

# Role of PET-MRI in Detecting & Diagnosing Focal Cortical Dysplasias

Dr. Sanidhya S. Karve<sup>1</sup>, Dr. R Rajesh Kannan<sup>2</sup>

<sup>1,2</sup>Department of Radiology, Amrita Vishwa Vidyapeetham, AIMS, Kochi, India

Corresponding Author: Dr. R. Rajesh Kannan

DOI: <https://doi.org/10.52403/ijhsr.20221219>

## ABSTRACT

Epilepsy is the one of the most prevalent neurological conditions. A lot of these epileptics have an underlying structural abnormality. Out of which, focal cortical dysplasia (FCDs) is quite often. Combined PET-MRI is the emerging imaging technique used to diagnose FCDs. We aimed to evaluate and describe PET-MRI findings in patients with FCDs. We studied 21 patients with suspected FCDs who underwent PET-MRI imaging and surgery later on. This study was done in a cross-sectional prospective way in a single medical center.

**Keywords:** Focal cortical dysplasias, Combined PET-MRI, Epilepsy

## INTRODUCTION

Focal cortical dysplasias are notorious to cause long standing intractable epilepsy. Most of these patients do not respond to anti-epileptic medications. These patients often undergo conventional clinical workup, EEG, MRI, etc. However, advent of combined PET-MRI is proving to be game changer in epilepsy imaging where it is available. It is common for twenty to forty percent of people with DRE to have a normal MRI, which dramatically reduces the likelihood that they would achieve seizure freedom after surgery (1,2). Three types of FCDs are known till date, type II being the most common. We have approximately only four functioning combined PET-MRI machines in India and thus we decided to conduct a study on combined PET-MRI in our center to study its capabilities in FCD imaging.

We aimed to describe PET-MRI findings in patients with focal cortical dysplasias (FCDs) and evaluate diagnostic effectiveness of combined PET-MRI in diagnosing the same.

## LITERATURE REVIEW

ILAE(2010) task force defined “drug resistant epilepsy as failure of adequate trials of two tolerated and appropriately chosen anti-seizure medications to achieve seizure freedom”(3). One of the most common causes of intractable epilepsy are focal cortical dysplasia, hippocampal sclerosis, tumors, meningoencephaloceles, etc. MTS, FCD, and DNET were among the relevant new diagnoses found in a retrospective evaluation of 804 unselected patients who had MRI at 1.5 T and then at 3 T. However, in people with negative MRI results, hippocampal sclerosis and focal cortical dysplasia are the most frequently overlooked diagnosis (4). Interictal FDG-PET can assist in indirectly detecting the epileptogenic focus by recognizing areas of the brain which show decreased FDG uptake (glucose hypometabolism) despite the absence of obvious structural lesions on MRI, or by placing a guide electrode during IC-EEG monitoring (5). Focal cortical dysplasias are more common in pediatric/

adolescent age group. Surgical resection of FCDs have proven to be very effective in providing seizure freedom. Thus, detecting and diagnosing FCDs is very crucial.

**MATERIALS & METHODS**

Between July 2020 and July 2022, the study was carried out at the AIMS, Kochi’s Radiodiagnosis Department. 21 patients with suspected focal cortical dysplasia were included in this prospective research (both recently identified and recurrent epilepsy).

The patients underwent a 2-deoxy-2-[fluorine- 18] fluoro-D-glucose (18-F FDG PET/MRI) brain study with positron emission tomography.

After receiving approval from the Thesis Protocol Review Committee, this prospective, cross-sectional study was carried out (Scientific, Ethical & Financial).

Study location: Department of Radiodiagnosis, AIMS, Kochi.

All of the patients participating in the trial provided their informed permission

**Statistical Analysis**

Statistical analysis was performed using IBM SPSS version 20.0 software. Categorical variables are expressed by frequency and percentage. Continuous variables are presented by mean and standard deviation. To test the statistical significance of the agreement between PETMRI, PET and MRI findings with HPE and surgical findings, McNemar’s Chi-Square test was used. Diagnostic measures such as sensitivity, specificity, predictive

values and accuracy was computed. In our study, combined PET-MRI proved to have sensitivity of 76.2%, specificity of 83.3%, accuracy of 80.4% and positive predictive value of 76.2% in diagnosing focal cortical dysplasia.

**RESULT**

The most common MRI abnormalities in a FCD were cortical thickening & blurring of the grey-white matter junction which were found in almost all 20 patients and 19 patients (90.5%) respectively. Subcortical T2/FLAIR hyperintense signal was found in 16 patients (76%) including 10 patients with the features of a transmantle sign (47.6%). Around 10 patients (47.6%) had all four imaging findings. Most of the FCDs in our study turned out to be Taylor type II which explains high number of cases showing transmantle sign in comparison to similar study done by Kim DW et al (85). All the FCDs detected on MRI images showed corresponding hypometabolism in fused PET-MRI images.

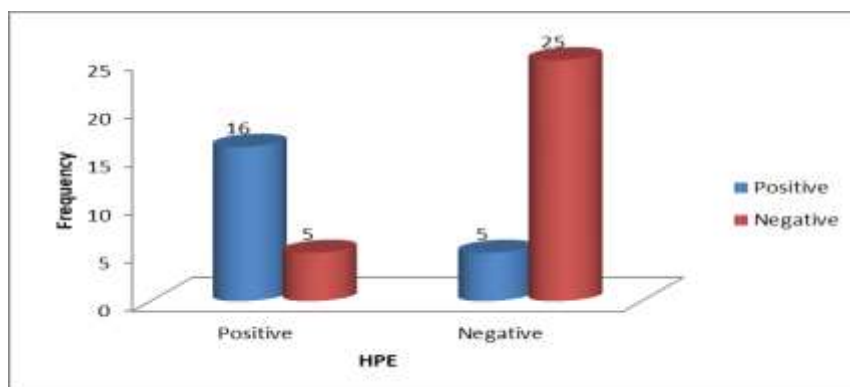
Table 1.0: Comparison of detection of FCD on PETMRI with HPE

FCD PETMRI	HPE		p value
	Positive n(%)	Negative n(%)	
Positive(21)	16(76.2)	5(16.7)	1.00
Negative(30)	5(23.8)	25(83.3)	

**Diagnostic measures(percentage)**

Sensitivity	Specificity	PPV	NPV	Accuracy
76.2	83.3	76.2	83.3	80.4

Fig 1.0: Comparison of detection of FCD on PETMRI with HPE



There was statistically no significant difference in the findings of PETMRI and histopathologic findings on the diagnosis of FCD (p value=1.00) with Sensitivity 76.2%, Specificity 83.3% and Accuracy 80.4%.

## DISCUSSION

Cortical thickening and blurring of grey-white matter junction were the most frequent findings in FCD, later followed by FLAIR signal changes and transmantle sign. Taylor type II showed all four signs in most of the cases. On the other hand, Taylor type I FCD were very subtle and PET hypometabolism was the only thing which it displayed.

Diagnostic effectiveness of combined PET-MRI in diagnosing FCDs with sensitivity of 76.2%, specificity of 83.3% and accuracy of 80.4%.

Limitation- Tiny Type I FCD still could be missed on PET-MRI, which could be further evaluated with other imaging and clinical investigations.

## CONCLUSION

PET-MRI displayed structural as well as metabolic activity in an FCD lesion. Combined PET-MRI helped us additionally in detecting subtle FCDs with its metabolic PET capabilities, especially type I FCD. Diagnostic agreement of combined PET-MRI with histopathology was good in terms of sensitivity, specificity and accuracy.

### Declaration by Authors

**Ethical Approval:** Approved

**Acknowledgement:** Dr. Prem Nair, Medical director, AIMS, Kochi. Dr. Gireesh Kumar KP, Principal, AIMS, Kochi. Dr. Srikanth Moorthy, Head of department, Radiology, AIMS, Kochi.

**Source of Funding:** None

**Conflict of Interest:** The authors declare no conflict of interest.

## REFERENCES

1. van Dijk JG, Thijs RD, Benditt DG, Wieling W. A guide to disorders causing transient loss of consciousness: focus on syncope. *Nat Rev Neurol.* 2009 Aug;5(8):438–48.
2. Ko TS, Holmes GL. EEG and clinical predictors of medically intractable childhood epilepsy. *Clin Neurophysiol.* 1999 Jul;110(7):1245–51.
3. Friedman E. Epilepsy Imaging in Adults: Getting It Right. *American Journal of Roentgenology.* 2014 Nov 1;203(5):1093–103.
4. Winston GP, Micallef C, Kendell BE, Bartlett PA, Williams EJ, Burdett JL, et al. The value of repeat neuroimaging for epilepsy at a tertiary referral centre: 16 years of experience. *Epilepsy Res.* 2013 Aug;105(3):349–55.
5. van Dijk JG, Thijs RD, Benditt DG, Wieling W. A guide to disorders causing transient loss of consciousness: focus on syncope. *Nat Rev Neurol.* 2009 Aug;5(8):438–48.

How to cite this article: Sanidhya S. Karve, R Rajesh Kannan. Role of PET-MRI in detecting & diagnosing focal cortical dysplasias. *Int J Health Sci Res.* 2022; 12(12):119-121. DOI: <https://doi.org/10.52403/ijhsr.20221219>

\*\*\*\*\*