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Personality traits in psychogenic non-epileptic seizures (PNES) and psychogenic movement disorder (PMD): Neuroticism and perfectionism

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Abstract

Objective—Psychogenic movement disorder (PMD) and psychogenic non-epileptic seizures (PNES) are two subtypes of conversion disorder (CD). In this case-control study, we asked whether these subtypes varied as a function of personality and history of childhood abuse, using the NEO Personality Inventory Revised (NEO PI-R).

Methods—Fifty-nine patients with PMD from the Human Motor Control Section Clinic at the National Institutes of Health, 43 patients with PNES from the Rhode Island Hospital Neuropsychiatry and Behavioral Neurology Division, and 26 healthy volunteers (HC) received a battery of neurological, psychiatric and psychological assessments.

Results—One-way ANOVA between the three groups indicated significant differences in overall domains of Neuroticism ($p=0.001$) and Conscientiousness ($p=0.009$): Patients with PNES reported significantly greater levels of Neuroticism ($p=0.002$) and lower levels of Conscientiousness ($p=0.023$) than patients with PMD. Levels of Neuroticism remained significantly higher in both PMD and PNES than HC following correction for multiple comparisons. Patients with PNES reported greater levels of depressive and anxiety symptoms, overall psychopathology, greater history of sexual abuse, greater levels of alexithymia, higher levels of dissociative symptoms, and

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an earlier age at which they experienced their most distressing traumatic event than patients with PMD.

Conclusions—These findings suggest that personality traits, type of abuse and age of onset of trauma varies as a function of CD subtype. Patients with PNES rated greater Neuroticism and lower Conscientiousness than patients with PMD. These differing psychological profiles may inform differing treatment approaches such as psychological therapies for PNES and physiotherapy (with/without psychotherapy) for PMD.

Keywords

personality; psychogenic movement disorder; non-epileptic seizures; functional disorders; conversion disorder

INTRODUCTION

Conversion disorder (CD) refers to involuntary symptoms that are not due to a known medical disorder and are thought to be psychologically mediated.(1) Major subtypes of CD include psychogenic movement disorder (PMD) (now often referred to as functional movement disorder) and psychogenic nonepileptic seizures (PNES). PMD can present with any type of hyperkinetic or hypokinetic abnormal paroxysmal or continuous movements, including tremor, dystonia, myoclonus, and gait difficulty.(2) PNES also can have a range of presentations, including paroxysmal movements of the trunk and limbs that appear similar to tonic-clonic epileptic seizures or focal motor paroxysmal events.(3) Patients with PMD are more likely to have ongoing, disturbing movement symptoms affecting everyday tasks,(4) while patients with PNES have intermittent symptoms frequently accompanied by alteration of consciousness, often prompting medical intervention including attempted resuscitation.(5)

While the clinical semiology may differ in these two CD subtypes, they are both presumed to be mediated by similar psychological processes. Historically, the key risk factors for CD were considered to be childhood history of abuse, psychiatric comorbidities, and female gender.(6) Recently, a study by our group found greater childhood emotional abuse and physical neglect, higher levels of fear regarding traumatic experiences, and a larger number of traumatic events in patients with PMD compared to healthy controls and patients with dystonia.(7) Of note, self-reported history of physical or sexual abuse did not differ between patients with PMD, healthy controls and patients with dystonia. Our findings stress the importance of environmental factors in childhood as playing a key role in PMD. Our findings also indicate that psychological factors might be less important in the diagnosis of PMD than previously thought. It is not known what determines the manifestation of CD (PMD versus PNES); for example, are differences due to the patient samples or the instruments used?

Several studies have found similarities between patients with PMD and PNES, including elevated rates of depression, anxiety, abuse, fatigue, chronic pain, unemployment, and somatization. One major difference that was found between the groups is higher anxiety in PNES patients compared to PMD patients.(5, 8, 9) Given the limited findings of differences, the current literature offers few reasons that might help to explain the variation in

manifestations of CD. One study specifically evaluating the history of abuse and trauma found a higher prevalence of childhood sexual abuse as well as borderline personality disorder in patients with PNES, suggesting possible differences that might underlie different conversion presentations.(10)

One factor that may help to explain the difference in manifestations of CD is personality functioning. Previous evaluations of personality in motor CD used the Minnesota Multiphasic Personality Inventory Second Edition (MMPI-2), the Personality Assessment Inventory (PAI) or a psychiatric interview for personality disorders,(11) (12) which are categorical pathology-driven measurements. We, however, thought it would be informative to utilize a measure that examines dimensions of normal personality functioning, the NEO Personality Inventory Revised (NEO PI-R).(13) We compared patients with PMD and PNES to healthy volunteers on this dimensional personality instrument, along with measures of childhood abuse using the Childhood Trauma Questionnaire (CTQ) and the Traumatic Life Events Questionnaire (TLEQ) in a case-control study. Based on previous studies, our primary hypotheses were that patients with PNES would report higher levels of Neuroticism and childhood sexual abuse,(10) compared to patients with PMD.

METHODS

Subjects

Patients with PMD were recruited from the Human Motor Control Section of the Medical Neurology Branch at the National Institute of Neurological Disorders and Stroke (NINDS). Fifty-nine patients with PMD assessed at NINDS between 2005 and 2009 participated in the study. Patients with PMD were included if they had “clinically definite” PMD as diagnosed by at least two neurologists.(14) Forty-three patients with seizure monitoring unit video EEG-confirmed PNES who met inclusion criteria were recruited on a consecutive basis from the RIH Neuropsychiatry and Behavioral Neurology Clinic between 2008 and 2012. Criteria for the diagnosis of events consisted of stereotypic motor manifestations with or without change in level of consciousness.(15) Patients with non-motor seizures (e.g., sensory or dyscognitive only) were not included because of the potential for scalp-negative EEG that could be epileptic seizures in those cases. No patients with mixed epilepsy/PNES were included. Patients 18 years of age or older with PMD or PNES, no other serious neurological or medical illnesses, and that had an 8th grade reading level were included. Twenty-six healthy control volunteers (HCs) were recruited from the NIH healthy volunteer database. Healthy individuals were excluded if they reported a history of neurological disorders, traumatic brain injury or a current major psychiatric disorder. Participants who could not answer self-report questionnaires were excluded. Patients may or may not have received some treatment for their CD prior to enrollment and when completing surveys. All individuals in the study agreed to participate upon written consent approved by the Institutional Review Boards of the NIH and RIH.

Assessments

All subjects completed the NEO PI-R (personality assessment),(16) the Childhood Trauma Questionnaire (CTQ),(17) the Toronto Alexithymia Scale (TAS-20)(18) and the Traumatic

Life Events Questionnaire (19) (please see Supplementary Data for further details), the Beck Depression Inventory (BDI),(20) Beck Anxiety Inventory (BAI),(21) the Symptom Checklist-90-R (SCL-90R, psychopathology) (22), and the Dissociative Experiences Scale (DES).(23) Patients with PMD and PNES also underwent diagnostic assessment using the Structured Clinical Interview for DSM-IV Axis I (SCID-I) psychiatric disorders (24)(VV, WCL). Questionnaires were administered only after diagnosis of CD was established.

Sample size was based on other similar case-control studies.

Statistical Analysis

Normality of data was assessed using the Shapiro-Wilks test. Variables that were not normally distributed ($p < 0.05$) were $\log_{10}$ -transformed (which included NEO-PI-R facets and domains, age at first experience of most traumatizing event, SCL-90R, BDI, BAI, and CTQ subscales). One-way ANOVA was used for between-group comparisons. Post-hoc analyses were adjusted for multiple comparisons using Tukey. On an exploratory level, we investigated correlations between personality variables and other factors (age, gender, depression (BDI), childhood trauma (CTQ) or psychopathology (SCL-90R)). The SCL-90R total score was used as a measure of total symptoms independent of subscales, given that SCID was performed to establish specific diagnoses categorically. To assess if these factors could account for the differences observed, ANCOVAs were conducted with these measures as covariates of no interest for significant variables. Because covariate values did not overlap in range, all covariates were centered around their respective group mean. For post-hoc analyses following ANCOVAs, a Bonferroni correction for multiple comparisons (for the three groups) was used (p -value less than < 0.017). In the case of variables available for only PMD and PNES groups, independent samples t -tests were used. Categorical variables were analyzed with Fisher's exact test. Pearson correlation coefficients were calculated for NEO PI-R associations with psychosocial variables. Statistical Package for the Social Sciences (SPSS) version 20 was used for all statistical analyses.

RESULTS

Sample demographics are shown in Table Ia. The PMD sample was significantly older than the PNES group ($p = 0.040$). Gender proportion and education level did not differ significantly. In addition, occupation/work status was not significantly different between the PMD and the PNES samples ($\chi^2 = 9.853$, $p = 0.079$). There was no drop-out of subjects after determining eligibility and enrollment. Participants demonstrated good effort during SCID and on exam and no results were deemed invalid.

Diagnoses were obtained from the SCID. Anxiety disorders (any anxiety disorder, Generalized Anxiety Disorder [GAD], Panic Disorder [PD] and Post Traumatic Stress Disorder [PTSD]) were present for a greater proportion of patients with PNES compared to PMD, according to the SCID-I (76% versus 44% for any anxiety disorder, 50% versus 24% for GAD, 19% versus 3% for PD, and 24% versus 0% for PTSD). Mood disorders (any mood disorder, Major Depressive Disorder [MDD]) were present at similar rates in patients with PNES and PMD, according to the SCID-I ($p = 0.102$ for any mood disorder and $p = 0.614$ for MDD, table Ic).

All PMD (n=59), PNES (n=43), and HC (n=26) subjects completed the NEO PI-R, BDI, SCL-90R, DES and CTQ. The patients with PNES (n=43) and a subset of the patients with PMD (n=42) also completed the BAI and DES. (See Supplementary Data Tables.) Patients with PNES scored significantly higher than patients with PMD and HCs on the BDI, SCL-90R, CTQ sexual abuse, DES and TAS-20 ($p<0.001$).

In the assessment of personality, we focused on the five main domains of Neuroticism, Conscientiousness, Extraversion, Agreeableness, and Openness.(25) To further understand the role of these personality factors on an exploratory level, we assessed facets, if there were significant group differences in the main factors (see table II). Group differences were present in Neuroticism ($p=0.001$) and Conscientiousness ($p=0.009$), which remained significant following correction for multiple comparisons (see Figure 1). Compared to patients with PMD and HC, patients with PNES had greater levels of Neuroticism ($p=0.002$ and $p=0.006$, respectively) and lower levels of Conscientiousness ($p=0.02$ and $p=0.02$, respectively).

The following covariates were entered into the model: age, SCL-90 total score, CTQ total score, and BDI score. When each covariate was entered into the ANCOVA model, the group effect remained significant for Neuroticism ($F=6.710$, $p=0.002$) but not for Conscientiousness ($F=3.557$, $p=0.032$). Higher self-reported levels of depression, anxiety, anger-hostility and vulnerability facet scores appeared to account for the higher Neuroticism domain in patients with PNES, and lower self-reported levels of competence, self-discipline and deliberation facet scores appeared to account for the lower Conscientiousness domain scores. In contrast, patients with PMD had domain and facet scores that were largely in the normal range and mirrored HCs.

With regard to traumatic events, patients with PMD ($p=0.01$) and with PNES ($p=0.001$) self-reported higher emotional abuse scores on the CTQ than HCs. A score of 6.9 for CTQ emotional abuse for the healthy control group is consistent with national norms (Females, all ages $M=6.99$, $SD=3.68$)(26).

Patients with PNES also reported higher physical abuse and neglect scores on the CTQ ($p=0.042$, $p=0.007$) than HCs and higher sexual abuse scores on the CTQ compared to PMD patients and HCs ($p=0.019$ and $p<0.001$). The CTQ score for each subscale (emotional, physical, and sexual abuse) does not take into account the frequency or number of episodes the individual experienced. The most distressing traumatic event first occurred at a younger age in patients with PNES than in patients with PMD (18.2 years for PNES, 32.1 years for PMD, $p<0.001$). In addition, patients with PNES were younger than HCs at the time of most distressing traumatic event (29.2 years for HC, $p=0.003$). (See Supplementary Tables.)

With regard to alexithymia, patients with PNES reported greater levels of difficulty describing and expressing emotions on the TAS-20 when compared to patients with PMD and HCs ($p=0.0002$).

DISCUSSION

Similarities in the underlying pathophysiology of CD (both PNES and PMD) have been described;(27, 28) however, understanding differences in psychosocial variables may help with understanding why different semiologies develop and could help with optimizing individualized treatment. In this study, we found significant personality differences, abuse histories, and psychiatric symptoms between patients with PMD or PNES and healthy controls.

Previous literature comparing patients with PNES and PMD have described these patients as more similar than different, with the general phenotype being a female patient with complaints of fatigue, pain and a history of abuse. The semiology of the PMD and PNES groups, as has been demonstrated in previous studies, differ in that PNES patients may be more likely to present with paroxysmal symptoms and associated changes in levels of awareness.(5, 8) These acute emergent crises in many patients with PNES often result in emergency department visits or hospitalization.(29)

The higher levels of Neuroticism and lower levels of Conscientiousness in patients with PNES compared to patients with PMD help illustrate personality characteristics in these two groups. These traits may inform different challenges associated with their treatment. Personality traits have also been shown to play an important psychological predictor of physical health with a recent study demonstrating that higher Neuroticism prospectively predicts the risk of high blood pressure, stroke, lung disease and arthritis, and higher Conscientiousness ameliorates these risks(30).

The Neuroticism domain describes a persistent, life-long tendency to experience events negatively. Neuroticism has been found to be elevated in association with mood disorders(31) (as was found in our study, also), as well as poorer prognosis in depression(32). Neuroticism predicts poorer prognosis in systemic disease, such as recovery from coronary heart disease and risk of cardiac events.(33) Neuroticism is also associated with Medically Unexplained Symptoms (MUS), correlating with possible biological substrates.(34) Neuroticism may represent a “distress proneness”(34); the higher Neuroticism domain reported in the PNES sample suggests that patients with PNES may be more sensitive to stressful events than patients with PMD. Higher levels of Neuroticism in patients with PNES may be part of a phenotype of greater predisposition to psychological distress than what is experienced by patients with PMD, although our analysis shows that this difference is not explained by greater psychopathology alone, as the difference in Neuroticism remained significant after controlling for SCL-90R (level of psychopathology across all symptom categories). This phenotype in patients with PNES may also include an association between “distress proneness” and history of trauma, similar to the conceptualization of PTSD as a convergence of distress and temperament(35).

The Conscientiousness domain may reflect a monitor system in personality organization with low “Will to Achieve”(36) suggesting that these patients may have an apathetic attitude towards adverse situations and may be more likely to accept the status quo, thus limiting their coping ability. Other studies have shown difficulty coping with stress in patients with

PNES(37, 38). Correlation of a higher BDI score with higher Neuroticism and lower Conscientiousness further confirms this lack of coping ability. Conscientiousness is commonly associated with higher well-being and productivity, but can also predispose an individual to greater distress and difficulties with coping in specific circumstances. In a longitudinal study following 9570 individuals, higher Conscientiousness predicted a greater decrease in life satisfaction after unemployment. On the other hand, individuals with lower Conscientiousness appeared to acclimate to their unemployed status. (39) Additionally, Conscientiousness has been associated with self-oriented perfectionism (setting excessively high standards for oneself) as opposed to socially-oriented perfectionism (believing that acceptance by others is conditional upon meeting excessively high standards) which is associated with Neuroticism.(40) While socially-oriented perfectionism is more clearly maladaptive, self-oriented perfectionism appears to be more complex: one study linked poor functional status in women with fibromyalgia to either too much or too little self-oriented perfectionism.(41) The lesser degree of Conscientiousness among PNES, and possible underlying self-oriented perfectionism in PMD, may help explain why, in the context of specific life events, patients with less psychopathology than PNES patients might also develop debilitating psychogenic symptoms. The group difference in Conscientiousness did not remain significant after controlling for other factors. There was no interaction between these variables and Conscientiousness when entered into the model. The less pronounced difference in Conscientiousness between groups than the difference in Neuroticism may indicate that there are facets within Conscientiousness present in both groups.

Higher Neuroticism and lower Conscientiousness in patients with PNES may also reflect the influence of several psychosocial mediating factors that cannot be measured directly(42). The subjective symptomatology of seizure experiences and the personal representation of seizures are useful in the evaluation of these patients. Subjective symptomatology may be determined by psychological factors such as personality functioning, which may also aid in evaluation and treatment(43).

Patients with PMD in this cohort are characterized by normal ratings on personality measures, lower depressive and anxiety symptoms, and lower levels of abuse than patients with PNES, but higher levels than HCs. Our study thus confirms the prior findings of higher anxiety in patients with PNES(5, 8, 9). While the difference in depressive symptoms between patients with PMD and PNES is greater than what has been reported in other studies(5, 8, 9) the level of depressive symptoms in PMD patients is in keeping with prior findings from our group(7). Our use of the NEO-PI-R to assess normal personality functioning, as opposed to more pathological personality instruments such as the MMPI, may have identified personality differences among CD subtypes, that are not as pathologic as some CDs (e.g. PNES), but worse than HCs. We speculate that a possible “intermediary state” of psychopathology may be associated with different semiologic manifestations of psychogenic illness; this intermediary state of psychological distress might predispose an individual to persistent or intermittent motor symptoms manifesting as PMD, rather than to recurrent paroxysms of symptoms as seen in PNES. By intermediary state, we do not believe that PMD is any less debilitating. One difference between the two disorders is that PNES sometimes results in driving restrictions, which has a number of socio-economic consequences.(44)

Patients with PNES also had higher levels of physical and sexual abuse compared to healthy volunteers, and higher depression, anxiety, psychopathology and dissociative symptoms compared to patients with PMD. Abuse history was associated with various personality dimensions. A history of verbal abuse correlated with Neuroticism and inversely correlated with Extraversion, Openness to experience, and Agreeableness. A history of physical abuse inversely correlated with Openness to experience and Agreeableness. However, no correlation between sexual abuse and personality traits was present in this sample. Heightened Neuroticism, which indicates increased sensitivity and vulnerability to life stressors, would be expected as a consequence of abuse experiences. Abuse experiences may also lower the domains of Extraversion and Openness to experience, which could be reflective of a self-preservation type coping style. Lower levels of extraversion suggest that the patient might be more reserved while a lower level of openness to experience could indicate a narrower and protective attitude. These influences on personality traits may characterize an individual's coping tendencies in adverse situations. A history of abuse could trigger hostility and unresponsiveness to outreach, resulting in lower levels of Agreeableness. The current results do not show uniform trends across different types of abuse experiences.

The PNES cohort in our study was significantly younger than the PMD sample, which has been a consistent finding across comparison studies of these two groups.(5, 8, 10) The time of onset of most traumatic event occurred in late adolescence in patients with PNES and in the early 30s in the PMD sample, suggesting a possible impact on neurodevelopmental stage in patients with PNES. Patients with PMD reported the first occurrence of the most traumatic event of their life to be significantly later than those with PNES (32 versus 18 years old). Research on the effects of early childhood trauma has shown that critical periods of trauma sensitivity likely exist in the course of development. In one study, depression was more common among women exposed to trauma prior to adolescence compared to those exposed after age 13.(45) This finding is supported by models that show intense negative emotions in childhood as challenging to the maturation of emotional regulation,(46) as well as the finding that severe early life stress leads to greater sensitivity of the hypothalamic-pituitary-adrenal axis to adult stress and therefore greater vulnerability to depression.(47) The average age of greatest traumatic event in our PNES cohort was 18 years old, whereas myelination of prefrontal cortices and neurodevelopment persists into the early 20s,(48) and thus there may be differing sensitivity to trauma in the two patient groups.

Patients with PNES in this study exhibited higher dissociative symptoms as well as childhood abuse, supporting the general hypothesis that a change in level of awareness during PNES exists on a continuum with dissociation and is therefore more likely in patients who were abused as children.(49). The experience of abuse in early childhood predisposes one to feeling that one has no control over one's decisions, direction or circumstances, which correlates with less energetic effort to take charge of one's life. Greater levels of childhood abuse have been reported in previous studies comparing PNES to PMD, although with the caveat that recall bias appeared to affect the PMD sample to a greater degree than the PNES sample.(8) Higher levels of sexual abuse are reported by females than males.(50) Gender differences on the personality domains of Neuroticism and Conscientiousness within our patient groups were not present in this study. The abuse reporting finding carries real-

world significance; patients with PMD and PNES are typically treated by different neurologist subspecialists, so they may be interviewed differently. Our findings confirm that both PMD and PNES patients show higher rates of some forms of abuse compared to HCs, but sexual abuse in particular may help explain the difference between these two psychogenic symptoms.

The PNES cohort in our study had a greater number of diagnoses of anxiety disorders in comparison to the PMD cohort. Both cohorts in our study had similar diagnostic rates of any mood disorder, as well as MDD. The anxious and neurotic traits found in PNES may help distinguish PNES and PMD. Comorbidities are well documented in patients with CD, and the presence of various psychiatric diagnoses and pathologic personality characteristics illustrates that there is no single unifying style in CD. These findings suggest that personality, type of abuse and age of onset of trauma varies as a function of CD subtype. Lower Conscientiousness scores may represent a learned helplessness that is not an uncommon outgrowth of early traumatic experiences and PTSD. Likewise, Neuroticism factors (anxiety, angry hostility, depression, self-consciousness, vulnerability) could be associated with the trauma/PTSD factors reported by the patients.

The patients with PNES in our study exhibited higher levels of alexithymia than patients with PMD (see Supplemental Table). Kaplan et al. (2013) (51) note that a score of at least 61 indicates high levels of alexithymia, while a score of 51 or below indicates low levels of alexithymia. In our study, mean scores for PNES (mean = 56.6) were in the moderate range, which were significantly different from patients with PMD who reported low scores (mean 43.1; $p=0.0002$). These differences in our study are consistent with Kaplan et al. (2013) (51) who also found that for every one-point rise in total TAS-20 score, the odds ratio for being affected by PNES was augmented by 1.028, with patients with PNES having higher levels of alexithymia than those with PMD (see Supplementary Table S1). Brown et al. (2013) (52) identified two different groups of patients with PNES: one of these groups had trouble describing and expressing their emotions, while the other group did not have difficulty with alexithymia. Demartini et al. (2014) (53) found that 34.5% of patients with functional motor symptoms (FMS) had alexithymia in their study comparing patients with neurological movement disorders. The authors also found that there was a robust positive relationship between obsessive-compulsive personality disorder (OCPD) and alexithymia, with 71.4% of patients diagnosed with OCPD reporting alexithymia. These findings are consistent with our study, where we found that the PMD group had significantly greater levels of conscientiousness including domain facets of competence, dutifulness, self-discipline, and deliberation, than patients with PNES. Conscientiousness is the personality trait most closely tied to OCPD.

Limitations of this study include that patients were collected from two different centers. This sampling difference, however, was minimized by careful planning and coordination between the two sites, the use of the same protocol, and both sites' familiarity and expertise with these populations, serving as tertiary referral centers for patients with psychogenic symptoms. Secondly, being a cross-sectional study, we are unable to differentiate between state and trait effects; however, personality traits such as Neuroticism have been shown to be stable over the lifespan.(54) Another limitation was the small sample size with the number

of tests conducted. To mitigate the possibility that a certain number of tests might be significant just by chance (false discovery rate), corrections for multiple tests were used. In addition, it should be noted that analyses conducted at the personality facet-level were intended to be of an exploratory nature; therefore, these results should be interpreted with caution. Other studies have examined personality characteristics and PNES semiology.(55, 56) While semiology is useful for distinguishing epileptic from nonepileptic seizures and neurogenic from psychogenic movement disorders, studies examining semiology and prognosis/treatment outcomes have not shown a consistent relationship,(57) so the focus of our analyses in this study was not on PNES or PMD semiology. Future studies could assess if a relationship exists. Finally, this study used the NEO PI-R intentionally to assess dimensional characteristics of personality functioning rather than categorical personality disorders, acknowledging that other personality assessments and measures exist. Earlier studies on patients with PNES utilized the MMPI, which was designed not only to measure personality characteristics, but to also assess psychopathological conditions such as anxiety, conversion disorder, depression and schizophrenia. Studies examining personality characteristics in patients with PNES and epilepsy conducted multivariate assessments of variables that often rendered the MMPI less useful in establishing correlations between normal personality traits and other clinical variables associated with PNES. The MMPI kept the focus on psychopathological aspects of patients with PNES. (58, 59) A dimensional personality assessment approach allows characterization of characterological/personality issues along a continuum of symptoms rather than a dichotomous categorical diagnostic perspective.

In conclusion, the observed relationships between psychiatric comorbidities, history of abuse, and normal personality traits in patients with PNES and PMD suggest that psychosocial risks, comorbid disorders, and personality traits could play an important role in etiology and presentation of CD. This multi-center study helps to further characterize these two patient populations, highlighting important differences that could be targeted during psychological therapy -- addressing not only Axis I disorders but also underlying personality factors. The differing psychological profiles may inform differing treatment approaches, such as psychological therapies for PNES (60, 61) and physiotherapy (with or without psychotherapy) for PMD.(62, 63) Greater levels of Neuroticism in patients with PNES and lower levels of Conscientiousness than in those with PMD, more anxiety disorders in PNES, along with differences in the type of trauma and timing in relation to critical developmental periods, may provide insight into why the physical manifestations of their illnesses are different. Taken together with the finding that patients with PMD are significantly older at the time of most traumatic event, the data show the interplay of predisposition and life events that may lead to the development of psychogenic illness.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

References

1. American Psychiatric Association., American Psychiatric Association. Task Force on DSM-IV. Diagnostic and statistical manual of mental disorders: DSM-IV-TR. 4. Washington, DC: American Psychiatric Association; 2000.
2. Hallett M. Physiology of psychogenic movement disorders. *J Clin Neurosci*. 2010; 17(8):959–65. [PubMed: 20493708]
3. Reuber M. The etiology of psychogenic non-epileptic seizures: toward a biopsychosocial model. *Neurol Clin*. 2009; 27(4):909–24. [PubMed: 19853215]
4. Ganos C, Aguirregomez M, Batla A, Stamelou M, Schwingenschuh P, Munchau A, et al. Psychogenic paroxysmal movement disorders--clinical features and diagnostic clues. *Parkinsonism Relat Disord*. 2014; 20(1):41–6. [PubMed: 24090947]
5. Hopp JL, Anderson KE, Krumholz A, Gruber-Baldini AL, Shulman LM. Psychogenic seizures and psychogenic movement disorders: are they the same patients? *Epilepsy Behav*. 2012; 25(4):666–9. [PubMed: 23168090]
6. Thomas M, Jankovic J. Psychogenic movement disorders: diagnosis and management. *CNS Drugs*. 2004; 18(7):437–52. [PubMed: 15139799]
7. Kranick S, Ekanayake V, Martinez V, Ameli R, Hallett M, Voon V. Psychopathology and psychogenic movement disorders. *Mov Disord*. 2011; 26(10):1844–50. [PubMed: 21714007]
8. Driver-Dunckley E, Stonnington CM, Locke DE, Noe K. Comparison of psychogenic movement disorders and psychogenic nonepileptic seizures: is phenotype clinically important? *Psychosomatics*. 2011; 52(4):337–45. [PubMed: 21777716]
9. Grimaldi I, Dubuc M, Kahane P, Bougerol T, Vercueil L. Anxiety and depression in psychogenic movement disorder and non-epileptic seizures: a prospective comparative study. *Rev Neurol (Paris)*. 2010; 166(5):515–22. [PubMed: 20056263]
10. Stone J, Sharpe M, Binzer M. Motor conversion symptoms and pseudoseizures: a comparison of clinical characteristics. *Psychosomatics*. 2004; 45(6):492–499. [PubMed: 15546826]
11. Butcher, J., Graham, J., Ben-Porath, Y., Tellegen, A., Kaemmer, B. MMPI-2: Minnesota Multiphasic Personality Inventory-2: Manual for administration, scoring, and interpretation. Minneapolis: University of Minnesota Press; 2001.
12. Morey, L. The Personality Assessment Inventory professional manual. Odessa, FL: Psychological Assessment Resources; 1991.
13. Costa, P., McCrae, R., editors. The NEO Personality Inventory Manual. Odessa, FL: Psychological Assessment Resources; 1985.
14. Williams DT, Ford B, Fahn S. Phenomenology and psychopathology related to psychogenic movement disorders. *Adv Neurol*. 1995; 65:231–57. [PubMed: 7872143]
15. Van Donselaar CA, Geerts AT, Meulstee J, Habbema JD, Staal A. Reliability of the diagnosis of a first seizure. *Neurology*. 1989; 39:267–271. [PubMed: 2915800]
16. Costa, PT., McCrae, RR. NEO-PI-R professional manual. Odessa, FL: Psychological Assessment Resources, Inc; 1992.
17. Bernstein DP, Fink L, Handelsman L, Foote J, Lovejoy M, Wenzel K, et al. Initial reliability and validity of a new retrospective measure of child abuse and neglect. *Am J Psychiatry*. 1994; 151(8): 1132–6. [PubMed: 8037246]
18. Taylor GJ, Bagby RM, Parker JD. The Revised Toronto Alexithymia Scale: some reliability, validity, and normative data. *Psychother Psychosom*. 1992; 57(1–2):34–41. [PubMed: 1584897]
19. Kubany, ES. The Traumatic Life Events Questionnaire (TLEQ). Los Angeles, CA: Western Psychological Services; 2004.
20. Beck, AT. Beck Depression Inventory: Harcourt. 1996.
21. Beck AT, Epstein N, Brown G, Steer RA. An inventory for measuring clinical anxiety: psychometric properties. *J Consult Clin Psychol*. 1988; 56(6):893–7. [PubMed: 3204199]
22. Derogatis LR, Lipman RS, Covi L. SCL-90: an outpatient psychiatric rating scale--preliminary report. *Psychopharmacol Bull*. 1973; 9(1):13–28. [PubMed: 4682398]

23. Carlson EB, Putnam FW, Ross CA, Torem M, Coons P, Dill DL, et al. Validity of the Dissociative Experiences Scale in screening for multiple personality disorder: a multicenter study. *Am J Psychiatry*. 1993; 150(7):1030–6. [PubMed: 8317572]
24. First, MB., Spitzer, RL., Gibbon, M., Williams, JBW. Structured Clinical Interview for DSM-IV-TR Axis I Disorders Research Version, (SCID-I). New York: Biometrics Research Department, New York State Psychiatric Institute; 2002.
25. Costa PT, McCrae RR. Personality Disorders and the Five-Factor Model of Personality. *Journal of Personality Disorders*. 1990; 4(4):362–371.
26. Scher CD, Stein MB, Asmundson GJ, McCreary DR, Forde DR. The childhood trauma questionnaire in a community sample: psychometric properties and normative data. *J Trauma Stress*. 2001; 14(4):843–57. [PubMed: 11776429]
27. van der Kruijs SJ, Bodde NM, Vaessen MJ, Lazon RH, Vonck K, Boon P, et al. Functional connectivity of dissociation in patients with psychogenic non-epileptic seizures. *J Neurol Neurosurg Psychiatry*. 2012; 83(3):239–47. [PubMed: 22056967]
28. Voon V, Brezing C, Gallea C, Ameli R, Roelofs K, LaFrance WC Jr, et al. Emotional stimuli and motor conversion disorder. *Brain*. 2010; 133(Pt 5):1526–36. [PubMed: 20371508]
29. Holtkamp M, Othman J, Buchheim K, Meierkord H. Diagnosis of psychogenic nonepileptic status epilepticus in the emergency setting. *Neurology*. 2006; 66(11):1727–9. [PubMed: 16769948]
30. Weston SJ, Hill PL, Jackson JJ. Personality traits predict the onset of disease. *Social Psychological and Personality Science*. 2014 (in press).
31. Jylha P, Melartin T, Isometsa E. Relationships of neuroticism and extraversion with axis I and II comorbidity among patients with DSM-IV major depressive disorder. *J Affect Disord*. 2009; 114(1–3):110–21. [PubMed: 18687471]
32. Surtees PG, Wainwright NW. Fragile states of mind: neuroticism, vulnerability and the long-term outcome of depression. *Br J Psychiatry*. 1996; 169(3):338–47. [PubMed: 8879721]
33. Denollet J, Van Heck GL. Psychological risk factors in heart disease: what Type D personality is (not) about. *J Psychosom Res*. 2001; 51(3):465–8. [PubMed: 11602215]
34. Deary V, Chalder T, Sharpe M. The cognitive behavioural model of medically unexplained symptoms: a theoretical and empirical review. *Clin Psychol Rev*. 2007; 27(7):781–97. [PubMed: 17822818]
35. Sellbom M, Lee TT, Ben-Porath YS, Arbisi PA, Gervais RO. Differentiating PTSD symptomatology with the MMPI-2-RF (Restructured Form) in a forensic disability sample. *Psychiatry Res*. 2012; 197(1–2):172–9. [PubMed: 22424904]
36. Digman JM, Takemoto-Chock NM. Factors in the Natural Language of Personality: Re-Analysis, Comparison, and Interpretation of Six Major Studies. *Multivariate Behavioral Research*. 1981; 16(2):149–170. [PubMed: 26825420]
37. Testa SM, Krauss GL, Lesser RP, Brandt J. Stressful life event appraisal and coping in patients with psychogenic seizures and those with epilepsy. *Seizure*. 2012; 21(4):282–7. [PubMed: 22425423]
38. Myers L, Fleming M, Lancman M, Perrine K, Lancman M. Stress coping strategies in patients with psychogenic non-epileptic seizures and how they relate to trauma symptoms, alexithymia, anger and mood. *Seizure*. 2013; 22(8):634–9. [PubMed: 23689067]
39. Boyce CJ, Wood AM, Brown GD. The dark side of conscientiousness: Conscientious people experience greater drops in life satisfaction following unemployment. *Journal of Research in Personality*. 2010; 44(4):535–539.
40. Stoeber J, Otto K, Dalbert C. Perfectionism and the Big Five: Conscientiousness predicts longitudinal increases in self-oriented perfectionism. *Personality and Individual Differences*. 2009; 47(4):363–368.
41. Molnar DS, Flett GL, Sadava SW, Colautti J. Perfectionism and health functioning in women with fibromyalgia. *J Psychosom Res*. 2012; 73(4):295–300. [PubMed: 22980536]
42. Verrotti A, Agostinelli S, Mohn A, Manco R, Coppola G, Franzoni E, et al. Clinical features of psychogenic non-epileptic seizures in prepubertal and pubertal patients with idiopathic epilepsy. *Neurol Sci*. 2009; 30(4):319–23. [PubMed: 19533284]

43. Plug L, Sharrack B, Reuber M. Seizure metaphors differ in patients' accounts of epileptic and psychogenic nonepileptic seizures. *Epilepsia*. 2009; 50(5):994–1000. [PubMed: 19178564]
44. LaFrance WC Jr, Benbadis SR. Avoiding the costs of unrecognized psychological nonepileptic seizures. *Neurology*. 2006; 66(11):1620–1. [PubMed: 16769930]
45. Maercker A, Michael T, Fehm L, Becker ES, Margraf J. Age of traumatization as a predictor of post-traumatic stress disorder or major depression in young women. *Br J Psychiatry*. 2004; 184:482–7. [PubMed: 15172941]
46. Pynoos RS, Steinberg AM, Piacentini JC. A developmental psychopathology model of childhood traumatic stress and intersection with anxiety disorders. *Biol Psychiatry*. 1999; 46(11):1542–54. [PubMed: 10599482]
47. Heim C, Nemeroff CB. The role of childhood trauma in the neurobiology of mood and anxiety disorders: preclinical and clinical studies. *Biol Psychiatry*. 2001; 49(12):1023–39. [PubMed: 11430844]
48. Gur RC, Gunning-Dixon FM, Turetsky BI, Bilker WB, Gur RE. Brain region and sex differences in age association with brain volume: a quantitative MRI study of healthy young adults. *Am J Geriatr Psychiatry*. 2002; 10(1):72–80. [PubMed: 11790637]
49. Bowman ES, Markand ON. Psychodynamics and psychiatric diagnoses of pseudoseizure subjects. *Am J Psychiatry*. 1996; 153(1):57–63. [PubMed: 8540592]
50. Briere J, Elliott DM. Prevalence and psychological sequelae of self-reported childhood physical and sexual abuse in a general population sample of men and women. *Child Abuse Negl*. 2003; 27(10):1205–22. [PubMed: 14602100]
51. Kaplan MJ, Dwivedi AK, Privitera MD, Isaacs K, Hughes C, Bowman M. Comparisons of childhood trauma, alexithymia, and defensive styles in patients with psychogenic non-epileptic seizures vs. epilepsy: Implications for the etiology of conversion disorder. *J Psychosom Res*. 2013; 75(2):142–6. [PubMed: 23915770]
52. Brown RJ, Bouska JF, Frow A, Kirkby A, Baker GA, Kemp S, et al. Emotional dysregulation, alexithymia, and attachment in psychogenic nonepileptic seizures. *Epilepsy Behav*. 2013; 29(1):178–83. [PubMed: 23973643]
53. Demartini B, Petrochilos P, Ricciardi L, Price G, Edwards MJ, Joyce E. The role of alexithymia in the development of functional motor symptoms (conversion disorder). *J Neurol Neurosurg Psychiatry*. 2014; 85(10):1132–7. [PubMed: 24610939]
54. McCrae RR, Costa PT Jr, Ostendorf F, Angleitner A, Hrebickova M, Avia MD, et al. Nature over nurture: temperament, personality, and life span development. *J Pers Soc Psychol*. 2000; 78(1):173–86. [PubMed: 10653513]
55. Griffith NM, Smith KM, Schefft BK, Szaflarski JP, Privitera MD. Optimism, pessimism, and neuropsychological performance across semiology-based subtypes of psychogenic nonepileptic seizures. *Epilepsy Behav*. 2008; 13(3):478–84. [PubMed: 18602027]
56. Griffith NM, Szaflarski JP, Schefft BK, Isaradisaikul D, Meckler JM, McNally KA, et al. Relationship between semiology of psychogenic nonepileptic seizures and Minnesota Multiphasic Personality Inventory profile. *Epilepsy Behav*. 2007; 11(1):105–111. [PubMed: 17602880]
57. LaFrance WC Jr, Plioplys S. Neuropsychiatric disorders: Does semiology of psychogenic nonepileptic seizures matter? *Nat Rev Neurol*. 2012; 8(6):302–3. [PubMed: 22546703]
58. Cragar DE, Berry DT, Schmitt FA, Fakhoury TA. Cluster analysis of normal personality traits in patients with psychogenic nonepileptic seizures. *Epilepsy Behav*. 2005; 6(4):593–600. [PubMed: 15907754]
59. Vanderzant CW, Giordani B, Berent S, Dreifuss FE, Sackellares JC. Personality of patients with pseudoseizures. *Neurology*. 1986; 36(5):664–8. [PubMed: 3703265]
60. LaFrance WC Jr, Baird GL, Barry JJ, Blum AS, Frank Webb A, Keitner GI, et al. Multicenter pilot treatment trial for psychogenic nonepileptic seizures: a randomized clinical trial. *JAMA Psychiatry*. 2014; 71(9):997–1005. [PubMed: 24989152]
61. Reiter, JM., Andrews, D., Reiter, C., LaFrance, WC, Jr. Taking Control of Your Seizures: Workbook. New York: Oxford University Press; 2015.

62. Czarnecki K, Thompson JM, Seime R, Geda YE, Duffy JR, Ahlskog JE. Functional movement disorders: successful treatment with a physical therapy rehabilitation protocol. *Parkinsonism Relat Disord.* 2012; 18(3):247–51. [PubMed: 22113131]
63. Dallochio C, Tinazzi M, Bombieri F, Arno N, Erro R. Cognitive Behavioural Therapy and Adjunctive Physical Activity for Functional Movement Disorders (Conversion Disorder): A Pilot, Single-Blinded, Randomized Study. *Psychother Psychosom.* 2016; 85(6):381–383. [PubMed: 27744440]

Highlights

- Neuroticism and Conscientiousness appear to vary by conversion disorder subtype.
- PNES patients reported an earlier age of onset of trauma than PMD patients.
- PNES patients reported a greater history of sexual abuse than PMD patients.

Figure 1. Neuroticism facets (n1–6) and Conscientiousness facets (c1–6) in patients with PMD and PNES and healthy controls (HC)

PMD, psychogenic movement disorder; PNES, psychogenic nonepileptic seizures; HC, healthy controls; *, significant difference, PNES vs PMD (and HC), $p < 0.02$

Table 1a

Demographic characteristics of patients with PMD, patients with PNES, and healthy controls.

	PMD (n=59) Mean [SD]	PNES (n=43) Mean [SD]	Healthy Controls (n=26) Mean [SD]	Test statistic and p-value
Age (years)	46.7 [12.7]	40.5 [11.6]	45.9 [13.5]	F = 3.293 p = 0.040
Gender (% Female)	73.0	86.0	65.0	$\chi^2 = 4.270$ p = 0.118
Education level (majority of group)	college degree	some college	college degree	$\chi^2 = 11.257$ p = 0.188
Marital Status (majority of group)	married	married	married	$\chi^2 = 9.693$ p = 0.468
Ethnicity (% Caucasian)	93.9%	95.3%		$\chi^2 = 0.900$ p = 0.638
On psychotropic medication (% yes)	63.3%	86.0%	n.a	$\chi^2 = 6.164$ p = 0.013
Handedness (% right-handed)	89.6%	78.6%		$\chi^2 = 2.840$ p = 0.242

Abbreviations: PMD, psychogenic movement disorder; PNES, psychogenic non-epileptic seizures, SD, standard deviation.

Table 1b

Occupation/work status of patients with PMD and patients with PNES

Occupation/Work Status	PMD = 47 N (%)	PNES = 43 N (%)
Unemployed/Retired	11 (23.4)	14 (32.6)
Full Time	14 (29.8)	8 (18.6)
Part-Time	5 (10.6)	0 (0)
Student	4 (8.5)	6 (14)
Disability	11 (23.4)	15 (34.9)
Homemaker	2 (4.3)	0 (0)

Abbreviations and Key: PMD, psychogenic movement disorder; PNES, psychogenic non-epileptic seizures. (Chi-Square test was not significant, $p=0.079$)

Table 1c

SCID diagnoses of patients with PMD and PNES

SCID Diagnosis	PMD (N=59) N (%) of PMD patients with diagnoses	PNES (N=42) N (%) of PNES patients with diagnoses	Chi-Square statistic and p-value for comparison of diagnostic frequencies
Any Mood Disorder ⁺	24 (40.68)	24 (57.14)	2.67, p = 0.10
Major Depressive Disorder (MDD)	24 (40.68)	15 (35.71)	.255, p = 0.61
Any Anxiety Disorder [#]	26 (44.07)	32 (76.19)	9.08, p = 0.0026
Generalized Anxiety Disorder (GAD)	14 (23.73)	21 (50.00)	6.36, p = 0.01
Posttraumatic Stress Disorder (PTSD)	0 (0)	10 (23.81)	13.037, p = 0.0003
Panic Disorder	2 (3.39)	8 (19.05)	6.74, p = 0.009
Phobia	10 (16.95)	9 (21.43)	0.096, p = 0.76

Abbreviations and Key: SCID, structured clinical interview for DSM-IV Axis I psychiatric disorders; PMD, psychogenic movement disorder; PNES, psychogenic non-epileptic seizures.

⁺ other mood disorders included Mood Disorders, not otherwise specified and dysthymic disorder;

[#] subjects could have more than one anxiety disorder.

Table II

Personality characteristics of patients with PMD, PNES, and healthy controls

NEO-PI-R Domain/facet	PMD (N=59) Mean T score (SD)	PNES (N=43) Mean T score (SD)	Healthy controls (N=26) Mean T score (SD)	F value	Significance
Neuroticism					
N1: anxiety	51.1 [*] (13.7)	60.0 ⁺ (12.2)	49.7 (10.7)	7.9	p = 0.001
N2: angry hostility	51.2 (13.8)	58.8 ^{*,+} (11.2)	49.3 (10.9)	6.4	p = 0.002
N3: depression	49.2 (10.9)	57.1 [*] (11.2)	52.9 (11.0)	6.3	p = 0.002
N4: self-consciousness	53.1 ⁺ (13.4)	62.1 [*] (13.7)	49.3 (10.9)	9.6	p < 0.001
N5: impulsiveness	48.5 (12.3)	55.5 [*] (12.9)	49.2 (10.0)	4.6	p = 0.015
N6: vulnerability	48.6 (10.8)	52.6 (10.7)	50.9 (10.3)	1.7	p = 0.180
Conscientiousness					
C1: competence	52.4 (14.7)	58.1 ⁺ (12.1)	47.4 (10.8)	5.7	p = 0.004
C2: order	50.4 (10.4)	44.6 ⁺ (11.3)	51.7 (10.4)	4.9	p = 0.009
C3: dutifulness	52.2 [*] (12.6)	44.3 ⁺ (10.7)	52.8 (11.4)	6.7	p = 0.002
C4: achievement striving	47.5 (9.8)	47.7 (12.9)	48.2 (9.7)	0.032	p = 0.969
C5: self-discipline	52.0 (9.8)	47.3 (10.1)	52.4 (10.8)	3.3	p = 0.041
C6: deliberation	50.6 (10.8)	48.8 (11.7)	51.2 (13.0)	0.44	p = 0.645
Extraversion					
E1: warmth	45.7 (11.6)	41.1 (12.4)	48.3 (11.3)	3.5	p = 0.033
E2: gregariousness	54.0 [*] (9.1)	45.6 ⁺ (12.6)	55.2 (11.6)	9.3	p < 0.001
E3: assertiveness	49.6 (12.3)	47.4 (10.6)	50.1 (12.4)	0.56	p = 0.575
Openness (to experience)					
O1: imagination	52.0 (11.5)	49.6 (11.3)	51.9 (11.7)	0.63	p = 0.536
Agreeableness					
A1: trust	54.9 (10.7)	50.4 (10.8)	48.8 (9.0)	4.1	p = 0.086

Domain T-scores reported for Neuroticism and Conscientiousness followed by facet scores for these two domains.

Abbreviations: PMD, psychogenic movement disorder; PNES, psychogenic non-epileptic seizures; NEO-PI-R, NEO Personality Inventory-Revised; SD, Standard Deviation.

^{*} significant difference, PNES vs PMD, p<0.02;

⁺ significant difference, PNES vs HC or PMD vs HC, p<0.02