



Brief Report

Stroke registry: hemorrhagic vs ischemic strokes

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Abstract

Background: Epidemiologic studies of stroke in the 1970s and 1980s have reported the percentage of ischemic stroke as 73% to 86%, with hemorrhagic stroke as only 8% to 18%; the remainder was undetermined (due to not performing computed tomographic [CT] scanning or an autopsy). In our clinical work, it appeared anecdotally to the authors that we were seeing more hemorrhagic strokes than these previously quoted figures.

Methods: We conducted a retrospective review for 1 year of all patients discharged from the hospital, a regional stroke center, with a diagnosis of stroke; we compared ischemic to hemorrhagic stroke types.

Results: There were 757 patients included. Of the patients, 41.9% were hemorrhagic and 58.1% were ischemic.

Conclusion: There were a much greater percentage of hemorrhagic strokes in this population than would have been predicted from previous studies. This finding may be due to improvement of CT scan availability and implementation unmasking a previous underestimation of the actual percentage or to an increase in therapeutic use of antiplatelet agents and warfarin causing an increase in the incidence of hemorrhage.

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1. Introduction

Previous population studies have found that 73% to 86% of strokes were ischemic, whereas only 8% to 18% were hemorrhagic, with the remainder being unspecified (a diagnosis was not able to be determined) [1–4]. Anecdotally, the authors have found that we were caring for a much larger percentage of hemorrhagic stroke patients, possibly even approaching 50% of the total strokes admitted through the emergency department (ED). The authors believe that the previous studies were performed before widespread use of

computed tomographic (CT) scans that may have lead to an underestimation of the hemorrhagic infarcts because clinical examination alone is insensitive at making an accurate diagnosis. We also suspect that developments in medical treatment, such as aggressive antiplatelet therapy and more prevalent use of warfarin, may now influence the incidence of hemorrhagic infarcts.

2. Methods

We retrospectively examined the stroke registry data for a 12-month period from November 2006 to October 2007 for all inpatients with discharge diagnoses of either hemorrhagic or ischemic stroke. Hemorrhagic stroke diagnoses included intracerebral hemorrhage, intraventricular hemorrhage, and

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Table 1 Monthly count of hemorrhagic and ischemic strokes for 1 year

N = 757 total	November 2006	December 2006	January 2007	February 2007	March 2007	April 2007	May 2007	June 2007	July 2007	August 2007	September 2007	October 2007
Hemorrhagic stroke = 317 (41.9%)	20	25	27	26	18	25	35	30	20	27	35	29
Ischemic stroke = 440 (58.1%)	28	27	42	42	41	42	38	36	36	43	32	33

SE, 1.8%; margin of error at 95% confidence, 3.4%.

subarachnoid hemorrhage; traumatic hemorrhages were excluded. Ischemic strokes excluded transient ischemic attacks. This study qualifies as exempt under institutional review board protocol because it used only data already collected and did not use any patient unique identifiers; all Health Insurance Portability and Accountability Act (HIPPA) requirements for confidentiality were upheld.

3. Setting

This study was conducted in an urban, nonacademic tertiary care facility with 850 inpatient beds serving as a regional stroke center in central Florida. The ED annual census is approximately 60 000 visits. The surrounding community has the following racial demographics: white, 51%; African American, 27%; Hispanic, 18%; Asian, 3%; and American Indian, 1%.

4. Results

Seven hundred fifty-seven patients were discharged from the hospital with a diagnosis of stroke for the 1-year study period; 317 had hemorrhagic stroke and 440 had ischemic strokes. Of the patients, 41.9% were hemorrhagic and 58.1% were ischemic; the standard error is 1.8%, and the margin of error at 95% confidence is 3.4% (Table 1).

5. Discussion

Because clinical examination alone cannot reliably distinguish a hemorrhagic from an ischemic infarct, brain imaging using CT or MRI is required [5]. The CT scanning is typically done acutely because it is more readily available and more expedient, but the CT features of the different types of stroke only remain for 2 to 3 weeks; small cerebral hemorrhages are evident by CT for only 14 days [5]. Earlier studies of stroke occurrence were often performed on populations who did not universally have brain imaging performed, with the diagnosis sometimes being made by clinical suspicion only. Patients who did not have cerebral imaging often were elderly, had mild stroke syndromes, or died early in their medical course; in some cases, the patients refused scanning, were treated at home

only, were at facilities that lacked scanning capabilities, and either were not transferred or were not medically stable for transfer [5]. Even in the 1990s after the access to CT scanning had improved, imaging was sometimes delayed in noncoma-tose patients because before the approval of thrombolytic therapy for ischemic stroke, the management of the stroke types were similar. For these reasons, it is possible that the actual percentage of hemorrhagic stroke may have been higher at that time.

As the worldwide incidence of stroke has been increasing, an increase in the factors associated with hemorrhagic stroke (hypertension, chronic hepatic disease, anticoagulation therapy, previous cerebral hemorrhage) may also have increased the percentage of this stroke type [2,6]. As more patients are being diagnosed with thrombotic and embolic disease states (coronary artery disease, cerebral vascular disease, atrial fibrillation, severely reduced left ventricular function, deep venous thrombosis, and pulmonary embolism) and surviving their initial clinical presentation, there has been an increase in the therapeutic use of antiplatelet agents and warfarin [7,8]. The use of these medications adds to the risk of hemorrhagic stroke occurrence.

6. Limitations

Because this data is compiled retrospectively, it is possible that some stroke cases were not captured. These diagnoses were recorded at hospital discharge, not at admission, so that only patients who survived to discharge were included. The inpatient mortality is generally higher for hemorrhagic strokes than it is for ischemic strokes, so that there may have been more deaths in the hemorrhagic group [9]. If we included all hospitalized patients with stroke, not only those who survived to discharge, the percentage of hemorrhagic strokes would likely have been higher.

As a stroke center, possibly more hemorrhagic stroke patients were transferred to this facility because patients who have ischemic stroke and who do not receive thrombolytics would be more likely to remain at a community hospital; more transfers of patients with hemorrhagic stroke potentially for intensive care unit care or neurosurgical consultation may have caused a population bias. Even removing all transfers from the data would not negate this bias because emergency medical service (EMS) may preferentially deliver

the most ill-appearing patients with potential stroke to this center by bypassing other community hospitals.

For future studies, a registry that enrolled patients prospectively at presentation or at diagnosis of stroke type would be an improvement. To reduce the population bias at a regional stroke center, there could be a separate count for patients who presented to the hospital from within the immediate area, and an additional count of patients who either presented to outside facilities and were subsequently transferred to the stroke center or were brought by outside community EMS preferentially to the stroke center.

Another difficult issue to sort out in this and any other stroke registry is the distinction between primary hemorrhagic strokes and initial ischemic strokes with hemorrhagic conversion. Some large territory ischemic strokes have early spontaneous hemorrhage, whereas there is also certainly an increased risk of intracranial bleeding with intravenous and intraarterial thrombolytic administration for ischemic infarcts. What is the appropriate categorization of these strokes? A further group of hemorrhagic strokes include those who completed their hospitalization for an ischemic infarct and were then placed on antiplatelet agents (aspirin, dipyridamole, clopidogrel) or warfarin for future stroke prevention, and consequently returned to the hospital with hemorrhagic conversion of their recent infarcts.

7. Conclusions

The prevalence of hemorrhagic stroke may have been underestimated in previous stroke epidemiologic studies and

may have increased in incidence for the last 2 decades due to more widespread use of anticoagulation and antiplatelet therapy. Although further studies are needed to validate this finding, it should be a consideration when stroke protocols and guidelines are developed for EMS and EDs because it may be a prior assumption that most strokes are ischemic.

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