Risk of Intracerebral Hemorrhage after Emergency Department Discharges for Hypertension

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Background: Recent literature suggests that acute rises in blood pressure may precede intracerebral hemorrhage. We therefore hypothesized that patients discharged from the emergency department with hypertension face an increased risk of intracerebral hemorrhage in subsequent weeks. *Methods:* Using administrative claims data from California, New York, and Florida, we identified all patients discharged from the emergency department from 2005 to 2011 with a primary diagnosis of hypertension (*ICD-9-CM* codes 401-405). We excluded patients if they were hospitalized from the emergency department or had prior histories of cerebrovascular disease at the index visit with hypertension. We used the Mantel–Haenszel estimator for matched data to compare each patient's odds of intracerebral hemorrhage during days 8-38 after emergency department discharge to the same patient's odds during days 373-403 after discharge. This cohort-crossover design with a 1-week washout period enabled individual patients to serve as their own controls, thereby minimizing confounding bias. *Results:* Among the 552,569 patients discharged from the emergency department with a primary diagnosis of hypertension, 93 (.017%) were diagnosed with intracerebral hemorrhage during days 8-38 after discharge compared to 70 (.013%) during days 373-403 (odds ratio 1.33, 95% confidence interval .96-1.84). The odds of intracerebral hemorrhage were increased in certain subgroups of patients (≥60 years of age and those with secondary discharge diagnoses besides hypertension), but absolute risks were low in all subgroups. *Conclusions:* Patients with emergency department discharges for hypertension do not face a substantially increased short-term risk of intracerebral hemorrhage after discharge. **Key Words:** Hypertension—intracerebral hemorrhage—emergency department—risk factors—stroke.

Introduction

Chronic hypertension,[1] especially uncontrolled hypertension,[2,3] is an established risk factor for intracerebral hemorrhage (ICH). The effect of acute hypertension on ICH has not been as well studied, despite a high proportion of emergency department (ED) patients presenting with hypertension—at least 25% have elevated blood pressure (over 140/90) and about 5% have severely elevated blood pressure (over 180/110).[4-8] Current guidelines recommend against the aggressive treatment of hypertensive ED patients without acute evidence of end-organ damage and instead recommend initiation of oral antihypertensives and outpatient follow-up.[9-11] In reality, however, these patients often receive inadequate follow-up care.[4,7,12]

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The clinical significance of hypertension in the ED is uncertain. Recent Joint National Committee guidelines addressing the management of acute hypertension are based on studies that did not conclusively demonstrate an increased risk of vascular complications after episodes of hypertensive urgency.[10-14] However, a recent study of detailed ambulatory blood pressure data before and after ICH suggested that an acute rise in blood pressure might precede the diagnosis of ICH.[15] Furthermore, conditions that acutely increase blood pressure, such as cocaine ingestion, are well known to cause ICH, presumably through deleterious effects on cerebral autoregulation and vascular integrity.[16,17]

We hypothesized that patients discharged from the ED with hypertension face an increased risk of ICH in subsequent weeks. Therefore, we performed a large population-based study evaluating the risk of ICH in patients discharged from the ED with a primary diagnosis of hypertension. To minimize confounding bias and to focus our study on the immediate effects of blood pressure elevation, we used a cohort-crossover design whereby patients served as their own controls. Specifically, we compared the risk of ICH soon after an ED diagnosis of hypertension to the rate of ICH in the same patient during a time period of similar length 1 year later.

Methods

Study Design and Setting

We performed a retrospective cohort-crossover study using administrative claims data on all discharges from nonfederal EDs and acute care hospitals in California, New York, and Florida. We identified all patients who were discharged from the ED with a primary diagnosis of hypertension from 2005 to 2010 in California, from 2005 to 2011 in Florida, and from 2006 to 2010 in New York. These dates were chosen to incorporate all available data with longitudinal patient identifiers in these large and demographically heterogeneous states.[18] Trained analysts used standard methods to collect administrative data on all ED and hospital discharges. After a multistep review for quality-assurance purposes, these data were reported in a deidentified format to the Agency for Healthcare Research and Quality for its Healthcare Cost and Utilization Project. This study was approved by the Weill Cornell Medical College Institutional Review Board; the right to informed consent was waived because of minimal risk to patients.

Selection of Participants

We identified all patients aged 18 years or older who were discharged from an ED with a primary discharge diagnosis of hypertension as defined by *ICD-9-CM (International Classification of Diseases, 9th Revision, Clinical Modification)* codes 401-405. Because we were primarily interested in capturing patients with an acute episode of hypertension rather than patients who frequently seek nonambulatory care for hypertension, we counted only the first ED visit with a hypertension diagnosis. To minimize misclassification error (i.e., the primary outcome was present but misdiagnosed during the initial ED visit for hypertension), we excluded patients if they were hospitalized from the ED or had concomitant *ICD-9-CM* codes for cerebrovascular disease (430-438) at the time of the index hypertension visit. To maximize longitudinal follow-up, we excluded patients who did not permanently reside in California, New York, or Florida.

Measurements and Outcomes

To characterize our study population, we collected patient data on demographics and medical comorbidities, including diabetes mellitus, coronary artery disease, congestive heart failure, peripheral vascular disease, chronic kidney disease, chronic obstructive pulmonary disease, atrial fibrillation, tobacco use, and ethanol abuse. Our primary outcome was ICH, defined by a diagnosis code algorithm previously validated to have a specificity of 96% and a sensitivity of 85%.[19]

Statistical Analysis

After instituting a prespecified 1-week washout period to minimize the risk of misclassification error (i.e., ICH was present but missed at the index ED visit because symptoms or signs were minor or misconstrued), we compared each patient's risk of ICH during the 4-week period soon after discharge (days 8-38) with the risk of ICH in the same patient during the 4-week period 1 year later (days 373-403). Therefore, the cohort period comprised days 8-38 following the ED visit for hypertension, whereas the crossover period comprised days 373-403 following the index visit. The choice of a 4-week period was based on recent evidence about the time course of blood pressure elevation before ICH.[15] Absolute risks and odds ratios (ORs) were calculated using a Mantel–Haenszel estimator for matched data.

Several prespecified subgroup analyses were performed to test the robustness of our results. First, we compared risks of ICH after malignant essential hypertension (401.0) versus all other hypertension diagnoses; previous studies using administrative data have defined malignant hypertension with this *ICD-9-CM* code.[20] Second, because national guidelines recommend higher blood pressure goals for older patients,[10] we compared risks of ICH after hypertension visits in those aged 60 years or older versus those younger than 60 years of age. Third, we compared risks of ICH in those with a sole ED diagnosis of hypertension versus those with accompanying secondary discharge diagnoses. Statistical significance was defined using an alpha of .05. All analyses were performed with Stata/MP version 13 (StataCorp LP, College Station, TX).