CASE OF THE MONTH

The uncontrollable shaking arm

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Case report

A 48-year-old male presented to the emergency department with the chief complaint of intermittent uncontrollable shaking of his left arm. He reported having had a brain tumour resected from the right frontoparietal region of his brain approximately 5 years earlier. He was admitted to hospital and underwent MRI scan of his brain. The MRI demonstrated a right frontoparietal region tumour, which was proven to be a partially resected (*i.e.* residual) low-grade astrocytoma. The residual tumour was resected without any apparent motor deficit. Although there was some abatement of seizure activity, focal motor seizures of the patient's left upper extremity did not completely resolve, despite anticonvulsant medication at therapeutic levels. Brain positron emission tomography (PET)/CT with 18-fluorodeoxyglucose (FDG) was performed. Selected tomographic slices with and without CT fusion are shown in Figures 1, 2 and 3.

What is the salient finding? What is the most likely explanation for this pattern of uptake?

Discussion

"Interictal" imaging was the intended procedure to demonstrate typical decreased metabolism corresponding to the seizure focus in a quiescent state [1, 2]. However, the patient's left arm was *in status epilepticus* during radiotracer injection and throughout the 50-min uptake period. The PET scan, with and without CT fusion

(Figures 1, 2 and 3), revealed a discrete gyriform focus of intense metabolic activity (arrows in Figure 1) in the anterior margin of the right frontal resection cavity, which involved the (somewhat distorted) primary motor cortex. This is the region corresponding to the patient's contralateral motoric activity and the presumed ictal focus [3].

As a result of the relatively prolonged uptake period of FDG, FDG PET epilepsy imaging is typically limited to interictal seizure evaluations in which the seizure focus presents as an area of relative photopenia, while the $^{99}\text{Tc}^{\text{m}}$ cerebral perfusion tracers, $^{99}\text{Tc}^{\text{m}}$ hexamethylpropyleneamine oxime and $^{99}\text{Tc}^{\text{m}}$ ethyl cysteinate dimer, are typically used for "ictal" imaging with injection at the onset of the seizure and visualisation of focally increased uptake indicating the seizure focus [1, 2]. It is not unexpected that FDG would accumulate in seizure foci if the duration of the seizure is sufficiently prolonged (*e.g.* status epilepticus) and there are case reports to testify to this phenomenon [4].

As opposed to photopenia, which is typically associated with seizure foci in FDG PET brain imaging, increased uptake is the norm in many FDG PET brain tumour evaluations [5]. Moreover, the degree of FDG avidity has been useful in assessing brain tumour grade; the degree of uptake serves as a marker of the grade and potential aggressiveness of at least some brain neoplasms. Focally increased FDG uptake in the brain should raise the suspicion of malignancy as a differential diagnosis, particularly where there is a history of a brain tumour. However, the histology of the malignancy in which there is a well-known lack of significant FDG avidity, the absence of demonstrable residual neoplasm on MRI following the most recent surgery, the morphology of the metabolic focus and the cerebral cortical regional-motoric correspondence militate against a tumorous aetiology for this uptake [6].

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(a)

(b)

Figure 1. Coronal 18-fluorodeoxyglucose positron emission tomography image of the brain (a) without and (b) with CT fusion. There is a discrete gyriform focus of intense metabolic activity (arrows).

Figure 2. Sagittal 18-fluorodeoxyglucose positron emission tomography image of the brain with CT fusion.

Figure 3. Axial 18-fluorodeoxyglucose positron emission tomography image of the brain with CT fusion.

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