The Role of Magnetic Resonance Imaging in Management of Patients With Nonlobar Hypertensive Intracerebral Hemorrhage

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Abstract

Background and Purpose: Despite the increased use and availability of magnetic resonance imaging (MRI), its role in hypertensive intracerebral hemorrhage (ICH) remains uncertain. In this retrospective study, we assessed the utility of MRI in diagnosis and management of patients with hypertensive ICH. **Methods:** We retrospectively reviewed the charts of patients with ICH presenting to our hospital over an 18-month period. We included patients who presented with hypertensive ICH in typical locations and excluded lobar hemorrhages. We further isolated cases that had undergone MRI. Collected data included mean age, gender, location of hematoma, neuroradiologist's interpretative report of the MRI, and management steps taken in response to the results of the MRI. Logistic regression was used to determine whether the overall yield of MRI in these patients was significant. **Results:** We found 222 patients with ICH in our database. Forty-eight patients met our inclusion criteria, of which 24 had brain MRI done as a part of their hospital workup. Brain MRI obtained in 2 (8%) of the 24 patients revealed abnormalities that led to a change in management. The diagnostic yield of MRI and the management decisions that followed were both insignificant. **Conclusions:** The diagnostic yield of brain MRI in patients with nonlobar hypertensive ICH is low and does not result in significant changes in management.

Keywords

intracerebral hemorrhage, magnetic resonance imaging, hypertension

Introduction

Hypertension is the most important risk factor for spontaneous intracerebral hemorrhage (ICH).¹ In hypertension-related ICH, bleeding usually occurs at or near the bifurcation of small penetrating arteries that originate from basilar arteries or the anterior, middle, or posterior cerebral arteries.² These small arteries supply blood to the deep nuclei of the basal ganglia (putamen and the caudate nucleus), thalamus, pons, and cerebellum. Accordingly, this type of brain hemorrhage typically occurs in these locations.³ In hypertensive ICH, histological abnormalities may be delineated via microscopy, yet other than the hematoma itself, one would rarely find any peculiar gross anomalies.² Although brain magnetic resonance imaging (MRI) can help with aging the hematoma and revealing underlying structural abnormalities, the contributory role of this modality specifically in management of hypertensive ICH is controversial, and its indiscriminate use can be quite costly.⁴ In this study, we sought to determine the added yield of MRI in steering the care of patients diagnosed with nonlobar hypertensive ICH.

Methods

The study received exemption from our University's Institutional Review Board. Using different ICD-9 codes for ICH (431, 432, and 432.9), we isolated medical records of patients who presented to our hospital with ICH from October 2011 through March 2013. We retrospectively reviewed the records and included patients with the diagnosis of hypertensive ICH. The criteria used for this diagnosis were (1) hematoma in a location typical for hypertensive ICH (basal ganglia, thalamus, pons, and cerebellum) identified via initial computed tomography (CT) head scan and (2) a history of hypertension

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Figure 1. A, Computed tomography (CT) of the head showing a small midline cerebellar intracerebral hemorrhage (ICH). Gradient echo brain magnetic resonance imaging (MRI) of the same patient revealing diffuse cavernomas (B-D).

or presenting systolic blood pressure ≥ 180 mm Hg. Excluded were patients with lobar ICH, known underlying vascular anomaly or mass, ICH secondary to trauma, hemorrhagic conversion of ischemic stroke, and warfarin-related ICH or a history of underlying coagulopathy. Cases of ICH in association with nonparenchymal hemorrhagic foci (ie, subarachnoid, subdural, epidural, and isolated intraventricular) were also excluded.

Records of included patients were reviewed and those who underwent MRI examinations were collected for further investigation. Gathered data included mean age, gender, location of hematoma, interpretation report of the MRI by an attending neuroradiologist, and management steps taken in response to the results of the MRI. In addition to reviewing the report rendered by the neuroradiologist, 2 independent neurologists visualized the images and provided their interpretation.

Statistical analysis was performed using the 1-dimensional chi-square (χ^2) test for goodness of fit. This method tests the proximity of the observed values to those which would be expected. Our hypothesis was that none of the MRIs done on our group of patients would yield positive findings and if any of them do, the results would not lead to any change in patient management.

Results

We found 222 patients with ICH in our database and 48 met our inclusion criteria. Of the 48 cases, 24 had brain MRIs done as a part of their hospital workup. This group included 14 men and 10 women with a mean age of 65.6 (range 48-88 years). The ICH locations were basal ganglia (12), thalamus (8), cerebellum (3), and pons (1).

All MRI examinations were performed with and without gadolinium contrast. An interpretative report by a neuroradiologist was available for all imaging tests. Specific

rationales for obtaining MRI were documented in 5 patients. They included, “rule out underlying mass,” “evaluate for possible tumor,” “evaluate progression of hemorrhage,” “evaluate for etiology,” and “assess for brainstem damage.”

The rest (19) did not have a documented reason by the attending physician who ordered the test. Independent interpretations of all images by the 2 neurologists corroborated the impression rendered by the neuroradiologists. The MRI in 2 (8%, $P = .68$) patients revealed abnormalities not appreciated on the initial head CT. One was a 57-year-old man with a small midline cerebellar hemorrhage where the MRI showed multiple cavernomas (Figure 1). The other patient was a 77-year-old man with a left thalamic ICH. His MRI showed multifocal lobar microhemorrhages suggestive of cerebral amyloid angiopathy (CAA; Figure 2). Both patients were taking low-dose aspirin. The management strategy in response to the MRI results comprised of advising both patients to avoid aspirin and other antiplatelet agents for life.

Discussion

This study demonstrated that brain MRI makes little contribution to the overall care of patients diagnosed with nonlobar hypertensive ICH. Other than the 2 patients whose management was modified by the results of their MRIs, we did not find any specific therapeutic action undertaken by the treatment team in the rest. All patients were treated with intravenous antihypertensive medications upon admission. The MRI results did not alter this strategy. Although discontinuation of aspirin and advising the 2 patients to avoid this drug may not appear as significant interventions, they were nonetheless the documented course of action vis-à-vis the MRI results. Therefore, we included them as management decisions. How justified were

Figure 2. Computed tomography (CT) of the head showing a left thalamic intracerebral hemorrhage (ICH; A). Gradient echo brain magnetic resonance imaging (MRI) of the same patient revealing multifocal lobar microhemorrhages suggestive of cerebral amyloid angiopathy (CAA; B-D).

those decisions will need to be scrutinized in the context of available evidence. In the patient with CAA, avoiding aspirin for life was perhaps justified. A study of 104 patients demonstrated that although aspirin after ICH was not associated with lobar ICH recurrence in univariate analyses, in multivariate analyses adjusting for baseline clinical predictors, it independently increased the risk of ICH recurrence.⁵ Furthermore, there is some evidence that long-term aspirin use may lead to cerebral microhemorrhages.⁶ For the other patient, the same recommendation was made based on the presence of multiple cerebral cavernomas. However, there is little evidence that long-term antiplatelet drug treatment increases the frequency of cavernoma-related ICH.^{7,8} It is therefore conceivable to suggest that MRI findings led to an evidence-based management modification in only 1 (4%) of the 24 patients. Yet, even in that patient who had a history of high blood pressure, the possibility that his ICH was hypertensive and not secondary to CAA could not be ruled out.

A study of 70 patients with spontaneous ICH suggested that early (within 30 days) MRI had potential additive clinical benefit.⁹ In this study, 26 patients had both a history of hypertension and a hematoma in a typical location for hypertensive ICH. Although the investigators reported that the yield of MRI was similar for patients with a “typical” hypertensive ICH and those with other types (35% vs 41%; $P = .6$), a “change in management” was undertaken in only 6% of patients with hypertensive ICH. The definition of change in management was not specified by the investigators.⁹

The main limitation of our study was the small size. A larger patient population could have delineated the contributory role of MRI more accurately. If a larger study shows that more patients with hypertensive ICH have negative MRIs, our hypothesis is further supported.

The other limitation was that the decision to perform MRI in these patients was inconsistent and varied among the

practitioners at our institution. Only 50% of patients who met the inclusion criteria underwent MRI. This perhaps reflects the heterogeneity in practice style, supporting the existence of controversy surrounding the utility of MRI in nonlobar hypertensive ICH.

Brain MRI in patients with hypertensive ICH has a low yield and is not conducive to significant changes in management. In an era that cost-effective medicine is strongly advocated, performance of diagnostic imaging modalities that add little to patient care should be minimized.

Declaration of Conflicting Interests

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