Perceived Stress Is Associated with Subclinical Cerebrovascular Disease in Older Adults

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Objective: *To examine the association of perceived stress with magnetic resonance imaging (MRI) markers of subclinical cerebrovascular disease in an elderly cohort.* **Methods:** *Using a cross-sectional study of a community-based cohort in Chicago, 571 adults (57% women; 58.1% African American; 41.9% non-Hispanic white; mean [SD] age: 79.8 [5.9] years) from the Chicago Health and Aging Project, an epidemiologic study of aging, completed questionnaires on perceived stress, medical history, and demographics as part of an in-home assessment and 5 years later underwent a clinical neurologic examination and MRI of the brain. Outcome measures were volumetric MRI assessments of white matter hyperintensity volume (WMHV), total brain volume (TBV), and cerebral infarction.* **Results:** *Stress was measured with six items from the Perceived Stress Scale (PSS); item responses, ranging from never (0) to often (3), were summed to create an overall stress score (mean [SD]: 4.9 [3.3]; range: 0−18). Most participants had some evidence of vascular disease on MRI, with 153 participants (26.8%) having infarctions. In separate linear and logistic regression models adjusted for age, sex, education, race, and time between stress assessment and MRI, each one-point increase in PSS score was associated with significantly lower TBV (coefficient = −0.111, SE = 0.049, t[563] = −2.28, p = 0.023) and 7% greater odds of infarction (odds ratio: 1.07; 95% confidence interval: 1.01, 1.13; Wald $\chi^2[1]$ = 4.90; p = 0.027). PSS scores were unrelated to WMHV. Results were unchanged with further adjustment for smoking, body mass index, physical activity, history of heart disease, stroke, diabetes, hypertension, depressive symptoms, and dementia.* **Conclusions:** *Greater perceived stress was significantly and independently associated with cerebral infarction and lower brain volume assessed 5 years later in this elderly cohort.* (Am J Geriatr Psychiatry 2014; 22:53−62)

Key Words: MR measures, perceived stress, biracial population sample

INTRODUCTION

A growing body of research shows that various indicators of stress, including job strain, chronic severe stress, and poor stress-coping capability, are associated with excess risk of incident stroke and stroke-related mortality.[1–5] These studies add to the existing literature regarding the influences of psychosocial factors on cardiovascular disease (CVD), which clearly documents the important contributions of chronic psychological stress to CVD morbidity, mortality, and other CVD-related health outcomes.[1,6–10] A number of studies have examined measures of stress in relation to prevalence and progression of subclinical atherosclerosis or other subclinical forms of CVD. However, few previous studies have investigated stress in relation to subclinical indicators of cerebrovascular disease as revealed by magnetic resonance imaging (MRI). Understanding the impact of stress earlier in the disease process may further understanding of disease progression and of the mechanisms by which chronic stress can contribute to increased stroke risk.

We used data from more than 500 participants in the Chicago Health and Aging Project (CHAP) to examine the association between perceived stress and subclinical cerebrovascular disease measured on average 5 years later. We hypothesized that higher levels of perceived stress would be associated with greater subclinical cerebrovascular disease, as measured by MRI and manifested as greater white matter hyperintensity volume (WMHV), lower total brain volume (TBV), and increased risk of cerebral infarction. We further hypothesized that these associations would be independent of known vascular risk factors and conditions.

METHODS

Study Design

CHAP is a longitudinal population-based study of common chronic health problems among older adults, with a focus on dementia and cognitive decline. CHAP study design and population characteristics have been previously reported.[11,12] Briefly, a complete census of three adjacent community areas in south Chicago was completed between 1993 and 1997. All residents identified via the census who were age 65 years or older were invited to participate; 78.9% of eligible persons (N = 6,158) agreed and provided informed consent. This is the CHAP Original Cohort. The study population reflects the race/ethnicity makeup of the community areas at the time of the census, predominantly African American and non-Hispanic white (<1% reported another race category or Hispanic ethnicity). Five data collection cycles have occurred, with data obtained, on average, every 3 years; that is, 1993–1997 (cycle 1), 1997–1999 (cycle 2), 2000–2002 (cycle 3), 2003–2005 (cycle 4), and 2006–2008 (cycle 5). Beginning with data collection cycle 3, residents from the CHAP community areas who had since turned 65 years old and who were identified through the previous community census or commercially available lists were enrolled into CHAP. These are the CHAP study Successive Cohorts, and they follow the same 3-year interview cycles and complete the same measures as the CHAP Original Cohort. For analyses, data from both cohorts are combined.

Procedures

Each CHAP data collection cycle has 1) an in-home population interview, with brief tests of physical function, psychosocial variables, and cognitive function, and 2) a clinical evaluation of a stratified random sample (about one-sixth) of subjects at each cycle that includes neuropsychological testing, a neurologic examination, medical history, laboratory testing, and expert clinical assessment for dementia. Starting with cycle 3 and continuing with subsequent cycles, those completing the clinical evaluation were invited to complete a neurologic imaging evaluation (MRI). Clinical evaluations usually take place in the subjects' homes and are conducted by a team of examiners led by a senior neurologist (NTA). Structured neurologic examinations and medical histories are performed by specially trained nurse clinicians. The diagnosis of dementia required the senior neurologist's assessment of loss of cognitive function and impairment in two or more areas during cognitive performance testing. The diagnosis of Alzheimer disease used the criteria of the National Institute of Neurological and Communicative Disorders and Stroke-Alzheimer's Disease and Related Disorders Association,[13] except that subjects who met these criteria and had another condition that impaired cognition were retained (i.e., enrolled in the present study). Vascular dementia diagnosis followed