

Unusual MR Features of Extravasation of Contrast Material in Hyperacute Intracerebral Hemorrhage

Seung Hong Choi, MD, Kee-Hyun Chang, MD, Woo Sun Chun, MD, Ji-Hoon Kim, MD,
Hyun Seung Kang, MD, Bae Ju Kwon, MD, Dong Gyu Na, MD,
Jae Hyung Kim, MD, Moon Hee Han, MD

Contrast extravasation in hyperacute intracerebral hemorrhage (ICH) indicative of active bleeding is a predictor of possible enlargement of hematoma, providing clinician with valid management decisions. We report unusual MR imaging features of contrast extravasation in hyperacute ICH in three patients: Case 1 with hypertension revealed dual foci of contrast extravasation, one in right basal ganglia and the other in left lateral ventricle, suggesting simultaneous bleeding of the two foci. Case 2 with presumed diagnosis of vasculitis showed relatively large area of contrast extravasation mimicking enhancing tumor or vascular lesion. Case 3 with hypertension showed the findings of active bleeding which was likely to occur during the time of MR imaging acquisition.

Index words : Brain, hemorrhage
Magnetic resonance (MR)
Contrast
Extravasation

Introduction

In acute hypertensive intracerebral hemorrhage (ICH), the bleeding can persist for up to 6 hours postictus. Continued bleeding may lead to enlargement of the hematoma, resulting in progressive neurological deterioration and increased fatality (1-3). Awareness of the possibility of hematoma enlargement during the acute phase, which may be predicted by extravasation

of contrast material with neuroimaging studies, is a valid basis for management decisions (1, 2).

Extravasation of contrast material usually indicative of sustained bleeding from ruptured blood vessels is not an uncommon finding on cerebral angiography, CT or MR imaging performed in the hyperacute stage (within a few hours after symptom onset) in patients with hypertensive ICH (1, 2, 4). Murai et al (1) reported that evidence of contrast material extravasation on MR imaging was observed in 36% (39/108) of acute ICH

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¹Department of Radiology and Institute of Radiation Medicine SNUMRC, Seoul National University College of Medicine, Seoul, Korea.

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Address reprint requests to : Kee-Hyun Chang, M.D., Department of Radiology and Institute of Radiation Medicine SNUMRC, Seoul National University College of Medicine, Seoul, Korea.

28, Yongon-dong, Chongno-gu, Seoul 110-799, Korea.

Tel. 82-2-760-2516 Fax. 82-2-743-6385 E-mail: changkh@radcom.snu.ac.kr

patients within six hours postictus and was well correlated with hematoma enlargement. The risk of contrast extravasation is increased with extreme hypertension, depressed consciousness, and large hemorrhage (2).

MR diagnosis of extravasation of contrast material in hyperacute ICH can usually be made without difficulty, as hyperacute ICH shows isointensity relative to the cerebral parenchyma on T1-weighted imaging (5).-However, it may be confused with enhancing vascular lesion with hematoma or enhancing neoplasm on MR imaging, especially when contrast enhancement appears unusual in location and shape. We present unusual MR imaging findings of the extravasation of contrast material in three patients with hyperacute ICH.

Case Report

Case 1

An 86-year-old man with hypertension was admitted to the hospital for sudden-onset altered mentality. A noncontrast brain CT obtained three hours after the symptom onset revealed a large hematoma in the right basal ganglia and deep frontal white matter with extension to both lateral ventricles and the third ventricle. Brain MR imaging performed one hour after CT scan showed the hematoma isointense relative to the brain parenchyma on T1-weighted image and heterogeneous hyperintensity on T2-weighted image (Fig. 1A and 1B). On contrast-enhanced sagittal T1-weighted image, multiple foci of intense contrast enhancement were found; one within the ICH of the right basal ganglia and the other in the posterior portion of the left lateral ventricle (Fig. 1C). On the subsequent axial T1-weighted images, the enhancing focus in the left lateral ventricle increased in size, was curvilinear-shaped, and located lateral to the isointense hematoma within the left lateral ventricle (Fig. 1D). The enhancing areas of the right basal ganglia and left lateral ventricle appeared to be far apart and remote from each other without any intervening enhancing focus. A part of the enhancing lesion in the left lateral ventricle was close to the choroid plexus of the left lateral ventricle (Fig. 1E). Catheter cerebral angiogram obtained one hour after MR imaging for evaluating possible underlying vascular lesion revealed neither vascular abnormality

nor extravasation of contrast material. Without undergoing surgical evacuation of the hematoma, the patient expired five days after symptom onset.

Case-2

A 49-year-old woman was referred to our hospital for suddenly developed left hemiparesis. She had no history of hypertension or other predisposing illness. Brain MR imaging performed three hours after symptom onset showed a large hematoma in the right frontal lobe with extension to the right lateral ventricle, the signal intensity of which was hypointense to isointense relative to the brain parenchyma on T1-weighted image and heterogeneous hyperintensity on T2-weighted image (Fig. 2A and 2B). A thick curvilinear contrast enhancement was noted in the periphery of the hematoma on axial contrast-enhanced T1-weighted images (Fig. 2C). Serologic studies and CSF profiles were all within normal range. Follow-up MR imaging obtained 14 days after initial MR imaging revealed slight decrease of the hematoma in size, absorption of the intraventricular portion of the hemorrhage and change of the hematoma in signal intensity into high signal on T1-weighted image. Neither evidence of contrast enhancement nor abnormal vascularity was seen. Catheter cerebral angiography performed 16 days following initial MR imaging revealed segmental narrowing of both the pericallosal arteries, and luminal irregularity and narrowing of both the middle cerebral arteries and branches (Fig. 2D). The patient was considered to have vasculitis, probably primary angiitis of the central nervous system that might cause the ICH.-Without surgical evacuation of the hematoma, the patient was discharged with improved hemiparesis.

Case 3

A 79-year-old man entered to the emergency room of our hospital for suddenly developed left sided weakness. Three years earlier, he was found to have hypertension and total occlusion of the right internal carotid artery. Afterward, he had been medicated with a regimen of nifedipine (10 mg, t.i.d.), enalapril (10 mg, b.i.d.), aspirin (100 mg, q.d.), and Warfarin (4 mg, q.d.).-Brain MR imaging obtained 3 hours after symptom onset showed multiple small foci of T2-high signal in the periventricular white matter and basal

ganglia suggesting small vessel disease, but there was no evidence of abnormal findings suggestive of intracerebral and/or intraventricular hemorrhage on both axial T2-weighted and sagittal T1-weighted images (Fig. 3A and 3B). Subsequent axial contrast-enhanced T1-weighted images showed focal areas of intense contrast enhancement in the right thalamus and posterior portion of the right lateral ventricle associated

with hypointense area in the right thalamus (Fig. 3C). Nonenhanced brain CT obtained immediately after MR imaging revealed a large acute hematoma of high attenuation with a focal area of iso to low attenuation in the right thalamus associated with intraventricular extension of the hemorrhage (Fig. 3D). After MR and CT scan, the patient's consciousness became drowsy, progressively got worse, and eventually he died in

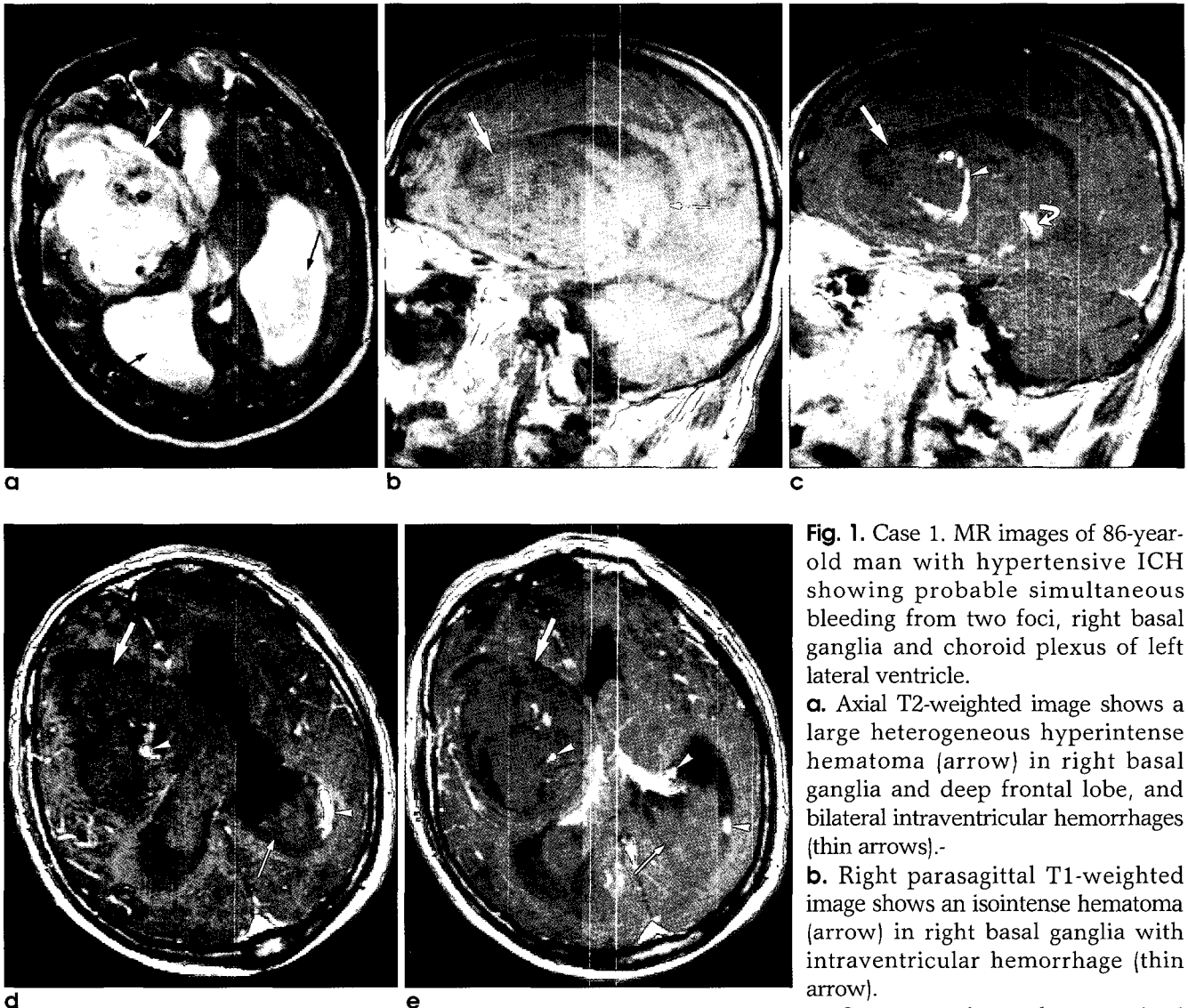


Fig. 1. Case 1. MR images of 86-year-old man with hypertensive ICH showing probable simultaneous bleeding from two foci, right basal ganglia and choroid plexus of left lateral ventricle.

a. Axial T2-weighted image shows a large heterogeneous hyperintense hematoma (arrow) in right basal ganglia and deep frontal lobe, and bilateral intraventricular hemorrhages (thin arrows).-

b. Right parasagittal T1-weighted image shows an isointense hematoma (arrow) in right basal ganglia with intraventricular hemorrhage (thin arrow).

c. Contrast-enhanced parasagittal

T1-weighted image shows a curvilinear enhanced area (arrow head) suggesting contrast extravasation within the hematoma (arrow) of right basal ganglia. Another small enhancing focus (curved arrow) posterior to the isointense hematoma seems to be enhancing choroid plexus of right lateral ventricle.

d, e. Sequential contrast-enhanced axial T1-weighted images show multiple enhancing foci (arrow heads) suggesting contrast extravasations within the hematoma (arrows) of right basal ganglia, and in the posterolateral aspect of left lateral ventricle. Thin arrows indicate the hematoma in left lateral ventricle. The contrast extravasations in left lateral ventricle appear far apart from that of right basal ganglia, one of which is located close to the choroid plexus of left lateral ventricle suggestive of bleeding from the choroid plexus.

three days.

Discussion

Our case 1, in whom hypertension is a presumed cause of ICH, is unusual in dual foci of contrast enhancement secondary to leakage of contrast material, far apart from each other with no interconnection between the two foci; one within the right basal ganglia hematoma and the other in the left lateral ventricle around the ventricular hematoma. It might be possible but unlikely that extravasated contrast material moved from the right basal ganglia hematoma to the left lateral ventricle, when considering far distant locations of the

two foci on all three imaging planes. It rather suggests simultaneous bleeding of the two foci. The mechanism of the contrast extravasation appears to be the result of rupture of microaneurysms in the perforating vessels of both right basal ganglia and the choroid plexus of the left lateral ventricle. It is speculated that theoretically, microaneurysms can develop in any small vessels of patients with hypertension including those of the intraventricular choroid plexus, rupture of which can cause hemorrhage in the cerebral ventricles. Multiple simultaneous ICHs can rarely occur (6, 7). In a series of 600 consecutive cases of ICH diagnosed by CT scan, Weisberg (7) found 12 patients (2%) with multiple hematomas. These double lesions were probably

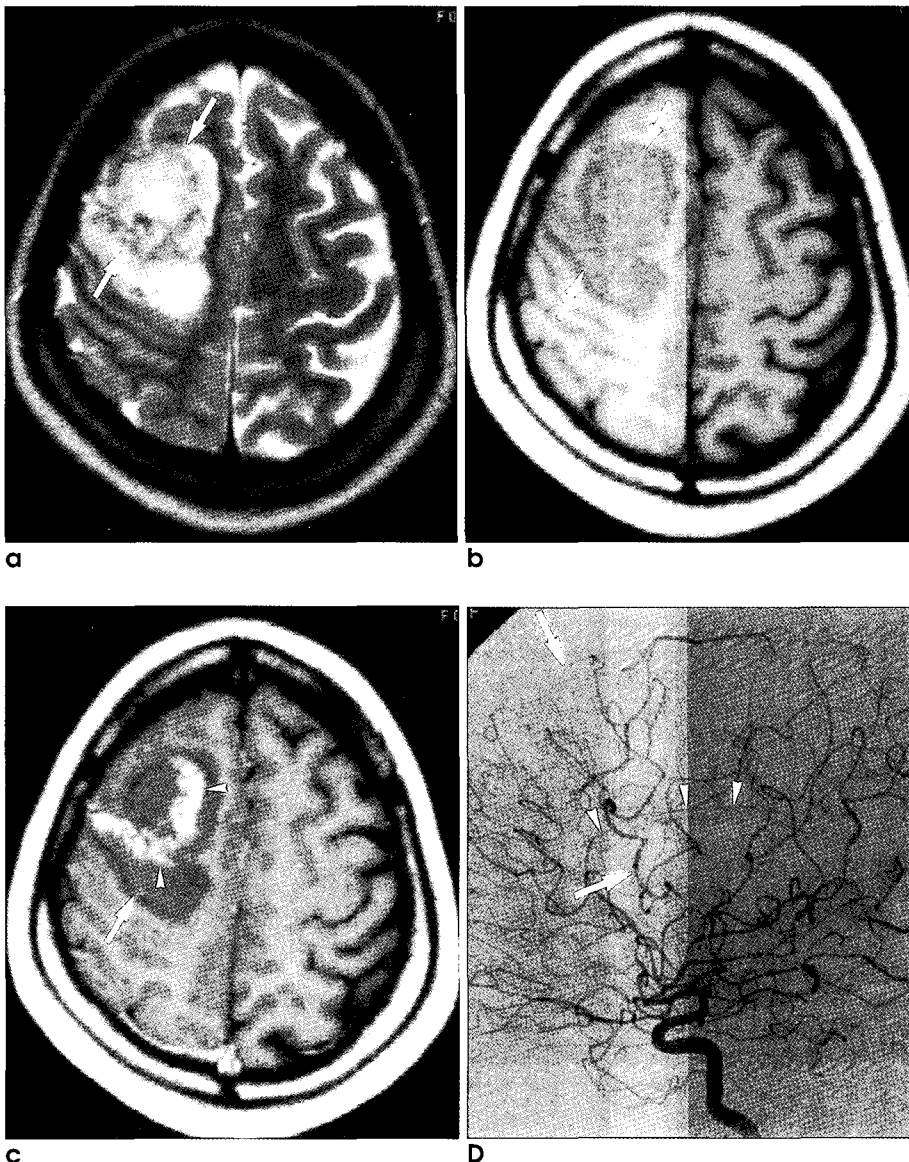


Fig. 2. Case 2. MR images obtained in a 49-year-old woman who presumably had primary angiitis of CNS.

a. Axial T2-weighted image shows a heterogeneous hyperintense hematoma (arrows) in-right frontal lobe.-

b. Axial T1-weighted image reveals slight hypointensity of the hematoma (arrows).

c. Contrast-enhanced axial T1-weighted images show a thick curvilinear enhanced area (arrow heads) suggesting contrast extravasation in the periphery of the right frontal lobe hematoma (arrows).

d. Lateral view of right internal carotid angiogram obtained 16 days following initial MR imaging shows segmental narrowing of the pericallosal artery (arrow heads) and luminal irregularity and narrowing of the branches of the middle cerebral artery (arrows).

simultaneous (because of equal CT attenuation values) in 11 instances, and they occurred in the same intracranial compartment (supratentorial or infratentorial) in all patients but one, in whom thalamic and cerebellar hematomas coexisted.

In case 2 with presumed diagnosis of vasculitis, the following two aspects appear unusual; first, ICH was the first manifestation, and secondly, the extravasation was located in the periphery of the hematoma and appeared unusually large and thick, making it confuse with neoplastic or vascular enhancing lesion. Cerebral

vasculitides generally result in arterial occlusion and cerebral infarction, only rarely being responsible for ICH. Most of these unusual examples of ICH secondary to cerebral vasculitis have been secondary to granulomatous angiitis of the central nervous system, which occurs in the absence of systemic involvement (8). ICH may rarely be the first manifestation and is predominantly lobar in location like in this condition (9). Murai *et al* (1) classified the pattern of contrast leakage in hyperacute ICH as three types as seen on MR; small punctuate enhancement within the center of

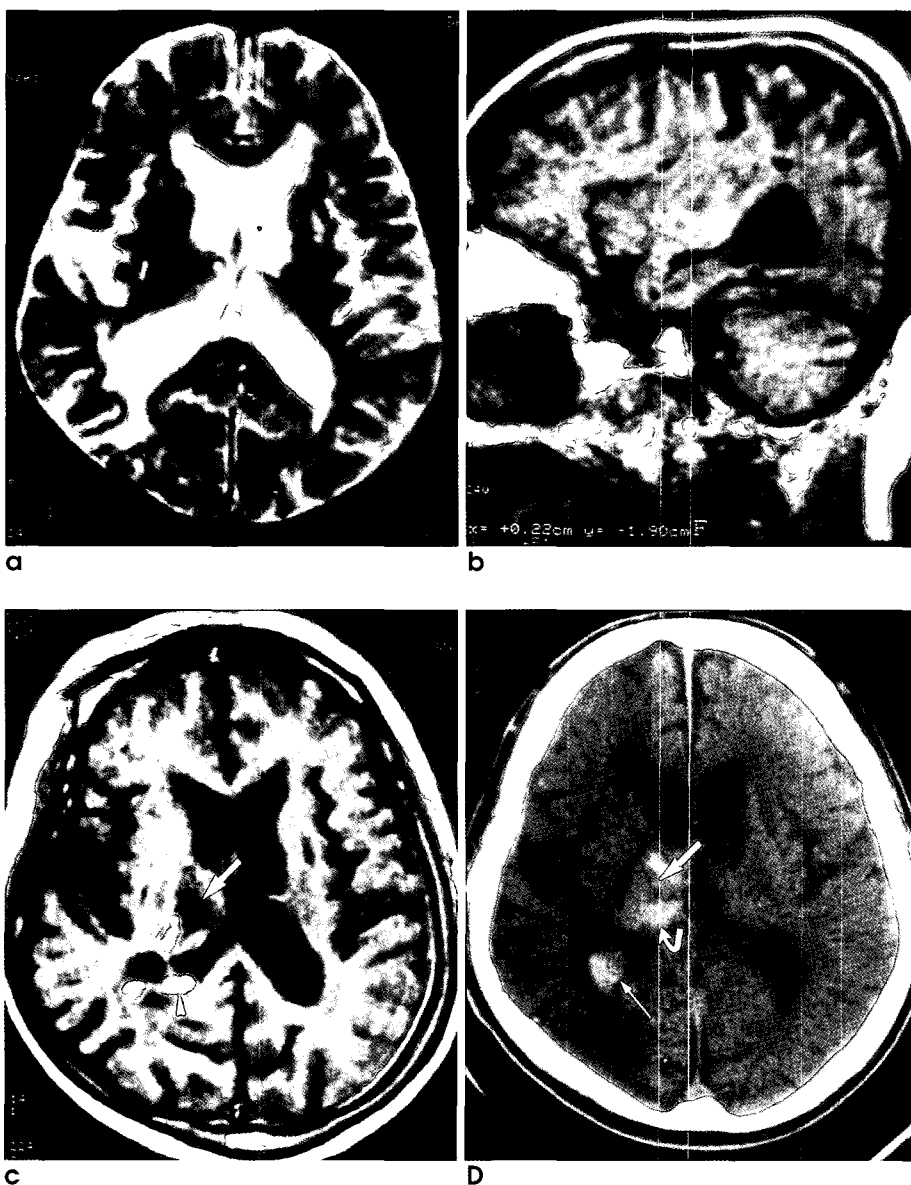


Fig. 3. Case 3. MR images obtained in a 79-year-old man who had hypertension and left-sided weakness of acute onset.

a. Axial T2-weighted image shows no abnormality in right thalamus and right lateral ventricle. There are small foci of T2-high signal suggesting old infarcts in right internal capsule and left basal ganglia.

b. Sagittal T1-weighted image also shows no definite abnormality in right thalamus and right lateral ventricle.

c. Contrast-enhanced axial T1-weighted image obtained after nonenhanced T1- and T2-weighted images shows a hypointense lesion (arrow) in right thalamus and contrast extravasation in right thalamus extending to right lateral ventricle (arrow head). Note that the hypointense lesion in right thalamus was not definite on nonenhanced MR images (A, B). This suggests that unclotted ongoing bleeding occurred during the time of MR examination.

d. Nonenhanced brain CT obtained immediately after MR imaging shows a large acute hematoma of high attenuation (curved arrow) containing a focal area of low attenuation (arrow) in right thalamus associated with intraventricular extension (thin arrow) of the hemorrhage. The

focal area of low attenuation within the hematoma corresponding to the hypointense lesion in right thalamus as seen on Fig. 3C suggests unclotted portion of the hemorrhage.

the hematoma, linear enhancement surrounding the hematoma and both. Becker et al (2) also described that in their study using CT angiography, contrast material extravasated into the center of the hematoma, but not into the periphery of the hematoma in most cases. In case 2, the extravasation within the hematoma might result from contrast leakage from the necrotic blood vessels caused by inflammation of the vascular wall, rupture of microaneurysm, or from ischemic change of the vascular wall secondary to compression by the hematoma which increases vascular permeability and causes leakage of contrast material outside the blood vessels. The primary cerebral vasculitis is occasionally associated with the formation of microaneurysm (10), and may rarely be associated with amyloid angiopathy (11). Thus, either vasculitis or amyloid angiopathy might have been responsible for the ICH of our case 2. The diagnosis of vasculitis is favored by the findings of CSF lymphocytic pleocytosis with elevated protein, and angiography may show a beaded pattern in multiple medium-sized and small intracranial arteries (9). However, our case 2 had no abnormal CSF findings and only showed narrowing of the medium-sized vessels with suspicious vascular luminal irregularity on angiography.

In case 3 with presumed hypertensive ICH, the hemorrhage seems to have occurred during the time of MR examination. As described earlier, on the initial nonenhanced two sequences of MR examination, axial T2-weighted and sagittal T1-weighted sequences, there was no evidence of abnormal findings suggestive of intracerebral and/or intraventricular hemorrhage. On subsequent contrast-enhanced axial and coronal T1-weighted images, focal area of hypointensity was noted in the right thalamus in addition to the findings of extravasation of contrast material. It is suggested that the focal area of hypointensity in the right thalamus might represent unclotted fresh blood occurred during the time of MR examination. This assumption is likely to be supported by a finding of CT obtained immediately after MR imaging, a focal area of iso to low attenuation within the acute hematoma of high attenuation in the right thalamus and by aggravation of the patient's consciousness immediately following the MR examination.

In conclusion, recently, contrast-enhanced MR

imaging has been increasingly used in the evaluation of patients with acute or hyperacute stroke for screening of underlying vascular abnormality. In that situation, one should keep in mind the possibility of extravasation of contrast material indicating active bleeding, when contrast enhancement is present within or around the isointense hyperacute hematoma on MR imaging. Since the extravasation of contrast material suggests possibility of hematoma enlargement during the acute phase, early recognition of contrast extravasation on MR imaging may be aided in patient management.

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초급성 두개내 출혈 환자에서 조영제의 혈관외 누출을 동반한 비전형적 자기공명영상

서울대학교 의과대학 방사선과학교실, 방사선의학연구소

최승홍 · 장기현 · 전우선 · 김지훈 · 강현승 · 권배주 · 나동규 · 김재형 · 한문희

초급성 두개내 출혈에 있어서 조영제의 혈관외 누출은 급성 출혈을 의미하며, 혈종의 크기 증가를 예견하는 소견이다. 또한, 임상 의사들에게는 적절한 치료 방침 결정에 있어 중요한 소견이다. 우리는 세 명의 초급성 두개내 출혈 환자에서 비전형적인 조영제의 혈관외 누출을 보인 자기공명 영상을 보고하고자 한다. 첫 번째 증례는 우측 기저핵과 좌측 측뇌실에 동시에 발생한 조영제 혈관외 누출의 예이며, 두 번째 증례는 혈관염이 의심되는 환자에서 조영증강을 보이는 중앙이나 혈관 질환을 감별하였던 비교적 다량의 조영제의 혈관외 누출을 보인 증례이다. 마지막으로, 세 번째 증례는 고혈압 환자에서 자기공명 영상을 얻는 중에 발생한 급성 출혈의 예이다.

통신 저자: 장기현, 서울특별시 종로구 연건동 28번지 서울대학교병원 진단방사선과
Tel. 82-2-760-2516 Fax. 82-2-743-6385 E-mail: changkh@radcom.snu.ac.kr