Case Report

MRI spot sign: Gadolinium contrast extravasation in an expanding intracerebral hematoma on MRI

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\textbf{A R T I C L E  I N F O}

Article history:
Received 9 November 2018
Revised 20 January 2019
Accepted 27 January 2019
Available online 23 February 2019

Keywords:
Spot sign
Intracerebral hematoma
Contrast extravasation

\textbf{A B S T R A C T}

We report a rare case of gadolinium contrast extravasation in a rapidly expanding basal ganglia hemorrhage on magnetic resonance imaging (MRI). Contrast extravasation within an intracerebral hematoma (ICH) on computed tomography (CT) angiography has been described as the “spot sign” and is a well-known indicator of active bleeding; however, contrast extravasation has seldom been reported on MRI. In this case, a 61-year-old female inpatient developed acute left hemiparesis and dysarthria on her third day of hospital admission. An initial noncontrast head CT showed an ICH, increasing in size on the follow-up CT study, and a subsequent MRI brain without and with contrast demonstrated multiple round collections of active bleeding at the margins of the hematoma on the postcontrast images. A CT angiogram performed following the MRI confirmed contrast extravasation along the margins of the hematoma. This case is unique as it demonstrates the “spot sign” with MRI, and the multiple foci of active bleeding identified with MRI support the “avalanche” hypothesis, which proposes that the initial expanding ICH leads to additional arterial ruptures and propagation of bleeding.

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\textbf{Introduction}

Contrast extravasation within intracerebral hematomas (ICHs) is a well-known phenomenon and is indicative of active ongoing bleeding. This has been described on computed tomography (CT) angiography as the “spot sign” and manifests as a collection of dense contrast within or along the margins of the hematoma. This phenomenon has rarely been reported on gadolinium contrast extravasation (MRI) in humans in the radiology literature. We report a case of significant gadolinium contrast extravasation involving a spontaneous rapidly expanding hematoma in the basal ganglia. It is important for radiologists to be aware of the appearance of extravasated contrast on MRI so as not to confuse this for enhancement due to an underlying lesion.

\textbf{Case report}

A 61-year-old woman was admitted to our hospital for a newly diagnosed pancreatic tumor. On the third day of her hospitalization, she developed acute onset of left hemiparesis and
dysarthria. A CT head was performed, which showed a small acute hemorrhage in the right basal ganglia (Fig. 1). The patient's neurologic symptoms rapidly deteriorated and a repeat CT head was performed 4 hours after the initial CT study. This CT showed substantial interval increase in size of the hematoma (2.1 cm × 1.8 cm × 1.9 cm to 3.5 cm × 2.8 cm × 2.8 cm; Fig. 1).

The patient's systolic blood pressure was initially maintained at a goal <160 mmHg. After imaging revealed hematoma expansion, blood pressure parameters were narrowed to meet a systolic blood pressure goal of <140 mmHg. Thirty minutes after the second CT, an MRI was performed to exclude an underlying mass or vascular malformation. On MRI, the hemorrhage appeared isointense on T1- and T2-weighted imaging indicative of an acute bleed containing intracellular oxyhemoglobin (Fig. 2). The post-contrast T1-weighted images demonstrated multiple small round collections of active bleeding along the margins of the hematoma (Fig. 2). These collections contained discrete fluid-fluid levels. The dependent portion of the collections contained isointense acute blood products, whereas the non-dependent portion of the collections contained hyperintense extravasated gadolinium contrast (Fig. 3).

A CT was performed 3 hours after the MRI that showed hypodensity corresponding to the areas of contrast extravasation (Fig. 1) and stable hematoma size. A follow-up CT 4 hours later showed continued stabilization of the basal ganglia hemorrhage. The patient's neurologic status did not decline thereafter and continued to improve over the course of the week. Follow-up MR as an outpatient demonstrated near complete resolution of the basal ganglia hemorrhage with developing encephalomalacia. Furthermore, no enhancement was identified on the follow-up MR, confirming the findings on prior CT and MR examinations were due to ICH without the presence of underlying metastatic disease in this patient with a pancreatic tumor.

Fig. 1 – CT non-contrast- right basal ganglia hematoma. Serial CT scans obtained at times 0 hour (left), 4 hours (center), and 7.5 hours (right) show a rapidly expanding hematoma in the right basal ganglia.

Fig. 2 – MR with and without contrast- spot sign. MRI obtained 30 minutes after the second CT demonstrates T1 (top left) and T2 (top right) hypointense blood products in the right basal ganglia indicative of acute hemorrhage containing intracellular oxyhemoglobin. Post-contrast images (bottom left and right) at 2 different levels demonstrate multiple small collections of extravasated gadolinium contrast along the margins of the right basal ganglia hematoma. The extent of hemorrhage seen in the image on the lower left corresponds to the last CT image in Figure 1.
Discussion

Spontaneous ICH is one of the most devastating forms of stroke. It accounts for 15% of all stroke and carries a mortality rate up to 50% [1]. Hematoma expansion is now known to be a major predictor of ICH-related morbidity and mortality. Identifying predictors of hematoma expansion is essential to decrease ICH-associated mortality.

The “spot sign” was first described in 2007 on CT angiography as a small focus of extravasated contrast within an ICH, which was shown to be a predictor for hematoma expansion [1]. Since then, multiple studies have confirmed that contrast extravasation is an independent predictor of hematoma expansion and is also a predictor of poor clinical outcome and mortality [2]. The spot sign has therefore become a reliable marker in selecting patients for hemostatic or surgical treatment and intensive blood pressure management.

The analogous MRI spot sign was recently described in a case series of 23 patients with primary ICH as well as a case report of a patient with a rapidly expanding subdural hemorrhage published in Stroke and Neurology, respectively [3,4]. Larger spot signs correlated with larger hematoma volume and worse outcome based on modified Rankin scale [3]. The spinal spot sign has similarly recently been reported in the neurology literature describing contrast extravasation on spinal MRI in a patient with spinal subdural hemorrhage [5]. Active gadolinium extravasation has also been described in an in vivo animal model in a radiology publication [6].

Our case is unique in that the extravasated contrast does not have the typical appearance of a “spot sign,” but instead manifests as multiple small collections or pockets of active bleeding along the margins of the expanding hematoma that contain fluid-fluid levels comprised of gadolinium and acute blood. The presence of additional foci of active bleeding along the margins of the expanding hematoma supports the “avalanche” hypothesis, which proposes that the initial expanding ICH leads to additional arterial ruptures and propagation of bleeding [7]. It is important for radiologists to be aware of this rare appearance of active contrast extravasation on MRI. This must not be confused for true contrast enhancement due to an underlying lesion such as a tumor or vascular malformation. Correlation with CT imaging, digital subtraction angiography, and follow-up imaging can be helpful to distinguish hemorrhage from underlying tumor or vascular malformation in such cases.

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