Stroke and Heart Failure: Clinical Features, Access to Care, and Outcomes

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Background and Objectives: Limited information is known regarding acute ischemic stroke (AIS) and heart failure (HF). The aim of the study was to evaluate clinical characteristics, predisposing factors, and outcomes in AIS with HF. *Methods:* We included AIS patients admitted to the institutions participating in the Registry of the Canadian Stroke Network. HF was defined as history of pre-existing HF or pulmonary edema present at the time of arrival. The primary outcome was death or disability at discharge (modified Rankin Scale score >3). Secondary outcomes included disposition, death at 3 months and at 1 year, and 30-day hospital readmissions. *Results:* Among 12,396 patients, HF was found in 1124 (9.1%) patients. HF was associated with higher risk of death at 30 days (24.5% versus 11.2%, $P < .0001$), at 1 year (44.3% versus 20.6, $P < .0001$), and disability at discharge (70.4% versus 56%, $P < .0001$). In the multivariable analysis, HF was an independent predictor of death and disability (odds ratio 1.18, 95% confidence interval [CI] 1.01-1.37), death at 30 days (hazard ratio [HR] 1.22, 95% CI 1.05-1.41), and hospital readmissions (HR 1.32, 95% CI 1.05-1.65) at 30 days. The results were unaltered

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when adjusting for pneumonia with the exception of death or disability at discharge. *Conclusions:* In this large cohort study, HF was observed in 9.1% of AIS patients. HF is an independent predictor of death and disability and hospital readmissions after stroke at 30 days. **Key Words:** Stroke—heart failure—quality of care—outcomes.

Introduction

Stroke is a major cause of death and disability worldwide. Some pre-existing medical conditions (e.g., atrial fibrillation [AF] and diabetes) directly influence stroke outcomes.[1,2] Heart failure (HF) is a complex clinical syndrome that results from structural or functional impairment of ventricular filling or reduction in the ability of the ventricle to eject blood.[3] The prevalence of HF is approximately 10 per 1000 after 65 years of age,[4] increasing to over 80 per 1000 populations among those aged 85 years and older.[5] HF carries high mortality with 1-year mortality of approximately 30%-45%.[6] After the onset of HF, only 50% will survive in 5 years.[7] Similarly, mortality is 2-fold higher in stroke patients with HF compared to those without HF.[8-10] With the growth in the aging population, the increasing prevalence of stroke and HF in patients is expected. However, there is not much known about acute ischemic stroke (AIS) with HF. The aim of our study was to evaluate (1) clinical characteristics, predisposing factors, and outcomes in patients who have AIS with HF and (2) to determine if HF is an independent predictor of stroke outcomes.

Methods

Study Population

We identified consecutive patients aged 18 years old or older who were admitted with a diagnosis of ischemic stroke to participating institutions in the Registry of the Canadian Stroke Network (RCSN) between July 1, 2003, and June 30, 2008. Patients with missing Canadian Neurological Scale (CNS) scores (n = 304) and baseline glucose levels (n = 701) were excluded from the study. The study population and exclusions are shown in Figure 1.

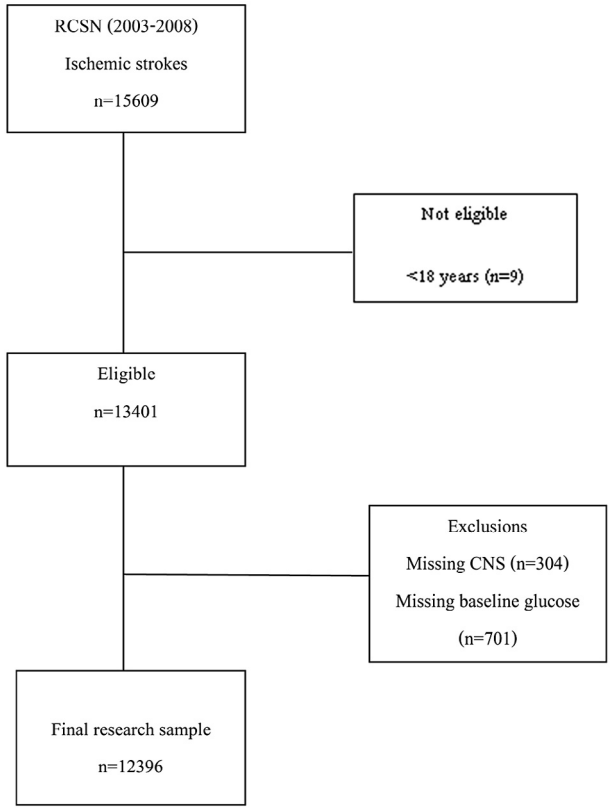

Figure 1. *Study population. Abbreviations: CNS, Canadian Neurological Scale; RCSN, Registry of the Canadian Stroke Network.*

Data Sources

The RCSN is a large prospective quality monitoring stroke care registry that comprises acute stroke patients admitted to 11 stroke centers in Ontario, Canada. Details of the RCSN can be obtained from http://www.ices.on.ca/Research/Research-programs/Cardiovascular/Ontario-Stroke-Registry and are published elsewhere.[11] The poststroke mortality was obtained through linkages to the Ontario Registered Persons Database at the Institute for Clinical Evaluative Sciences. The Registered Persons Database was linked with the RCSN for capturing postdischarge mortality. Demographic data and clinical variables, including vascular risk factors, medical history of AF, and cardiac comorbidity, were recorded from clinical data. Stroke severity on admission was determined by the CNS score: mild (CNS score ≥ 8), moderate (CNS score 4-7), severe (CNS ≤ 4).[12] We applied the iScore, a validated risk assessment tool, to estimate prognosis and outcomes in AIS with and without HF.[2]

Exposure

HF was defined as a pre-existing history of HF or pulmonary edema present at the time of arrival documented in emergency room records/notes, history and physical exam, and physician's admission notes. HF is one of the main variables captured in the RCSN.