Psychological trauma, somatization, dissociation, and psychiatric comorbidities in patients with psychogenic nonepileptic seizures compared with those in patients with intractable partial epilepsy

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ABSTRACT

Objective: The objective of this study was to compare patients with intractable epilepsy with patients with psychogenic nonepileptic seizures (PNES) on the presence of psychological traumas, clinical factors, and psychological measures of somatization and dissociation.
Background: Several studies have reported a high prevalence of psychological trauma in patients with PNES, while less have examined the prevalence of psychological trauma in patients with epilepsy and compared both groups. Reports have been somewhat divergent with some describing significantly higher prevalence in physical abuse, others, in emotional abuse/neglect, and others, in sexual abuse in patients with PNES compared with those in patients with epilepsy.
Methods: This is a retrospective study of 96 patients (61 women, 35 men) with intractable epilepsy (2009 to 2017) and 161 patients (107 women, 54 men) with PNES (2008 to 2018).
Demographic and clinical (psychological trauma, depression, anxiety, seizure frequency, and number of antiepileptic drugs) data were collected. The Trauma Symptom Inventory II and the Minnesota Multiphasic Personality Inventory 2RF were administered.
Results: Patients with PNES differed significantly from those with intractable epilepsy on sexual trauma (χ^2 (5df, N = 257) = 9.787, p < .002) and "other" trauma (χ^2 (5df, N = 257) = 17.9076, p < .000). On psychological measures, there was a significant difference on Somatization scores in patients with PNES (M = 59.63, SD = 11.47) and patients with intractable epilepsy (M = 53.98, SD = 11.31); t(173) = 2.8396, p = .0051, but no difference was noted on a measure of Dissociation. Subsequent principal components analysis revealed that the first 3 principal components (sexual, physical, and other trauma) explained 74.19% of the variability, and that one principal component (dissociation, somatization, demoralization) explained 61.57% of the variability. However, after adjusting for the effects of covariates, only the presence of trauma discriminated between epilepsy and PNES.
Conclusions: Patients with PNES diagnoses differed from those with epilepsy on a Somatization scale but not on Dissociation or Intrusive Experiences and exhibited significantly higher rates of sexual and "other" trauma compared with those with intractable epilepsy. However, subsequent analyses revealed that a history of psychological trauma was the only condition found to discriminate between patients with PNES and those with epilepsy. These findings suggest that during initial workup and diagnosis, when patients report a history of psychological trauma (sexual or otherwise) a psychogenic nonepileptic etiology should be strongly considered in the differential diagnosis.

1. Introduction

Psychogenic nonepileptic seizures (PNES) are paroxysmal events that resemble epileptic seizures in presentation but lack electrophysiological correlates or clinical evidence for epilepsy. Instead, there is evidence of psychological antecedents (e.g., psychological trauma and life stressors), and PNES are categorized as functional neurological disorders (FND)/conversion disorders within the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5) [1].

In contrast, epilepsy is a disorder of the brain characterized by abnormal neuronal activity [2] with recurrent seizures. Approximately one-third of patients with epilepsy (PWEs) do not respond satisfactorily to antiepileptic drugs (AEDs). When more than two AEDs have been tried without adequate seizure control, this form of epilepsy is considered

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intractable or refractory [3]. Drug-resistant epilepsy can have a significant impact on the patients' lives. Persons with epilepsy frequently experience comorbid psychiatric disorders [4]. Depression and anxiety disorders are the two most frequent psychiatric comorbidities [5]. The prevalence of depression is estimated to be 20–55% in individuals with refractory epilepsy [6]. Persons with epilepsy are also known to experience considerable psychosocial adversities including domestic violence, abuse, other traumas, and discrimination [7].

Psychological trauma and life adversities as well as psychiatric comorbidities are often observed in patients with PNES. A review of existing studies of PNES found preliminary support for a link between childhood sexual abuse (CSA) and PNES, and another review on functional neurological disorders found that the experience of stressful life events and childhood or adult abuse is associated with an increase in the risk of functional neurological disorders [8–10]. Anxiety and depression are also typically higher in patients with PNES than those with epilepsy [11]. The prevalence rates of depressive disorders in adults with PNES ranges from 21 to 60% [12,13]. This is significantly higher than the prevalence rates not only in the general population, but also in PWEs that either have well-controlled seizures or intractable epilepsy [14,15]. However, other studies have reported high psychiatric comorbidities (anxiety, depression) in both PNES and epilepsy while others have identified that only certain clusters of patients with PNES differ from epilepsy controls on anxiety measures [16–18].

The objective of this study was to compare patients with intractable epilepsy to patients with PNES on characteristics of psychological trauma, demographic, and clinical factors as well as dissociation, somatization, demoralization, and cynicism. We hypothesized that patients with PNES differ from patients with intractable partial seizures on all types of psychological trauma and on measures of dissociation and somatization. Given the mixed findings in prior research relating to depression and anxiety noted above, we did not expect to find a significant difference between groups in levels of depression and anxiety.

2. Methods

This is a retrospective study of 96 (61 women, 35 men) consecutive patients with diagnosed intractable partial epilepsy (2009 to 2017) and 161 (107 women, 54 men) consecutive patients with diagnosed PNES (2008 to 2018) who underwent neuropsychological testing. These are patients who are treated at the Northeast Regional Epilepsy Group, an epilepsy program that serves New York and New Jersey with 15 hospital epilepsy monitoring units and 14 outpatient offices. Neuropsychological testing is requested when the referring physician is seeking to further characterize the patients' cognitive or diagnostic condition or when a patient reports concerns about his/her cognitive functioning. In patients with PNES, all patients given this diagnosis are referred for neuropsychological testing because characterization is always sought and utilized for subsequent treatment decisions. In PWEs with intractable partial epilepsy, the protocol at the practice is also to refer these patients for assessment in order to gain better characterization (localization, lateralization, quantification of cognitive deficits, presurgical evaluation, etc.). Diagnosis was confirmed with video-electroencephalography (EEG). Intractability was defined as having failed 2 or more AEDs in a lifetime. The initial number of 334 patients was reduced to 257 because 15 had a dual diagnosis of PNES and epilepsy, and 62 were determined to not have intractable partial epilepsy. Patients were examined on demographics (age, education), clinical (age of onset; trauma (yes/no) and trauma type: sexual, physical, or other; age of first trauma; seizure frequency; and number of current AEDs being taken). Seizure frequency was calculated as "seizures per day." For example, one seizure per week would translate into 1/7 (0.14), one seizure per month would translate into 1/30 (0.03), and 3 seizures per week would translate into 3/7 (0.43). Patients' psychiatric histories and specifics regarding psychological trauma types (e.g., childhood sexual, physical, verbal,

school bullying, witness of abuse, other type of trauma, work or school bullying associated with having seizures, and recent stressors) were obtained from the patients on an intake form they were asked to fill out prior to meeting with the neuropsychologist. These were further explored during the neuropsychological intake and testing. Neuropsychological testing was conducted on an outpatient basis. Review of their histories identified prior diagnoses of depression, anxiety, posttraumatic stress disorder (PTSD), and substance abuse, as well as a detailed trauma history.

Select psychometric measures, administered as part of the standard Northeast Regional Epilepsy Group neuropsychological battery, were examined with regard to posttraumatic symptomatology and personality scales. Psychometric measures included the Trauma Symptom Inventory-2 (TSI-2) [19] and the Minnesota Multiphasic Personality Inventory-2-RF (MMPI-2-RF) [20].

The TSI-2 is a 136-item self-report measure that is used to evaluate acute and chronic posttraumatic symptomatology in adults. The TSI-2 assesses the effects of sexual and physical assault, intimate partner violence, combat, torture, motor vehicle accidents, mass casualty events, medical trauma, traumatic losses, and childhood abuse or neglect. The clinical scales of the instrument measure the extent to which the respondent endorses trauma-related symptoms. For the purpose of this study, the following subscales were included: anxious arousal (anxiety and autonomic hyperarousal), intrusive experiences (e.g., nightmares, flashbacks, upsetting memories), dissociation, and somatic preoccupations (pain or general health concerns). The TSI-2 has been thoroughly examined with regard to reliability and validity. Internal consistencies have been reported for all scales ranging from .74 to .94, and test–retest coefficients have been reported for all scales ranging from .76 to .94. The predictive validity of PTSD using the TSI-2 was tested through discriminant function analysis using the T scores for the anxious arousal, intrusive experiences, and defensive avoidance scales. An optimally weighted combination of these TSI-2 scales significantly predicted PTSD with a sensitivity of 1.00 and a specificity of .88. A T score of 65 or higher is considered clinically significant.

The MMPI-2-RF [20] is a self-report measure of psychopathology and personality. The test comprises 338 true–false items that measure of psychopathology and personality and is intended for adults (18 years and older). There are 9 validity scales as well as 3 Higher-Order (H-O) scales and 9 Restructured Clinical (RC) scales. The Restructured Clinical scales (RC3: Cynicism and RCd: demoralization) are also of special interest given their potential relationship to PNES. Consequently, these two scales were used for analyses. Higher scores reflect greater psychopathology.

3. Analysis

A chi-square test of independence was performed to examine the relation between diagnosis (intractable epilepsy or PNES) and the presence of trauma histories (physical, sexual, or other) and psychiatric diagnoses at time of evaluation (depression, anxiety, PTSD, substance abuse).

An independent-sample t-test was conducted to compare Dissociation, Somatization, and Intrusive Experiences from the TSI-2 and Demoralization and Cynicism scales from the MMPI 2RF in patients with PNES and those with epilepsy.

Target variables were represented with indexes by conducting cluster analysis on the standardized target variables. The relationship between the target variables with the Condition (epilepsy or PNES) were analyzed via likelihood ratio tests. Subsequently, each group was compressed into just a few indexes, and the variability of those between the PWEs and those with PNES was tested. The compression was done via principal component analysis (PCA).

The Institutional Review Board (IRB) approval for an anonymous archival record review was obtained with removal of nonrelevant Protected health information (PHI) (Copernicus IRB NRE1-11-155).

4. Results

In the sample of PWE, mean age was 39.5 ± 24.75 years, and number of years of education was 13.6 ± 2.12. Mean duration of epilepsy was 18.4 ± 7.07 years. In the sample of patients with PNES, mean age was 35 ± 2.06 years, and mean number of years of education was 13.7 ± 0.71. There were no significant differences between samples on demographic characteristics. The mean duration for PWEs was much longer ((M = 18.39, SD = 15.52) t(254) = 7.449, p = .000) than that of those with PNES (M = 7.11, SD = 8.70). Patients with epilepsy (M = 0.52, SD = 0.79) and those with PNES ((M = 0.68, SD = 0.87); t(1.5191), p = .13) did not differ significantly on seizure frequency. Patients with epilepsy (M = 21.49, SD = 17.10) did however have an age of onset that was significantly younger than that of patients with PNES ((M = 28.37, SD = 12.67); t(3.6793), p = .0003), and as could be expected, PWEs (M = 2.12, SD = 0.88) differed significantly on number of AEDs prescribed from those with PNES ((M = 0.98, SD = 0.97); t(9.81), p = .0001) (Table 1).

Patients in both samples reported experiencing a variety of traumatic events, including sexual and physical trauma as well as a number of other types of traumatic events and adverse life experiences. Patients with PNES differed significantly from PWEs on histories of childhood sexual trauma (χ^2 (5df, N = 257) =9.787, p < .002) and "other" trauma (χ^2 (5df, N = 257) = 17.9076, p < .000). "Other" traumas included adult sexual assault, violence, bullying, abusive adult relationship, natural disaster/terrorism, incarceration, military trauma, severe health problem, witness abuse, death of close family member/parent, death of child, motor vehicle accident, abandonment by parent, homelessness, shunning by family. Childhood sexual abuse was significantly higher in females with diagnosed PNES than in females with epilepsy ((χ^2 2df, N-257) = 9.598, p < .002). No significant difference on physical abuse/trauma was found between the groups (χ^2 (5df, N = 257) = 3.4175, p < .064) (Table 2). Patients with PNES differed significantly from PWEs on diagnosis of depression (χ^2 (4df, N = 257) = 10. 1295, p < .001), anxiety (χ^2 (4df, N = 257) = 8.6275, p < .003), and PTSD (χ^2 (4df, N = 257) = 7.9892, p < .005). No significant differences were found between groups on substance abuse history (χ^2 (4df, N = 257) = 3.7792, p < .052) (Table 3).

On psychological measures, there was a significant difference on Somatization in patients with PNES (M = 59.63, SD = 11.47) and PWEs (M = 53.98, SD = 11.31); t(173) = 2.8396, p = .0051. Patients with PNES (M = 63.42, SD = 11.72) also showed a trend toward higher scores on a measure of demoralization compared with that of PWEs ((M = 60.34, SD = 11.30); t(1.7508), p = .082). Patients with PNES did not differ on a measure of Dissociation (M = 58.18, SD = 12.66) from PWEs (M = 58.11, SD = 14.44); t(0.0307), p = .9755, and did not differ on a measure of Intrusive Experiences (M = 59 = 8.95, SD = 12.62) from PWEs (M = 57.96, SD = 12.24); t(0.4625), p = .64. Similarly, those with PNES (M = 54.22, SD = 12.07) did not differ

Table 1
Demographic and clinical data of both groups: intractable partial epilepsy and PNES.

	Patients with epilepsy (35 men, 61 women) (mean & standard deviation)	Patients with PNES (54 men, 107 women) (mean & standard deviation)
Age	39.76 ± 11.99	35 ± 12.53
Education	13.6 ± 2.12	13.7 ± 0.71
Duration of illness (years)	18.39 ± 15.52*	7.1 ± 5.66*
Age onset	39.5 ± 24.75	35 ± 2.06
Seizure frequency (per day)	0.48 ± 0.78	0.58 ± 0.87
Number of antiepileptic drugs	2.12 ± 0.88*	0.98 ± 0.97*

Bold and italic values indicates statistically significance at p < .05.
* Significant.

Table 2
Rates of self-reported childhood sexual, physical, emotional abuse and other psychological traumas and life adversities in intractable partial epilepsy and PNES samples.

	Patients with epilepsy (n = 96)	Patients with PNES (n = 161)	Significance p < .05
Childhood sexual abuse	11 (11.5%)	49 (30.4%)	.002
Childhood physical abuse	11 (11.5%)	28 (17.4%)	ns
Other traumas	27 (28%)	89 (55%)	.000
Childhood emotional abuse	9 (9.4%)	29 (18.0%)	
Adult sexual assault	5 (5.2%)	6 (3.7%)	
Adult violence	3 (3.1%)	15 (9.3%)	
Bullying	3 (3.1%)	7 (4.3%)	
Abusive relationship	7 (7.3%)	6 (3.7%)	
Natural disaster	1 (1%)	1 (.6%)	
Terrorism	0	2(1.2%)	
Incarceration	1 (1%)	1 (.6%)	
Military trauma	1 (1%)	5 (3.1%)	
Severe health problem	1 (1%)	4 (2.5%)	
Witness abuse	3 (3.1%)	15 (9.3%)	
Death close family member/parent	2 (2.1%)	7 (4.3%)	
Death of child	1 (1%)	4 (2.5%)	
MVA	3 (3.1%)	7 (4.3%)	
Abandoned by parent	1 (1%)	5 (3.1%)	
Homelessness	0	3 (1.9%)	
Shunned by family	0	2 (1.2%)	

on a measure of Cynicism from those with epilepsy (M = 56.06, SD = 11.68); t(0.9974) p = .32 (Table 3).

Subsequently, the analysis focused on eight-target variables (physical abuse, sexual abuse, other trauma, depression, anxiety, Dissociation, Somatization, and MMPI 2RF-rd) in both groups of patients. The comparison was performed after adjusting for potential effects of gender, age, age of onset, education, seizure frequency, and number of AEDs. Statistical tests comparing the 8-target variables in aggregate terms were employed. The first step was to perform cluster analysis on the standardized target variables. Cluster analysis indicated that 1) physical abuse, sexual abuse, other trauma, depression, and anxiety formed one cluster ("group A") while 2) Dissociation, Somatization, and the MMPI 2RF-rd formed another cluster ("group B"). Reliability calculations were consistent with the cluster analysis. The agreement among the group A variables was acceptable (Cronbach's alpha = 0.525), and the agreement among the group B variables was stronger (Cronbach's alpha = 0.687).

Subsequently, the two groups of target variables were analyzed separately testing their relationship with Condition (epilepsy or PNES) via likelihood ratio tests. We estimated three logit models — model O: the response variable is Condition; the predictors are the 6 covariates (Gender, Age, Onset, Education, Seizure Frequency, and Number of AEDs); model A: the response variable is Condition; the predictors are

Table 3
Comparison of psychiatric comorbidities and psychometric scores in samples of patients with intractable epilepsy and patients with PNES.

	Patients with epilepsy (n = 96)	Patients with PNES (n = 161)
Depression	44 (45.8%)	105 (65.2%)
Anxiety	21 (21.9%)	65 (40.4%)
PTSD	15 (15.6%)	40 (24.8%)
Substance abuse	6 (6.3%)	18 (11.2%)
SOM	53.9	59.6
DIS	58.1	58.2
IE (Intrusive Experiences)	59.6	59.0
MMPI 2RF r3 (cynicism scale)	55.9	54.2
MMPI 2RF rd (demoralization scale)	60.3	63.4

PTSD: posttraumatic stress disorder; SOM: TSI-2 Somatization score; DIS: TSI-2 Dissociation; IE: TSI-2 Intrusive Experiences score, MMPI 2RF r3: Minnesota Multiphasic Personality Inventory 2RF Cynicism scale; MMPI 2RF rd: Minnesota Multiphasic Personality Inventory 2RF Demoralization scale.

group A (Physical Abuse, Sexual Abuse, Other Trauma, Depression, Anxiety) and the 6 covariates; model B: the response variable is Condition; the predictors are group B (Dissociation (DIS), Somatization (SOM), and MMPI-RFrd) and the 6 covariates.

Next, each group was compressed into just a few indexes, and the variability of those was tested between the PWEs and those with PNES. The compression was done via principal component analysis (PCA). An "optimal" linear model for the first principal component in each group was run. The candidate predictors were Condition and the 6 covariates. The "optimality" was achieved via the process of backward stepwise selection. The analysis started with the "full model" containing all the candidate predictors, and then the least significant predictors were dropped one by one until all the remaining predictors were statistically significant at the 5% significance level. The statistical significance of each term was determined using bootstrap based on 1000 independent bootstrap samples. This was done because the group A principal component was highly non-Gaussian and the objective was to have consistency between the analysis for group A and analysis for group B.

A principal components analysis revealed for group A (physical, sexual, other trauma, depression, anxiety) that the first 3 principal components explained 74.19% of variability in the standardized versions of the variables. The principal components analysis for group B (dissociations, somatization, demoralization) indicated one major principal component explained 61.57% of variability in the standardized versions of the variables.

When the existence of a relationship between Condition (epilepsy, PNES) and group A was checked after adjusting for potential effects of the covariates (gender, age, age of onset, education, seizure frequency, and number of AEDs), the test indicated that at least one target variable from group A had a different distribution between the PWEs and those with PNES ($\chi^2 = 27.93742$, df = 5, p < .05).

When the existence of a relationship between Condition (epilepsy, PNES) and group B (TSI II DIS, TSI II SOM, MMPI 2RF Demoralization) was checked after adjusting for potential effects of the covariates (gender, age, age of onset, education, seizure frequency, and number of AEDs), the test indicated that at least one target variable from group B had a different distribution between PWEs and those with PNES ($\chi^2 = 168.789$, 3, p-value $\ll$ .05). The "optimal" linear model did not have any predictors. In particular, the variable Condition was dropped in the last round, with the p-value of .273 > .05 = significance level. We concluded that there was no relationship between Condition and group B variables, as captured by their first principal component. Therefore, after adjusting for the effects of covariates, Condition (epilepsy or PNES) only had a relationship with the presence of trauma; patients with PNES experienced trauma more often than PWEs (Table 4).

5. Discussion

A relatively small number of studies with large, representative samples have examined the prevalence of psychological trauma/adverse childhood events in PWEs [21], and a number of those have reported mixed results. Although for the most part, higher numbers of psychological trauma have been reported in PNES as compared with that in PWEs, there have been important discrepancies in trauma types and in the frequency of PTSD diagnosis from study to study. Alper et al. [22] first reported finding significantly more incidents of CSA in patients with PNES compared with that in patients with complex partial epilepsy, especially noting a trend for incest among patients with PNES. Duncan et al. [23] found a history of sexual abuse in nearly 25% of patients with PNES, and either sexual abuse, physical abuse, or combined types of abuse in 32% of patients. However, subsequent studies have not directly replicated those findings. Fleisher et al. [24] reported that a PNES diagnosis correlated with PTSD and total number of lifetime traumas, adult traumas, and abuse traumas but not with CSA. Likewise, Dikel et al. [25] found no differences between women with PNES and women with epilepsy for histories of PTSD or CSA. They concluded that neither a positive history of CSA nor a history of PTSD was evidence against epilepsy. Arnold and Privitera [26] also found that although the experience of psychological trauma was an important factor in the development of psychogenic seizures, they did not find that sexual trauma alone was significantly associated with the development of PNES. Brown and Reubers' [27] comprehensive review of over 100 studies also could not reach firm conclusions about the relative prevalence of trauma exposure in PNES nor of the significance psychological trauma has in the development of PNES.

In the present study, we found significant differences in CSA between patients with PNES and those with intractable epilepsy. Twelve percent of PWEs reported CSA, and a total (combined pediatric and adult) of 16% reported sexual trauma, which is comparable to the US prevalence rate of CSA of 10.1% [28]. In contrast, up to 30% of patients with PNES reported CSA, and 34% reported sexual trauma (combined pediatric and adult). General US estimates indicate that 7.9% of males and 19.7% of females experience sexual abuse before the age of 18 years [29]. In our sample, nearly 12% of PWEs (all women) reported CSA, which is comparable to US estimates while the sample of patients with PNES had 7% of males and 30% females reporting CSA. These elevated numbers in females replicate a previous study that examined PNES risk factors in the two genders [30] and underscore that CSA appears to be significantly more prevalent in females with diagnosed PNES.

Estimates of childhood physical abuse (CPA) in the US fall at about 4–16% per year [31]. Twelve percent of our PWE sample reported CPA, and 17% of the sample of patients with PNES reported CPA. These

Table 4
Principal component analyses for Group A (physical, sexual, other trauma, depression, anxiety) and Group B (TSI II DIS, TSI II SOM, MMPI 2RF Demoralization).

Total variance explained						
Group A components	Initial Eigenvalues			Extraction sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	1.742	34.844	34.844	1.742	34.844	34.844
2	1.013	20.264	55.108	1.013	20.264	55.108
3	.954	19.083	74.191	.954	19.083	74.191
4	.682	13.639	87.830	.682	13.639	87.830
5	.608	12.170	100.000	.608	12.170	100.000
Group B components	Initial Eigenvalues			Extraction sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	1.847	61.569	61.569	1.847	61.569	61.569
2	.603	20.094	81.663	.603	20.094	81.663
3	.550	18.337	100.000	.550	18.337	100.000

Extraction method: principal component analysis.

rates did not differ markedly from the general population nor did they differ significantly between the two samples.

A notable finding is the amount of "other traumas" and adverse life events reported by both samples, with significantly elevated numbers in the sample of patients with PNES. Twenty-eight percent of PWEs reported experiencing "other trauma," which is consistent with some reports of PWEs experiencing extensive psychosocial adversities including domestic violence, abuse, and discrimination [7]. However, those with PNES appeared to have experienced a substantially higher number of adverse life events (55%) with many having experienced a multitude of these. Johnstone et al.'s [32] study examined 77 epilepsy (temporal lobe and other) cases compared with 47 cases with PNES and found a significantly higher prevalence of early life trauma among patients with PNES with 36% of patients with PNES and 15% of PWEs experiencing childhood trauma. Of note, they identified as the most marked difference between groups to be reports of emotional abuse and emotional neglect, although physical abuse, sexual abuse, and physical neglect were also significantly different. Our present study revealed that 48% of patients with PNES reported childhood sexual or physical abuse while 23% of PWEs reported these types of abuse, while childhood emotional abuse was comparably lower than CSA. Based on our present samples, although both PWEs and those living with PNES have experienced high numbers of adverse life events, those with PNES appear to have been especially exposed to harsh experiences that could act as risk factors for the subsequent development of functional seizures.

The present study also determined that patients with PNES compared with those with intractable epilepsy had higher rates of psychopathology (depression, anxiety, PTSD). Similar findings were reported in a recent study comparing axis I pathology in patients with PNES and patients with dual diagnoses of PNES and epilepsy [33]. Patients also earned higher somatization scores in the present study. High somatoform symptoms have been associated with traumatic exposure [34] as it is speculated that the neurobiological changes and increased physiological arousal that follows exposure to trauma can develop tendencies toward somatization. Moreover, it has been reported that patients who report somatic symptoms also tend to report higher overall PTSD symptoms and depression [35] than patients with PTSD who do not report such physical symptoms. In fact, somatization is thought to be related to other psychological consequences of trauma such as depression, anxiety, and PTSD. The present findings are consistent with another recent report [36] that found that somatization was associated with poor quality of life and that those with PNESs reported higher rates of somatization compared with PWEs.

Studies have found that trauma in general [37] and CSA in particular, correlate with dissociative tendencies [38]. Therefore, one might expect that those with PNES who have experienced higher rates of CSA and trauma in general would have significantly higher rates of dissociation as compared with those with epilepsy [39,40]. Unexpectedly, measures of dissociation in the present study did not reveal significant elevations in sample of patients with PNES compared with the sample of PWE. However, it is possible that no difference was detected because both groups' scores tended to be elevated (PNES mean T score 58.183, epilepsy mean T score 58.114), rather than because dissociation is low in PNES. Possibly, patients with intractable partial epilepsy exhibit a greater tendency toward dissociative phenomena than samples with epilepsy that respond to treatment or to a healthy population, as a result of the temporal lobe origin of the seizures. In fact, Litwin & Cardeña [41] found that a substantial number of ES (and PNES) in their study fulfilled dissociative disorder criteria, and proposed that this might suggest that while PNES could be considered dissociative in nature, epilepsy might also be associated with dissociative phenomena. Likewise, Reuber et al. [42] compared patients with PNES to those with epilepsy and determined that dissociation, somatization, and general psychopathology were significantly different in PNES compared to epilepsy, but later found that only the latter two discriminated between the two groups.

Moreover, they concluded that "although dissociation may be relevant in some individuals it does not appear to be an independent factor across the whole PNES patient group." Similarly, there was no significant difference between groups on a scale of Intrusive Experiences. Although one possible explanation is that patients with PNES are under-reporting, it should also be considered that PWEs may be experiencing high numbers of intrusive experiences as a result of epilepsy-related phenomena, which can be distressing and "invasive" (e.g., concerns about sudden and unexpected attacks, about seizure onset, about sudden unexpected death in epilepsy (SUDEP), about injuries, the reaction from others, etc.). Alternatively, it might also be a possibility that Intrusive Experiences are simply not that elevated in intractable partial epilepsy and PNES when these are undifferentiated samples, rather than samples of distinct subgroups (e.g., PNES or epilepsy with post-traumatic stress disorder).

A limitation of the present study is that participants in our sample are from a tertiary epilepsy program. Although the sample of PWEs may be representative of intractable epilepsy, the sample patients with PNES may not fully reflect other patients with PNES whose diagnoses are done in a community, nontertiary setting, whose PNES may have been diagnosed sooner, and/or who may present with less severe psychiatric histories. Another important limitation is the reliance on self-report of traumatic experiences and psychiatric history, which might result in the documentation of lower (and inaccurate) rates. Another concern might be the use of self-report psychometrics as there is a potential for recall bias and under or over-reporting of symptomatology, although the MMPI-2-RF and the TSI-2 include validity measures to control for this. Additionally, future studies with international study participants could provide significant contributions regarding differences in clinical histories and psychometric measures (dissociation, somatization, etc.) in patients with PNES who are from other cultures, races, and ethnicities.

In sum, a tendency to express unexplained somatic symptoms seemed to be present in patients with PNES (more so than dissociative tendencies). Additionally, patients with PNES presented with high rates of psychopathology (depression, anxiety, PTSD) compared with PWEs. However, having a history of psychological trauma/adversity proved to be the best predictor of a PNES diagnosis. Identifying this key risk factor in those diagnosed with PNES is important to the diagnostic process and for decision-making when choosing first line treatment approaches. With regard to the latter, significantly elevated rates of CSA, "other" traumas, and life adversities suggests that trauma-focused treatment should be considered as a potential treatment choice.

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