Unespected dectection of unruptured brain arteriovenous malformation with ^{18}F-DOPA PET/MR

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Abstract
Unruptured brain arteriovenous malformations (AVM) have a heterogeneous clinical presentation, mainly related to the presence of intracerebral hemorrhage. We report the diagnosis of AVM in a patient with Parkinson's disease (PD), who undergone positron emission tomography/magnetic resonance imaging (PET/MRI) molecular brain imaging with fluorine-18-dihydroxyphenylalanine (^{18}F-DOPA). This case suggests that AVM may be occasionally recognized in molecular imaging studies using positron-emitting amino acids. Magnetic resonance imaging with susceptibility-weighted imaging (SWI) sequences and 3D time of flight (TOF) reconstruction may contribute to manage patients with AVM.

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Case Report

Unruptured brain arteriovenous malformations (AVM) have a heterogeneous clinical presentation, mainly related to the presence of intracerebral hemorrhage. Annual risk of hemorrhage is generally low, and patients are frequently asymptomatic. Thus, AVM detection may be unexpected during occasional brain anatomical imaging, including contrast-enhanced/computed tomography (CE/CT) and magnetic resonance imaging (MRI) [1].

We report the diagnosis of AVM in a 64 years-old patient with Parkinson's disease (PD), who was referred to our center for hybrid positron emission tomography (PET)/MRI molecular brain imaging with fluorine-18-dihydroxyphenylalanine (^{18}F-DOPA).

The patient was administered with 200mg carbidopa orally, one hour before the intravenous injection of 185MBq ^{18}F-DOPA. Eighty minutes after radiopharmaceutical injection, a 20-min emission PET scan was acquired simultaneously with blood oxygenation level dependent (BOLD) MRI sequences for motion correction, followed by ultrashort echo-time (UTE) pulse sequences for attenuation correction. Finally, reconstructed PET images were fused with non-CE volumetric T1-weighted (MPRAGE) sequences.

Fluorine-18-DOPA PET images demonstrated remarkably reduced uptake by the striatum, particularly by the putamen, bilaterally. In addition, a diffuse and faint uptake (SUVmax=2.4) in the right temporal lobe was observed, significantly higher than that of the surrounding background.

Co-registered MPRAGE sequences showed some small hypointense spots in white matter of right temporal lobe excluding focal lesions.

Based on these findings, a full diagnostic brain MRI with CE [2] was performed few days after PET/MR, demonstrating a specific alteration in susceptibility weighted imaging (SWI) MRI sequences suspected for vascular content in the corresponding area of right temporal lobe. 3D MRI angiographic reconstruction identified an AVM in the right temporal lobe.

This case suggests that AVM may be occasionally recognized in molecular imaging studies using positron-emitting amino acids. This was previously observed in PET studies using O-(2-^{18}F-fluoroethyl)-L-tyrosine (FET) but, to our knowledge, was not previously demonstrated with ^{18}F-DOPA [3]. In addition, we showed that, although mild, increased ^{18}F-DOPA uptake may be seen in delayed (90 minutes) images too. Vascular malformations are frequent and should be taken into account as potential pitfall for amino acid PET image interpretation. Magnetic resonance imaging with SWI sequences and 3D time of flight (TOF) reconstruction may contribute to manage patients with AVM.

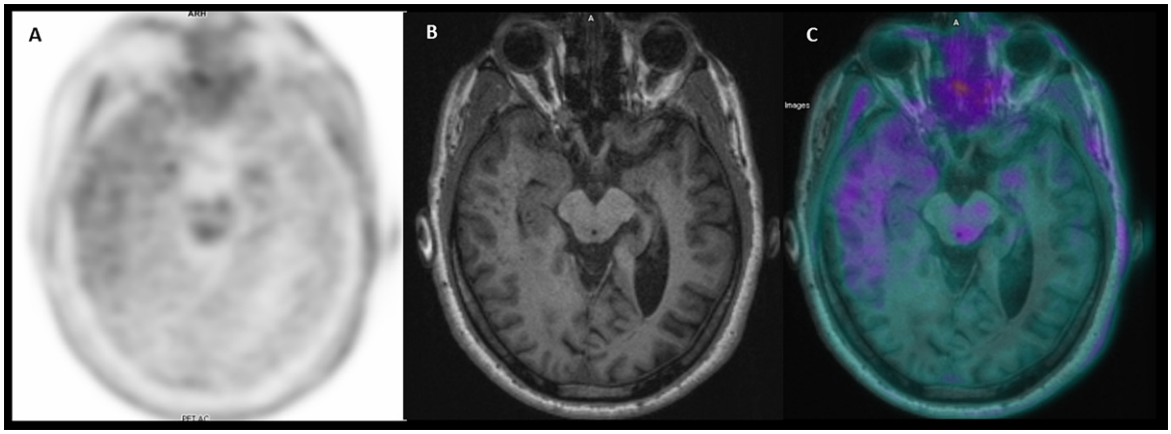

Figure 1. PET/MRI acquisition. Abnormal, mildly increased uptake is seen on ^{18}F-DOPA images in the right temporal lobe (A). No significant or specific abnormality can be recognized on T1 MPRAGE MRI images (B) or on fused images (C),

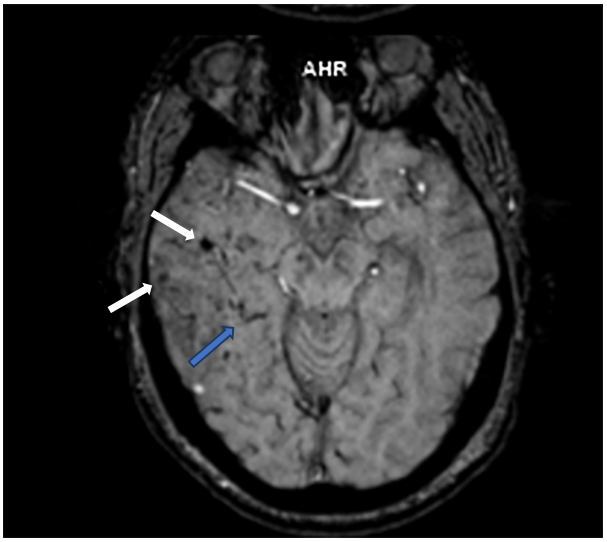

Figure 2. Axial-Susceptibility weighted imaging (SWI) sequence shows a multiple engorged vessels, showing flow-signal void (white arrows). This picture posed a differential diagnosis between AVM and multiple cavernomas. An enlarged tortuous venous structure (blue arrow) is also noted, possibly referable to deep venous drainage in AVM.

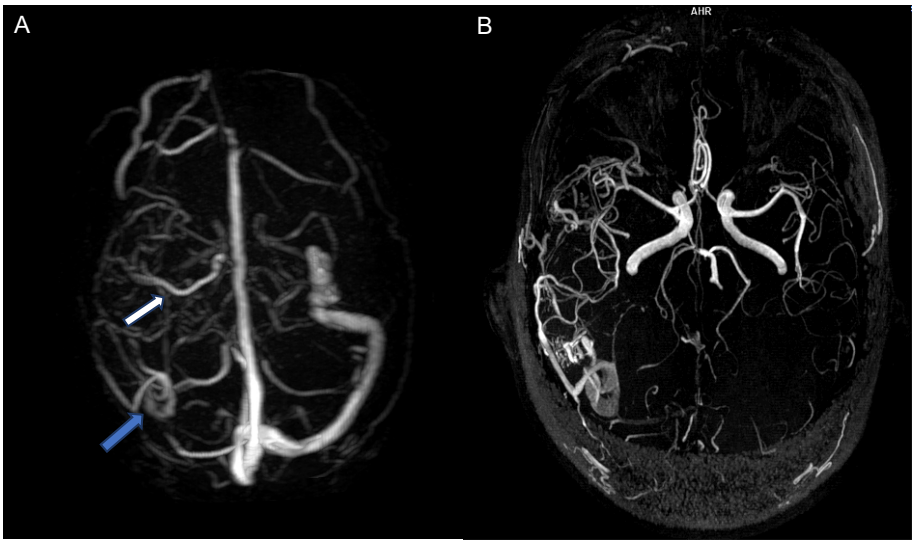

Figure 3. a. 3D-TOF with MIP reconstruction showed a right temporoparietal AVM with superficial venous drainage and associated enlargement of cortical veins (white arrows). Deep venous drainage is demonstrated with an enlarged tortuous venous structure (blue arrow) connecting a right subependymal vein, which drains into the right internal cerebral vein. b. The arterial study revealed marked ectasia and congestion of the arterial component of the AVM.

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