

Imaging in Psychogenic Nonepileptic Seizures: An Observational Study

Sir,

Psychogenic nonepileptic seizures (PNES) are characterized by paroxysmal time-limited alterations in motor, sensory, autonomic, or cognitive signs and/or symptoms in the absence of excessive and hypersynchronous brain discharges.^[1] It is reported that 5%–10% of outpatients in epilepsy clinics and 20%–40% of patients in epilepsy monitoring units have PNES.^[2] Recently, there are reports on associations between PNES and many structural and functional brain abnormalities,^[3] suggesting a neurobiological origin for PNES.

We undertook this study to look at the neuroimaging profile of our patients with PNES. This was a cross-sectional analysis of the data collected (from June 2010 to July 2013) for a study on induction techniques in PNES.^[4] Demographic data including age, sex, education, occupation, religion, etc.; clinical data including duration of symptoms, use of antiepileptic drugs (AEDs), psychiatric and other comorbidities, coexisting epilepsy, frequency of events, and imaging data were collected after obtaining ethics approval. Imaging results, if available, were reviewed by a neurologist and impression recorded, if required, after discussion with a radiologist. Continuous data were compared using the *t*-test or Mann–Whitney *U* test depending upon normality. Frequencies were compared using Chi-squared tests. All data were analyzed using STATA version 14.2, StataCorp, USA.

Seventy-seven subjects with documented PNES [Video-electroencephalograph (VEEG) review by two epileptologists showing typical event in the absence of EEG changes] were included. The mean age of the participants was 22 years (SD 10.8), and 59 (76%) were women. Forty-six (60%) were on AEDs, but only ten (13%) had coexistent epilepsy. None of the participants reported sexual abuse, and two (2%) had a coexistent psychiatric illness (one psychosis and one anxiety disorder). By self-report, 14 (18%) were employed, 11 (14%) were studying, and the rest 52 (68%) described themselves as unemployed. Twenty-eight (36%) had undergone neuroimaging, of which 25 (93%) had undergone CT scans of the brain while only three had undergone MRI.

In univariate analysis, undergoing neuroimaging was associated with secondary school or higher level of

education ($\chi^2 = 3.93$; $P = 0.05$) and lack of suspicion of PNES by referring physician ($\chi^2 = 5.69$; $P = 0.02$). The other factors including age, gender, duration of PNES, coexisting epilepsy, and AED intake appeared to be similar in both the groups.

Out of the 28 subjects imaged, 11 (39%; 95% CI 11%–57%) had abnormalities. The abnormalities observed are given in Table 1. Calcified granuloma(s) was the most common abnormality, seen in five (45%) of the 11 subjects. Both patients with psychiatric comorbidity had abnormal imaging. Only two patients with coexisting epilepsy were imaged, and one of them had abnormality (right frontal calcification). On univariate analysis, those with abnormal imaging were more likely to be men (OR = 5.6; 95% CI 0.8–45.8) and more likely to be on two or more AEDs (OR = 6.2; 95% CI 0.8–77.1) compared with those with normal imaging. Other features like age, duration of PNES, education levels, and coexisting epilepsy were not different between those with imaging abnormalities and those with normal imaging.

Patidar *et al.*, in their study on demographic features of subjects with PNES from India, wanted to image all their subjects. However, they reported that only 27 of 50 patients (54%) were imaged.^[5] This is, as expected, higher than 36% of subjects who were imaged in our cohort as we only collected imaging data as available at referral. So, we were able to explore the factors that may cause such patients to be more readily imaged. Higher education levels and lesser physician suspicion for PNES were found to be significantly associated with imaging. While we

Table 1: Abnormalities detected on neuroimaging

Patient no.	Age/sex	Imaging modality	Abnormality
1	13/M	MRI	Bilateral basal ganglia hyperintensity
2	21/M	MRI	Left hippocampal atrophy ?cyst
3	15/F	MRI	Tuberculoma
4	13/F	CT	Suprasellar arachnoid cyst
5	18/M	CT	Asymmetric ventricles, partial agenesis of the corpus callosum
6	60/M	CT	Frontal contusion
7	14/F	CT	Leftpareito-occipital calcification
8	30/M	CT	Asymmetric temporal horns
9	24/M	CT	Multiple calcifications
10	14/F	CT	Multiple calcifications
11	22/F	CT	Right frontal calcification

have no direct evidence to suggest that education will lead greater demand for imaging, there is sufficient evidence from literature in epilepsy and other fields that health-seeking behavior improves with education and lower education is associated with higher treatment gaps.^[6,7] Lower physician suspicion for PNES will also understandably lead to increased imaging. Surprisingly, we found no association between frequency of events, coexisting epilepsy, or number of AEDs used with being imaged.

Abnormal structural imaging was seen in 39% (95% CI 11%–57%) in our cohort, with the commonest abnormality being calcified granulomas. This proportion of abnormal findings in structural imaging is similar to the results presented by McSweeney *et al.*^[8] who reported a prevalence of 25%–33% but is larger than the 18.5% reported in Indian PNES patients by Patidar *et al.* Possibility of incidental findings may be considered, but the prevalence of such findings on brain MRI have been reported to be around 2%^[9] and on CT, 1%–19%.^[10] Hence, our higher frequency of 39% cannot be accounted for by incidental findings alone.

The importance of the association between abnormalities on imaging and PNES is unclear, as these abnormal findings may be the cause of PNES, the result of unrelated trauma, a marker of associated conditions, or the result of changes secondary to PNES or therapy of PNES. In addition, in resource-poor settings like India where video EEG evaluation of PNES events is difficult, a lack of video EEG evaluation of PNES events is difficult, a lack of awareness of this relatively frequent presence of imaging abnormalities may result in inappropriate exposure of these patients to AEDs and their toxicity.

We also found that abnormalities in imaging were associated with AED polytherapy and male gender. We are unable to explain why abnormal imaging findings were more likely among men. Myers *et al.* studied gender difference in PNES and reported a significant difference between the genders in the frequency of events, utilization of mental health services, report of sexual trauma, levels of dissociation, and use of avoidance, but they did not comment on neuroimaging.^[11] Unfortunately, most studies on PNES neuroimaging have an underrepresentation of men, and the differences between the genders remain unexplored.

The strengths of our study are that all our participants had documented PNES according to International League Against Epilepsy guidelines.^[1] The number of subjects in our study is comparable to that in similar studies in the literature. Limitations of our study are

that imaging was done according to the discretion of the referring physician, most underwent CT only, and no control group was present.

In conclusion, structural imaging abnormalities are not uncommon in patients with PNES. Further studies are needed to verify if these changes are specific to PNES or due to confounders like epilepsy. Gender differences in PNES also remain to be explored.

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Conflicts of interest

There are no conflicts of interest.

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