

# CLINICAL CASE REPORTS

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## Primary Intraventricular Hemorrhage Imaged by High-Field Magnetic Resonance Imaging—A Case Report

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### *Abstract*

**Primary intraventricular hemorrhage (PIVH) imaged by magnetic resonance imaging (MRI) is reported. A fifty-seven-year-old man with long-standing hypertension suddenly developed severe headache, vomiting, and retrograde amnesia. A computed tomography scan on the same day revealed hematoma in the right posterior horn of the lateral ventricle and in the 4th ventricle. Angiography of the neck and head failed to demonstrate any vascular abnormalities. On the second day his neurological symptoms almost recovered except for the loss of the memory of the ictal day. High-field MRI on the sixteenth day demonstrated an isointense lesion surrounded by a hypointense area in the T1 weighted image or a hyperintense lesion in the T2 weighted image, suggesting subacute hematoma consistent with hypertension, just anterior to the right trigone of the lateral ventricle.**

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### *Introduction*

Primary intraventricular hemorrhage (PIVH) is an uncommon cerebral hemorrhage that was first reported by Sanders as hematoma in the ventricles without any vascular lesions in the cerebral parenchyma.<sup>1</sup> Hemorrhagic foci, mainly examined by autopsy, have been reported to be vascular malformation, aneurysm, hemangioma, or brain tumor,<sup>2-11</sup> and in many cases the origin has been undetermined.<sup>5,12-14</sup> More recently, magnetic resonance imaging (MRI) has been used for the detection of cerebral infarction at an early state<sup>15,16</sup> and for the diagnosis of

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subacute or chronic cerebral hematoma.<sup>17,18</sup> Occult vascular malformations, being difficult to detect by angiography, have been also imaged by MRI.<sup>19,20</sup>

In this communication a patient with PIVH, who presented transient disorientation and retrograde amnesia following severe headache and vomiting, is reported. Though neither CT scan nor angiography demonstrated a bleeding focus, MRI clearly imaged the site of hemorrhage in the ventricular wall. To our knowledge, this is the first reported case in which PIVH was demonstrated by MRI.

### Case Report

A fifty-seven-year-old right-handed man with a twenty-year history of untreated hypertension woke up complaining of severe headache at 4 AM, May 20, 1987. His wife noticed his complaints and frequent vomiting. His symptoms soon subsided and he fell asleep by 5 AM, but at 7:30 AM she found him sitting vacuously in his room. He could not respond to her. His eyes were opened and urinary incontinence was observed. Thirty minutes later he recovered his speech, but it was difficult to understand him. He did not know what day it was. He was transferred to our clinic by ambulance at 12:30 PM.

On admission his blood pressure was 170/90 mmHg, pulse rate was 117/min and regular, and both heart and breath sounds were normal. He showed severe disorientation for time and his recent memories for the past three days were completely lost. His calculation and reversed digit span were within normal limit. Examination for ocular fundi revealed clear disc margins of the papillae and hypertensive changes of the retinal vessels (KWIIa). The other cranial nerves were also intact. Nuchal stiffness and Kernig's sign were absent. Hemiparesis or sensory disturbance suggesting a focal lesion in the central nervous system was not evident.

Computed tomography (CT) brain scan after admission demonstrated high-density lesions in the right posterior horn of the lateral ventricle and in the 4th ventricle (Figure 1). Conventional angiography of the neck and brain on the same day revealed mild stenosis and wall irregularity in the distal portion of the right vertebral artery, but no abnormalities such as aneurysm or vascular malformation were observed. Neuroradiological diagnosis was compatible with primary intravascular hemorrhage (PIVH).

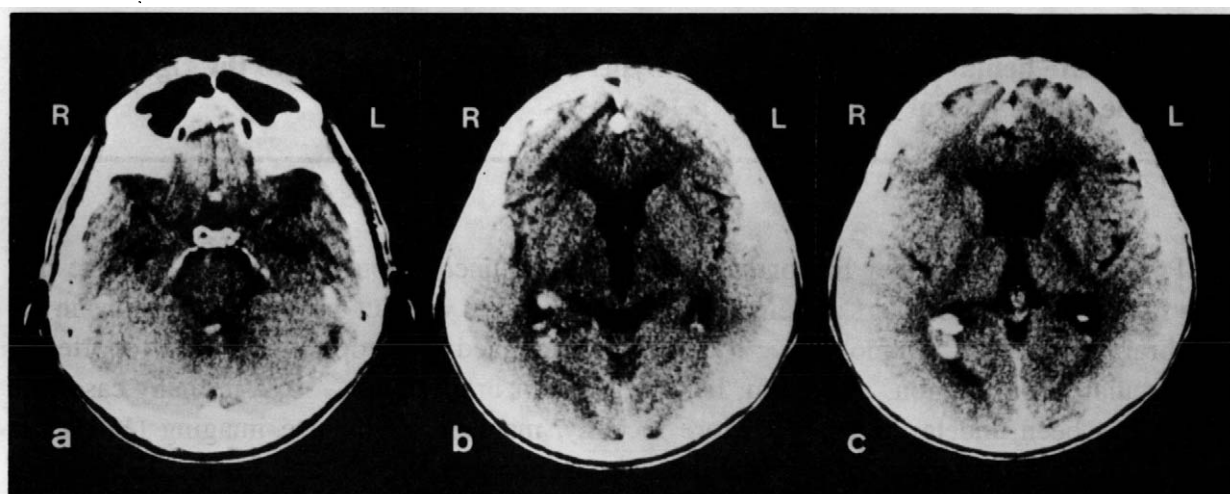


FIG. 1. CT scan on admission day. High-density areas are demonstrated in the 4th ventricle (a) and in the right posterior horn of the lateral ventricle (b, c).

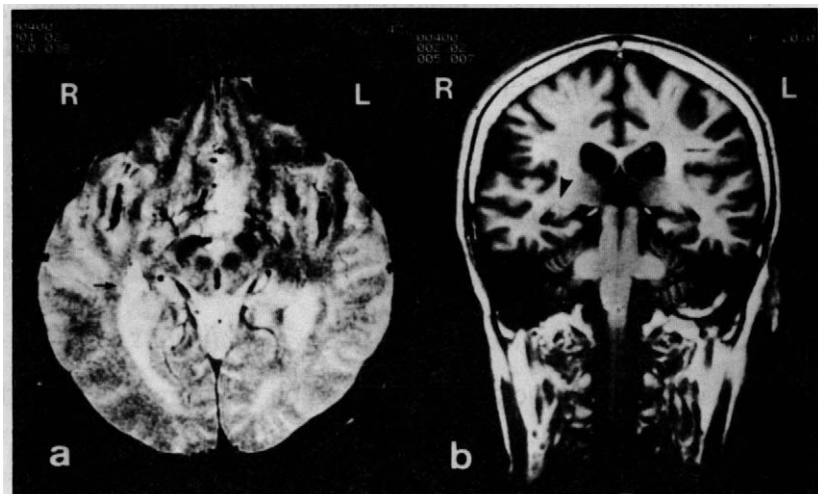
Cerebrospinal fluid (CSF) on the sixth hospital day was xanthochromic with lymphocytosis ( $20/\text{mm}^3$ ). The lactate level in the CSF was elevated to  $1.94 \text{ mmol/L}$  (normal:  $1.50 \pm 0.17$ ). A second CT scan with contrast medium on the eighth hospital day did not demonstrate any focus for bleeding in the parenchyma. Magnetic resonance imaging (MRI) was performed on the sixteenth hospital day, and an isointense lesion with a hypointense rim in the T1 weighted image or a hyperintense lesion partially surrounded by a thin hypointense rim in the T2 weighted image was demonstrated just anterior to the right trigone of the lateral ventricle (Figure 2), indicating the primary site of PIVH.

His psychologic disorder had almost completely improved on the second hospital day, and he was discharged on the fiftieth day after the ictus without neurological deficit, but the memory of the ictal day was still absent. Three months later he was reexamined neurologically and angiographically. MRI demonstrated the hypointense area with a central hyperintense component in the T2 weighted image, being compatible with an old hematoma, at the same region as in the first MRI, but no other abnormal findings were obtained.

### Discussion

In 1881, Sanders studied an autopsy series for intraventricular hemorrhage and proposed primary intraventricular hematoma (PIVH) as a rare condition of intracerebral hemorrhage originating from within the ventricle or from the ventricular wall without hematoma in the cerebral parenchyma.<sup>1</sup> The characteristic clinical feature is sudden onset of coma, and paresis or rigidity is uncommon. The prognosis is severe and usually fatal.<sup>1-3</sup> Butler et al reported another type of PIVH that is more frequent in adolescents and young adults<sup>4</sup> than the cases of Sanders were. In Butler's patients headache and vomiting or seizures were common as premonitory symptoms, but impairment of consciousness was rare and the clinical course was favorable. In a recent prospective study, the incidence of PIVH was reported to be 3.1% of the total cases of intracranial hemorrhage.<sup>5</sup> Underlying diseases, mainly in the autopsied cases, have been vascular malformation such as arteriovenous malformation, aneurysm, hemangioma, and brain tumor like choroid plexus papilloma,<sup>2-11</sup> whereas in the majority the etiology has remained unclear.<sup>5,12-14</sup>

FIG. 2. High-field magnetic resonance imaging (1.5T) on sixteenth hospital day. The T2 weighted image (spin echo method: TR 2000, TE 80, axial scan) demonstrates a hyperintense area partially surrounded by a thin hypointense rim (arrow) just anterior to the right trigone of the lateral ventricle (a). The T1 weighted image (inversion recovery method: TR 1500, TE 20, TI 600, coronal scan) reveals an isointense area with a more apparent hypointense rim (arrow head) in the same region (b).



In the present case CT scan on admission revealed high-density areas only in the right posterior horn of the lateral ventricle and the 4th ventricle. The patient developed headache and vomiting followed by mild consciousness disturbance with urinary incontinence. The recovery from these disorders was satisfactory, being compatible with the PIVH that Butler et al reported. As a unique symptom, he was found to be suffering from retrograde amnesia on admission. Short-term memory deficits or severe amnesia have been reported in several cases of PIVH.<sup>5</sup> Disorientation in regard to date seems to be associated with memory disturbance, which is similar to the total global amnesia.<sup>21</sup> The location of a hematoma near the limbic system such as at the hippocampus might contribute to the initiation of the symptom.

A bleeding site could not be demonstrated by serial CT scans or angiography of the head and neck. MRI study on the sixteenth hospital day showed a hemorrhagic lesion just anterior to the right trigone of the lateral ventricle: in the T1 weighted image an isointense area with a hyperintense rim and in the T2 weighted image a hyperintense area partially surrounded by a subtle hypointense rim. These findings seemed to represent a subacute hemorrhagic lesion with associated changes of the surrounding tissue. Thus, occult or cryptic vascular malformation and hypertensive cerebral hemorrhage were considered for the differential diagnosis.

Occult or cryptic vascular malformation usually repeats asymptomatic minor hemorrhage and changes in size, and both CT scan and MRI have demonstrated the characteristic features of old hematoma.<sup>19,20</sup> Recently high-field MRI has been reported to demonstrate a hemosiderin ring of an old hematoma as a hypointense rim in both the T1 and T2 weighted image, and it was much more obvious and wider in the T2 weighted image than in the T1 weighted image.<sup>17,18</sup> In our case, therefore, the appearance of a hypointense rim around the lesion in the initial MRI was not in accordance with that of an old hematoma. Consequently, vascular malformation as the origin of hemorrhage seems to be unlikely in our case of PIVH. Hemorrhage from brain tumor, primary or secondary, has also been reported to show findings similar to the occult vascular malformation in MRI.<sup>22</sup> In our case, however, serial CT scans, angiography, and the clinical course did not support this possibility. The appearance demonstrated by the initial MRI (sixteenth hospital day) likely represents the hemorrhagic episode in a subacute stage: methemoglobin with surrounding edema and precipitated hemosiderin. A second MRI three months later also demonstrated an appearance compatible with old hematoma.

Several cases of PIVH have been reported in association with hypertension.<sup>5,14</sup> Five cases of PIVH with hypertension have been reported by Gates et al<sup>23</sup> that showed intracranial and extracranial arterial occlusion. One autopsied case demonstrated a hemorrhagic lacuna in the ventricular wall that was in continuity with an intraventricular hematoma. There were no occlusions of intracranial and extracranial main arteries, but long-standing hypertension strongly suggests a hypertensive hemorrhage in the ventricular wall, based on hypertensive arterial necrosis, to be a possible cause of PIVH in our case.

### Conclusions

This is the first case of PIVH in which the primary hemorrhagic site was demonstrated by high-field MRI. Hypertensive hemorrhage may not be uncommon as a cause of PIVH and should be carefully differentiated from vascular malformation or brain tumor for the surgical

indication. This new imaging device (MRI), in addition to conventional CT scan and angiography, may be especially useful for small vascular lesions in the brain.

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