

# Ictal onset zone and seizure propagation delineated on ictal F-18 fluorodeoxyglucose positron emission tomography/computed tomography

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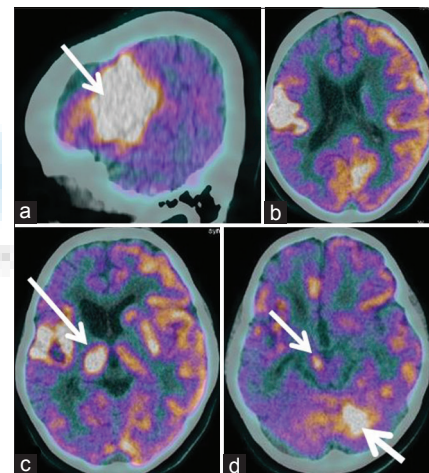
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## ABSTRACT

The present case highlights the utility of ictal F-18 fluorodeoxyglucose (FDG) positron emission tomography (PET)/computed tomography (CT) in delineating the seizure onset zone in a child with complex partial seizures. Although F-18 FDG PET has been successfully used to delineate interictal hypometabolism, planned ictal FDG PET, in cases with prolonged seizure activity, can provide better spatial resolution than single-photon emission CT by delineating the seizure onset zone and propagation pathway.

**Keywords:** F-18 fluorodeoxyglucose, epilepsy, hypermetabolism, ictal positron emission tomography

An 8-year-old female child with recurrent left complex partial seizures since the age of 2 years was being worked up for epilepsy surgery. Her magnetic resonance imaging (MRI) revealed right cerebral atrophy and keeping a working diagnosis of Rasmussen's encephalitis, she was planned for a hemispherotomy. Video electroencephalogram (EEG) revealed right frontocentral-temporal discharges which prompted consideration for an anterior disconnection if all seizures originated anterior to the motor strip, thus prevent disabling hemiparesis posthemispherotomy. She was referred for an F-18 fluorodeoxyglucose (FDG) positron emission tomography/computed tomography (PET/CT). F-18 FDG PET/CT revealed focal hypermetabolism in the right frontal lobe [Figure 1]. In addition, increased FDG uptake was seen the right basal ganglia, right thalamus, right cerebral peduncle, and left cerebellar hemisphere (crossed cerebellar diaschisis). An interictal/ictal single-photon emission CT (SPECT) was also done followed by subtraction ictal SPECT coregistered to interictal SPECT which localized seizure onset to the right frontal lobe [Figure 2]. The MRI of the child had revealed right cerebral



**Figure 1:** Sagittal (a) and transaxial (b) fused F-18 fluorodeoxyglucose positron emission tomography/computed tomography images, showing the right frontal hypermetabolism, with hypermetabolism in the right thalamus (c-arrow), cerebral peduncle (d-arrow) and left crossed cerebellar diaschisis (d-thick arrow), thus localizing the ictal onset zone to the right frontal lobe. The remaining right cerebral hemisphere shows hypometabolism consistent with Rasmussen's (right hemiatrophy)

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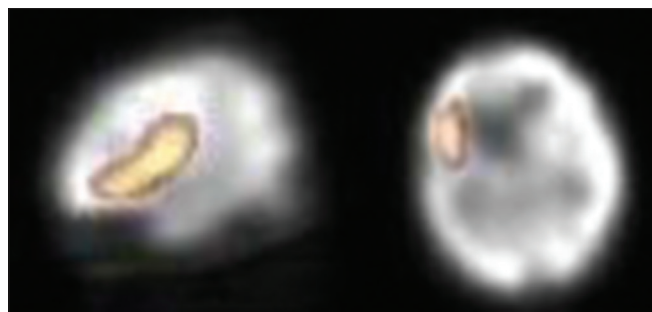
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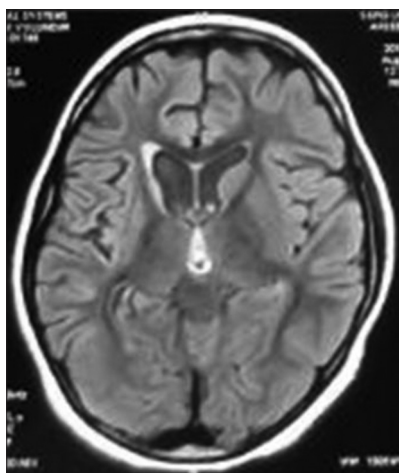
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hemiatrophy [Figure 3], and the EEG localized the seizure onset to the right cerebral hemisphere [Figure 4].

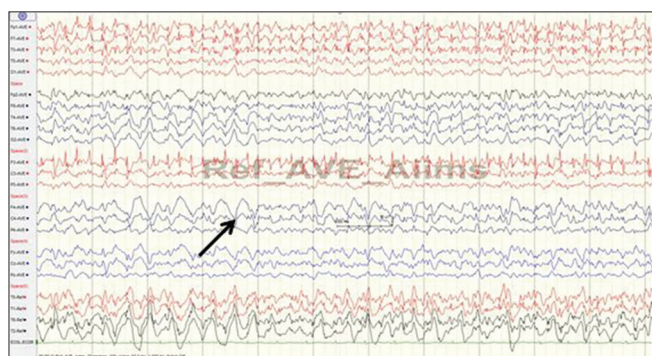
PET imaging is considered integral for pediatric intractable epilepsy presurgical workup.<sup>[1]</sup> Commonly, PET is performed



**Figure 2:** Sagittal and transaxial SISCOS images localizing the seizure onset zone to the right frontal lobe



**Figure 3:** Transaxial T1 fluid attenuation inversion recovery magnetic resonance imaging images of the child showing right cerebral hemiatrophy



**Figure 4:** Electroencephalogram of the child showing the evolution of ictal delta over the right hemisphere (arrow)

in the resting interictal state. Ictal PET is limited by the fact that dynamic uptake of FDG continues over 45 min and thus capturing the brief ictal episode is difficult. The utility of ictal PET to establish a diagnosis of focal status epilepticus has been outlined in a number of case reports.<sup>[2-6]</sup> Siclari *et al.* have outlined the clinical indications for ictal PET in focal status epilepticus where it helps in diagnosis or deciding therapeutic management.<sup>[7]</sup> Ictal PET can also be considered in patients with high seizure frequency more so in extra-temporal epilepsies.<sup>[8]</sup> In patient with a large structural MRI abnormality, ictal PET, or ictal SPECT can help localize “seizure onset zone” within this abnormality that helps planning invasive recordings, guides neurosurgical intervention, and prognosticates seizure outcomes after surgery. In our case, both were done correctly localizing the seizure onset zone to the right frontal lobe, in addition the resolution of ictal FDG PET highlighted the entire seizure propagation. Thus, ictal PET can be a useful tool in the presurgical workup of intractable epilepsy in predefined clinical situations as discussed above.

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### Conflicts of interest

There are no conflicts of interest.

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