Time Trends and Characteristics of Prevalent Dementia among Patients Hospitalized for Stroke in the United States

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Background: Little is known about how prevalent dementia rates among patients with stroke have evolved over the last decade or how this relationship varies by gender, race ethnicity, stroke type, or dementia type. We assessed time trends and demographic predictors of coexisting dementia in a large cohort of patients hospitalized for stroke. *Materials and Methods:* Patient admission data between 1999 and 2012 were sourced from the National Inpatient Sample. Patient admission records were included in the retrospective analysis if they were diagnosed with ischemic or hemorrhagic stroke during admission. Predictors of dementia subtype were analyzed using unadjusted and adjusted multinomial logistic regression. *Results:* Of 1,170,051 patients hospitalized for stroke between 1999 and 2012, 66,703 (5.7%) had a coexisting diagnosis of dementia. Female gender was associated with increased odds of Alzheimer's dementia (AD) (adjusted odds ratio [aOR] 1.15, 95% confidence interval [CI] 1.11-1.19) but decreased odds of both vascular dementia (VaD) (aOR .50, 95% CI .44-.58) and non-Alzheimer's–nonvascular dementia (aOR .79, 95% CI .79, 95% CI .74-.83). Relative to whites, African-Americans had higher odds of AD (aOR 1.25, 95% CI 1.18-1.32) and VaD (aOR 1.51, 95% CI 1.40-1.64). Similarly, Hispanics had increased odds of AD (aOR 1.40, 95% CI 1.30-1.50). *Conclusions:* Rates of coexisting dementia among patients hospitalized for stroke in the United States have risen over the last decade. Prevalence of dementia among these patients varies by gender and race-ethnicity. Key demographic groups may need to be targeted to reduce disparities in dementia occurrence. **Key Words:** Stroke—dementia—dementia subtype—nationwide—hospitalization.

Introduction

Stroke is a major cause of disability among the elderly, and the progression from stroke to cognitive impairment and dementia is common. Recent estimates of the prevalence of cognitive impairment among patients with stroke range from 20% to 80%, depending upon the setting and appear to be increasing in parallel to improvements in poststroke survival.[1] Although the neurovascular mechanisms underlying the pathogenesis of vascular dementia (VaD) in patients with stroke have been well described, less is known around the relationship between stroke and Alzheimer's disease.[2] These include well-documented vascular risk factors such as hypertension, dyslipidemia, diabetes mellitus, previous infarct history, and alcohol intake in addition to more lifestyle and clinical predictors such as diet, physical activity, cerebral magnetic resonance imaging markers, peripheral arterial disease, and heart failure.[3-7] There is a considerable overlap between risk factors for stroke and both vascular cognitive impairment and Alzheimer's disease.[8] Although previous studies have suggested a synergistic interaction of such risk factors in the clinical manifestation

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of both dementia and cerebrovascular disease,[9-11] isolating the independent influence of any 1 risk factor has been proven to be difficult, particularly with regard to relatively heterogeneous diseases such as VaD. Of the comparatively limited studies on dementia risk factor studies explicitly in a stroke cohort setting, results are mixed. This is particularly the case with less well-established demographic risk factors including gender and ethnicity. The 14-year longitudinal ARIC magnetic resonance imaging confirmed hypertension, insulin resistance, and previous stroke as correlates of increased risk of cognitive decline in the stroke cohort, but was unable to isolate any demographic risk factors such as gender or ethnicity.[12] Conversely, a meta-analysis of 30 stroke cohorts across 59 years observed that the female gender was associated with a higher risk of a dementia diagnosis before stroke relative to the male gender, although this correlation was not replicated for poststroke dementia.[13]

The objective of the present study was primarily to explore the clinical and demographic predictors of dementia type, and secondarily to also elucidate trends of disease association and prevalence in a large cohort of patients with stroke sourced from the Nationwide Inpatient Sample (NIS) administrative admission database and describe trends in dementia subtype over time.

Materials and Methods

Data Source

All data used in this analysis were sourced from the NIS, a database of hospital inpatient admissions derived from hospital-level administrative data from across the United States, administered as part of the broader Health Cost and Utilization Project (HCUP).[14] Because this was an analysis of publicly available deidentified data, the study was exempted by the institutional review board. Patient records included in the NIS represent a 20% sample of discharges from hospitals participating in the HCUP. Patient records were stratified as per the sampling methodology employed by NIS. Prevalence trend data were further weighted in accordance with NIS guidelines.

Inclusions

Patient admission records were included in the analysis if they recorded any of the following International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis codes for any admission available from NIS within the observation years of 1999 through 2012 inclusive: "431" for hemorrhagic stroke, and "434.01," "434.11," or "434.91" for ischemic stroke. Records where both hemorrhagic and ischemic strokes were recorded concurrently for the same admission were excluded from the analysis. This process identified 1,170,051 eligible discharge records, which were then screened for the following primary dementia type codes: "331.0" for Alzheimer's dementia (AD), and 290.4X VaD and "331.11," 331.19," or "331.82" for non-Alzheimer's–nonvascular dementia (NAVD). Both primary and secondary diagnosis codes were included. This resulted in a total of 66,703 eligible patient admission records used for the primary analysis.

Outcomes and Definitions

The primary outcome of the analysis was dementia subtype, defined over 3 levels: (1) AD, (2) VaD, and (3) NAVD.

Statistical Analyses

Categorical variables were summarized using frequency and percentage and were compared across dementia types using a chi-square test. Continuous variables were summarized using mean, standard deviation, and standard error (SE) or median and interquartile range, and were compared by dementia type using an analysis of variance or Kruskal–Wallis test as appropriate. A chi-square test of trend was used to assess prevalence trends for significance. Demographic, socioeconomic, and comorbidity factors potentially associated with dementia type were analyzed using unadjusted and adjusted multinomial logistic regressions. The multinomial approach describes an extension of traditional binary outcome logistic regression and is appropriate for outcome variables defined on 3 or more levels. For this analysis, the 3 dementia subtypes were compared against a reference group comprising nondementia stroke admissions. Comorbidity factors included in the modeling were identified using ICD-9-CM codes as summarized in Supplementary Table S1. Subgroup analysis was performed disaggregating the models on age (<85 years, 85+) and stroke type (hemorrhagic or ischemic). An Akaike Information Criterion (AIC) was used to compare goodness of fit across models. For all analyses, a P value less than .05 was considered significant. All analyses were conducted in SAS version XX (SAS Institute Inc, Cary, NC).

Results

Admission Characteristics

Of the 1,170,051 admission records identified between 1999 and 2012 recording a stroke diagnosis, 1,003,218 (85.7%) were ischemic strokes and 166,833 (14.3%) were hemorrhagic strokes. Of these admissions, 66,703 (5.7%) also recorded a dementia diagnosis, of which 43,524 (65.3%) were AD, 20,321 (30.5%) were VaD, and the remaining 2858 (4.3%) were NAVD. The mean (SE) age at stroke admission was highest in the AD group at 83.3 years (.03) compared with 81.4 years (.13) for NAVD and 79.7 years (.06) for VaD (Table 1). The mean (SE) length of stay was longest for patients with VaD (7.1 days, SE .06), marginally greater than both NAVD (6.4 days) and AD (6.1 days).