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CASE REPORT

# Neuroimaging features and pathology of mixed glioblastoma—AVM complex: A case report

## *Caractéristiques en neuro-imagerie et anatomopathologie d'une lésion complexe associant un glioblastome (GBM) et une malformation artérioveineuse (MAV)*

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**KEYWORDS**
Glioblastoma multiforme;
Arteriovenous malformation;
Neuroimaging;
Pro-angiogenic factors

**Summary** This report is of a rare case of glioblastoma coexisting with an arteriovenous malformation in a 65-year-old man. Multimodal magnetic resonance imaging (MRI) performed at 3 T revealed a necrotic and cystic lesion in the left hemisphere; morphological and metabolic findings were consistent with an infiltrating high-grade glioma, but the presence of dark vessel-like signals on T2* and susceptibility-weighted imaging (SWI) suggested the coexistence of a vascular malformation. The arteriovenous malformation was confirmed by MR angiography and cerebral angiography. The patient was operated on, and histological examination revealed atypical cells characteristic of glioblastoma multiforme and, in the same area, arteriovenous malformation. The possible role of angiogenic factors in this case is also addressed.


## Introduction

The coexistence of glioma and arteriovenous malformation (AVM) in the brain is extremely rare. Only a few cases are mentioned in the literature and many of these are single case reports [1—11]. The largest series addresses 14 cases of AV shunts associated with tumors of glial origin [11], and two reported the association of an AVM with glioblastoma multiforme (GBM). The favorable or causative conditions as well as the physiological substrate of such an association are poorly understood. However, multiple hypotheses to explain the association of brain vascular malformations and tumors within the same patient have been proposed. These include fortuitous association, genetic predisposition, a distinct entity possibly of viral origin with a biological potential to evolve along different lines, and a secondary or reactive neoplastic process [5]. In addition, the imaging diagnosis of such a lesion may be challenging because of entangled magnetic resonance imaging (MRI) features. This

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report involves the multimodal imaging panel of a patient who had a unifocal GBM encompassing an AVM at the core of the tumor. This is the third such case of a GBM coexisting with an AVM. The potential role of genetic and angiogenic factors that might have interfered with the condition is also discussed.

## Case report

A 65-year-old man presented in our hospital with a 3-week history of dysphasia and progressive right hemiparesis. The medical history of the patient included asthma, diabetes and dyslipidemia. No history of recent trauma was found. On admission, brain MRI was performed with a 1.5-T Achieva scanner (Philips, Best, The Netherlands) in the emergency unit and subsequently completed at 3-T (Achieva R2.6, Philips). Morphological assessment using fluid-attenuated inversion recovery (FLAIR), gradient-echo T2 (T2*) imaging and T1-weighted (T1 W) imaging (before and after contrast injection) revealed a necrotic and cystic lesion in the left hemisphere, involving the basal ganglia, with midline shift and uncal herniation (Fig. 1, A—C). Some high-signal areas on unenhanced T1 W and dark signals on T2-weighted images were seen in the lesion (Fig. 1, B,D). The lesion also showed ring-like heterogeneous enhancement. Diffusion-weighted imaging (DWI) showed multifocal restricted apparent diffusion coefficient (ADC) areas (Fig. 1,

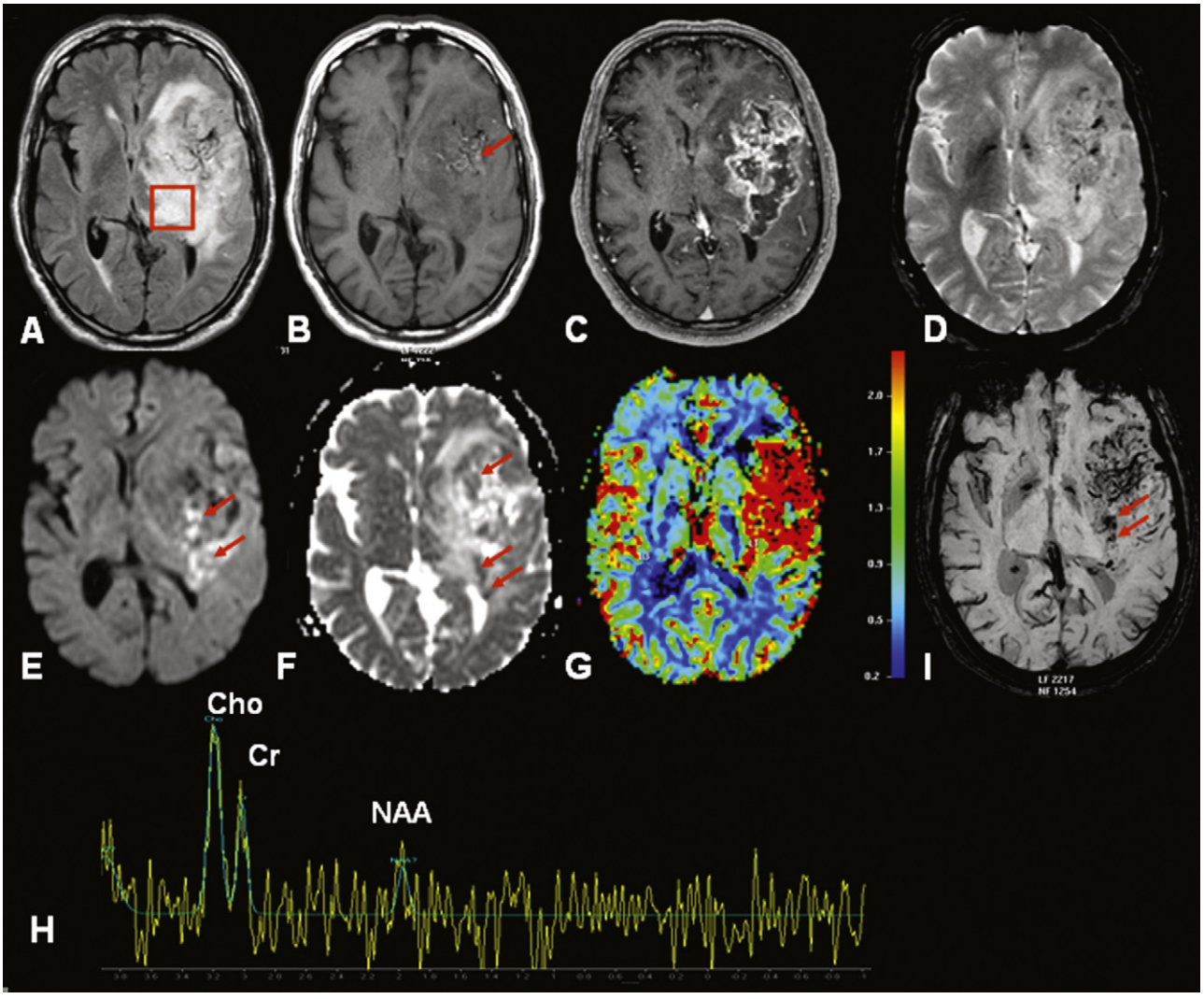


**Figure 1** Axial FLAIR (A) and T1 W pre- (B) and post-contrast (C) images show a necrotic and cystic lesion in the left hemisphere involving the basal ganglia with midline shift, a hypersignal foci on non-enhanced T1 W (red arrow) and ring-like heterogeneous enhancement. The axial T2 gradient-echo image (D) shows dark signals next to the insula. Diffusion-weighted MRI (E) and apparent diffusion coefficient (ADC) maps (F) reveal areas of restricted diffusion (red arrows). There is also an increased relative cerebral blood volume (rCBV) on perfusion-weighted maps (G). The susceptibility-weighted image (SWI, I) shows a tangle of serpiginous vessels in the lesion. Proton spectroscopy (H), from a single voxel at long TE located over the left capsulothalamic region (red square on E), demonstrates high choline/creatine (Cr) and choline/N-acetyl aspartate (NAA) ratios, and a severely decreased NAA/Cr ratio. These findings considered together suggest an aggressive infiltrating tumor, but the presence of abnormal vessels, as revealed by SWI, indicates the need for angiography.