Utilization of brain imaging in evaluating patients with psychogenic nonepileptic spells

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ARTICLE INFO

ABSTRACT

Background: Psychogenic nonepileptic spells (PNES) are paroxysmal movements or sensory events that resemble epileptic seizures but lack corresponding ictal electrographic changes. A confirmed diagnosis of PNES is only accomplished via video electroencephalogram (vEEG) monitoring. Prior to diagnosis, patients are often assessed with neurodiagnostic imaging and their conditions treated with anticonvulsant medications, both of which are of limited clinical value and contribute to the higher cost of care. In this study, we assessed the relationship between the semiological features of PNES, medication regimen, or psychiatric comorbidities and the frequency of referrals for brain imaging tests prior to diagnosis of PNES.
Methods: This is a retrospective chart review of 224 adult patients diagnosed as having PNES at a level 4 epilepsy care center from 2012 to 2017. Patients with coexisting epilepsy were excluded. The 882 segments of vEEG records were reviewed for semiology of spells, and patients were categorized into one of seven distinct phenotypic classes according to the accepted clinical classification. The frequency of neurodiagnostic tests completed for each patient prior to vEEG was correlated with PNES phenotype and other clinical characteristics.
Results: There were 68 (30%) males and 156 (70%) females diagnosed as having PNES with a median age of 36 years. Seventy-four percent of patients were receiving one or several anticonvulsant medications, and 67% of patients were treated with psychotropic medications other than benzodiazepines. The most prevalent PNES events were characterized by semirhythmic small amplitude movements in the extremities (class 2; 34%) followed by those resembling tonic–clonic seizures (class 4; 28%). Neurodiagnostic imaging tests including computed tomography (CT) and magnetic resonance imaging (MRI) of the brain were performed at least once in 60% of patients and 4 times or more in 11% prior to vEEG. There was a significant association between the frequency of neurodiagnostic tests and the PNES phenotype (p = 0.02). Specifically, patients with sensory changes (class 6) had more imaging tests than those with primitive gesturing and truncal posturing (classes 1 and 5, respectively). Additionally, patients diagnosed with 3 or more psychiatric disorders underwent significantly more neurodiagnostic tests relative to patients diagnosed with two or fewer psychiatric disorders (p = 0.03). Furthermore, patients whose conditions were treated with anticonvulsant medications tended to undergo more imaging scans prior to vEEG as compared with the patients whose conditions were not being treated with anticonvulsants.
Conclusions: These findings suggest that the frequency of brain imaging obtained prior to the definitive diagnosis of PNES is influenced by semiology of spells and the psychiatric health of patients. Patients who demonstrate minimal paroxysmal movements in the settings of multiple psychiatric comorbidities represent a particularly challenging patient phenotype which is linked to more frequent referrals for brain imaging. These patients should be promptly referred for vEEG to improve diagnostic accuracy and prevent treatment with anticonvulsants as well as referrals for serial neurodiagnostic tests.

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1. Introduction

Psychogenic nonepileptic spells (PNES) are paroxysmal motor, sensory, or autonomic disturbances that resemble epileptic seizures. In contrast to epileptic seizures, PNES have no corresponding ictal changes on videoelectroencephalogram (vEEG) and occur in the absence of

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recognized neurologic or medical conditions [1–3]. Semiological features of PNES range from pseudosyncope and paucikinetic primitive gesturing to impressive hyperkinetic movements reminiscent of those occurring in seizures [4]. Although several signs are considered to be suggestive of PNES [5], none of the features are pathognomonic, and the reliance on the clinical characteristics alone in distinguishing PNES from seizures is discouraged. Therefore, an established standard of practice proposed by the International League Against Epilepsy is to perform long-term EEG with accompanied video recording in all patients with suspected PNES [6]. While vEEG is currently considered to be the most accurate and reliable diagnostic technique for PNES [7] in healthcare facilities where access to vEEG is limited, the electrographic monitoring is frequently replaced or complemented by other diagnostic modalities such as computed tomography (CT), magnetic resonance imaging (MRI), and single photon emission computed tomography (SPECT). Globally, availability of vEEG for the diagnosis of PNES varies across countries and has been recently reported to be particularly limited in low-income countries [8].

In previous studies, evidence of abnormalities on brain MRI was found in 9–10% of patients with PNES [9]. However, the presence of cerebral pathology on imaging could not be relied upon to distinguish between epileptic seizures and pseudoseizures [10]. Furthermore, redundant brain imaging in these patients contributed to the growth of total national inpatient admission cost for PNES from 34 million USD in 1993 to more than 2 billion USD in 2013 [11]. Given that the emergency department (ED) is visited by these patients on average 6 times before the definitive diagnosis of PNES is established [12], it is important to understand which clinical characteristics are associated with higher rates of referral for brain imaging by ED physicians and other health practitioners. Using an interstate electronic medical record system, in the present study, we assessed the patterns of referrals for neurodiagnostic testing (e.g., head CT and brain MRI) in patients with psychogenic spells. In addition, we examined the relationship between the semiological features of PNES (e.g., extent of the abnormal movements) and likelihood of undergoing neurodiagnostic testing prior to vEEG. We hypothesized that PNES with prominent movements will be more likely misdiagnosed as epileptic seizures and these patients will be referred for imaging more often than those with more subtle movements. Furthermore, we examined the association between the clinical–demographic characteristics of patients with psychogenic spells and the frequency of brain imaging prior to the definitive diagnosis of PNES.

2. Methods

2.1. Patient selection

The present cohort was drawn from all retrospectively identified subjects (age: 18 years and above) who underwent vEEG monitoring to confirm diagnosis of PNES at the University of Nebraska Medical Center (UNMC), a level 4 comprehensive epilepsy center. The cohort was a sample of patients who underwent vEEG monitoring between January 2012 and April 2017 (Fig. 1). The diagnosis of PNES was established in patients presenting with new or recurrent psychogenic events that were registered during one or multiple vEEG recordings. The paroxysmal events were regarded as psychogenic if patients had motor and sensory disturbances or changes in affect occurred without ictal electrographic correlates and the semiology of those events was not consistent with EEG-negative epileptic seizures. Patients with clinical or laboratory data supporting the evidence of acute encephalopathy, delirium, syncope, or panic attacks were excluded. In addition, patients with coexisting established diagnosis of epilepsy or those with epileptic seizures on the assessed vEEG were excluded (Fig. 1). In patients who underwent multiple vEEGs for PNES, only the most recent recordings were reviewed as these studies were considered diagnostic for those patients. The events recorded during the diagnostic vEEG were assumed to be typical for these patients.
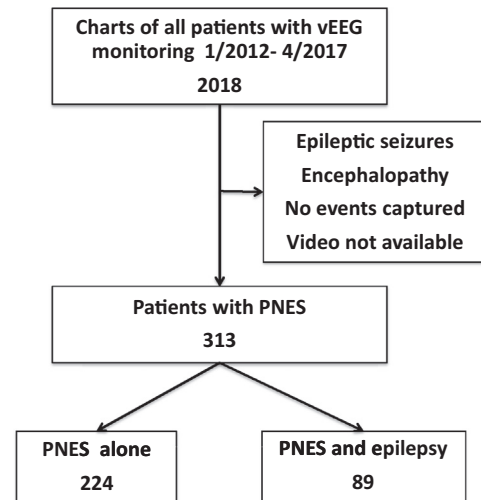

Fig. 1. Flow diagram.

2.2. vEEG analyses

The video segments of all PNES captured during the diagnostic vEEG recording were reviewed independently by a board-certified epileptologist and a licensed neuropsychologist; all events were also previously diagnosed as PNES at the time of admission by a treating epileptologist. Every event was assigned to a category based on the previously developed classification of PNES [13] which was modified to include seven classes based on the event semiology. The events were classified as follows: class 1 — dystonic attacks with primitive gestures; class 2 — attacks with tremor or low range semirhythmic movements in the extremities and various degrees of alteration of awareness; class 3 — dialeptic (or pseudosyncope); class 4 — attacks with hyperkinetic movements reminiscent of generalized tonic–clonic seizures; class 5 — axial dystonic attacks characterized by sustained posturing of the trunk and minimal movements in the extremities; class 6 — sensory and pseudoautonomic disturbances (e.g., paresthesia, numbness, palpitations, and dyspnea); and class 7 — unspecified complaints including speech difficulties, change in affect, and perceived weakness. If overlapping features of several classes were present, the category was assigned based on the degree of abnormal movements since the latter feature was thought to be of concern for the physicians requesting referrals for brain imaging. All event categories accompanied by abnormal movements (i.e., hyperkinetic events) were ranked according to the severity of associated movements in the rank order of 4-5-2-1 from the most to the least severe movements. The event categories without movements (i.e., paucikinetic attacks) were ranked according to the presence or absence of pseudosyncope in the order of 3-6-7 from the most severe PNES with unresponsiveness to the least severe events with poorly defined semiology. Patients who presented with multiple events during the same diagnostic vEEG were assigned an overall category; the events with multiple semiologies were reconciled based on the rank orders noted above. The number of different semiological categories identified during the diagnostic vEEG was recorded for each patient. The rare (less than 3%) discrepancies in the designations of the overall categories by the two independent reviewers were adjudicated during joint discussions. The information regarding the presence of epileptiform and nonepileptiform abnormalities on diagnostic vEEG (e.g., interictal epileptiform discharges, generalized, and focal slowing) was recorded for each patient.

2.3. Extraction of the imaging data

The electronic medical charts were reviewed to collect patients' age, gender, date of the diagnostic and preceding vEEGs, past or present