for 1 standard deviation (SD) change in BMI, WHR, WHtR, and WC; and (4) comparisons of the receiver–operator curves (ROCs) in relation to stroke or TIA for BMI, WHR, WHtR, and WC. The area under the ROC is a measure of the accuracy of the test. An accurate test is associated with an area under the ROC of 1.0, whereas a test accuracy of 50% has an area of .5, and a test with an area of .0 is completely inaccurate. ROCs were compared using the method of DeLong et al.[17]

Results

Among the 55,518 patients, 1745 had a history of stroke or TIA. These 1745 patients were matched for age and gender with 5235 regional controls. Table 1 describes the demographic data, anthropometric values, and the distribution of vascular risk factors in the study population stratified by gender. Cases had significantly higher values of markers of abdominal obesity (WHtR, WC) and a higher prevalence of vascular risk factors (arterial hypertension, diabetes mellitus, and dyslipidemia).

The results of the logistic regression analysis across tertiles of WC, WHtR, WHR, and BMI are shown in Table 2. BMI was not associated with the risk of stroke or TIA in any of the four mathematical models used. In contrast, markers of abdominal obesity were associated with an increased risk of stroke or TIA in the unadjusted model (WC: OR 1.15; 95% CI, 1.00-1.32; WHR: OR