

Clinical Area: FDG PET for presurgical evaluation for refractory seizures
Keywords: FDG PET, invasive EEG, seizure focus determination
Reference: Theodore WH, Sato S, Kuffa CV, Gaillard WD, Kelly K. FDG-positron emission tomography and invasive EEG: Seizure focus detection and surgical outcome. *Epilepsia* 1997; 38: 81-86.

Study Type: Case Series, prospective
Study Aim: To study the value of FDG PET for guiding surgical decisions in patients with refractory seizures when surface ictal video-EEG (VEEG) is nonlocalizing.

Outcomes

- *Primary:* Association between EEG and PET findings, seizure-free at follow-up.

Design

- *Number of subjects:* n=46
- *Method of subject selection (inclusion/exclusion criteria):* **Inclusion:** Uncontrolled complex partial seizures (CPS); prolonged ictal video-EEG monitoring failed to show consistently lateralized (n=22) or localized (n=24) seizure onset. **Exclusion:** Patients with MRI abnormalities, except for increased mesial temporal signal or volume loss.
- *Consecutive patients?* Yes.
- *Description of study population:* No demographic information given.
- *Exposure/Intervention:* Patients were evaluated using FDG-PET imaging, VEEG and IEEG. Based on EEG localization, 34/46 (74%) patients had a temporal lobectomy which included resection of both lateral and mesial structures. Seizure status was measured at follow-up for patients with and without operations.
- *Source of outcome data (e.g. patient self-report, doctor report, lab results):* Clinical data, clinical follow-up for surgical outcome data.
- *Length of follow-up:* Mean of 67.7 months (range 12-113 months).
- *Completeness of follow-up:* 100% but for varying lengths of time.

Validity

- *Is the study type appropriate for the question(s) being asked?* Yes.
- *Were patients similar with respect to baseline characteristics?* Not known how patients differed demographically.
- *Was the intervention and other aspects of patient care similar for all patients (or for all patients in a defined subgroup)?* No, some but not all of the patients received surgery.
- *Was the process of observation likely to affect the outcome?* No.
- *Did an objective observer assess outcomes and were outcome measurements consistent?* Appear to be.
- *Was follow-up duration appropriate?* Greater consistency in length of follow-up would have been better.
- *Was follow-up rate sufficient?* Appears to be.

Conclusions regarding validity of methods:

This study was appropriate to answer the question whether FDG PET is sufficiently associated with IEEG findings such that IEEG can be avoided. Limitations include the relatively small sample size and the wide variation in follow-up duration.

Results

Interpretation of FDG PET scans

Definition of unilateral temporal hypometabolism= mesial or lateral temporal asymmetry $\geq 15\%$ was present and extratemporal AIs (asymmetry index) were $< 15\%$.

Relation of FDG PET hypometabolism to surgical outcome

Outcome	FDG PET hypometabolism				Total*
	Temporal	Frontal temporal	Frontal	None	
Seizure-free	18	3	--	4	21
Not seizure-free	5	2	--	3	17
No operation	3	--	1	7	

*of those with FDG PET hypometabolism

Hypometabolism was greater in patients who became seizure-free, but the difference for inferior lateral temporal (ILT) AI was not significant ($p < 0.10$). The difference was significant for inferior mesial temporal (IMT) AI ($p = 0.03$).

Comparison of FDG PET findings (asymmetry index) in patients with and without IEEG localization

Localization in area of brain	Patients with Localized IEEG AI (mean \pm SE)* (n=40)	Patients with Nonlocalized IEEG AI (mean \pm SE)* (n=6)	p-value **
Lateral temporal	0.19 \pm 0.02	0.04 \pm 0.04	< 0.01
Mesial temporal	0.13 \pm 0.02	0.03 \pm 0.01	< 0.02

* AI $\geq 15\%$ in mesial or lateral temporal lobe and AI $< 15\%$ in extratemporal lobe indicates the presence of hypometabolism.

** p-value compares patients with and without localized IEEG, paired t-tests.

Authors' Conclusions

“ We showed that the presence of temporal hypometabolism on FDG PET predicts successful temporal lobectomy even when surface EEG is nonlocalizing. Although patients without hypometabolism can benefit from operation, IEEG studies may be less likely to disclose an epileptogenic region when FDG PET shows no hypometabolism.”

Reviewer's Conclusions

This study found a higher mean asymmetry index (AI) in patients with localized compared to non-localized IEEGs which suggests that FDG PET results may correlate with the results of IEEG. This preliminary finding needs to be confirmed in a larger study with a standard follow-up period. Studies need to include a larger number of patients for whom seizure focus could not be localized by IEEG. The AI in the mesial temporal lobe did not exceed the cut-off value for hypometabolism; the authors did not suggest a cut-off for FDG PET AIs to use in order to decide that IEEG is not necessary.