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Nonepileptic seizures in individuals attending neurological services in New Zealand

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ABSTRACT

Objectives: This study examined the demographic, social, and clinical (neurological and psychiatric) characteristics of people with psychogenic nonepileptic seizures (PNES) presenting to tertiary neurological services at Auckland District Health Board, New Zealand.
Methods: Electronic notes and video-electroencephalography (video-EEG) data gathered from the telemetry unit based on synchronized acquisition (motor activity and brain electrophysiology) over a five-year period (2011 to 2015 inclusive) were retrospectively examined. Two groups were compared: people with PNES only or people with combined PNES and epileptic seizures (ES) (the group with PNES) and a control group with ES only, matched 1:1 by age and gender.
Results: Sixty-six people in the group with PNES were matched with an equivalent number of ES controls. As a cohort, there was high psychiatric and medical comorbidity in both groups, but overall, those with PNES experienced higher rates than their ES counterparts. An older age of onset, female gender, and history of abuse were more frequently seen in those with PNES. Compared with controls, people with PNES more commonly had daily seizures (rather than monthly) but presented less frequently to neurology services. A high proportion of people with PNES experienced historical traumas, ongoing stressors, and disability. Almost half of the people with PNES were on antiepileptic drugs (AEDs) and received limited psychiatric or psychological input. In contrast, people with ES were more likely to be on psychotropic medication.
Conclusion: Both PNES and ES are associated with high levels of psychiatric and medical comorbidity. Additionally, PNES were found to be associated with iatrogenic harm and disability. Though people with PNES and ES often have a range of associated needs, there is, however, limited access to appropriate services. The needs of these populations should be better met through enhanced integration across psychiatry, neurology, and multidisciplinary services.

1. Introduction

Psychogenic nonepileptic seizures (PNES) manifest with paroxysmal changes in behavior that superficially resemble epileptic seizures (ES) but without evidence of abnormal neuronal activity [1]. Analysis by video-electroencephalography (video-EEG) is the gold standard [2] and reveals changes in consciousness, sensorimotor activity, and behaviors in the absence of abnormal electrical discharges. While theories regarding the causal mechanisms of PNES are diverse [3,4], a number of associations have been proposed (e.g., history of abuse and neglect as well as psychiatric comorbidities) [4,5]. Given that suggested associations are neither sufficient nor necessary to account for PNES, impaired integration of identity, attention, memory, emotion, and sensory processing has been suggested as a common underlying mechanism [3].

While the estimated incidence of PNES in the general population is low, at around 1.5/100,000 [6], approximately 40–50% of those referred to tertiary epilepsy centers are diagnosed with PNES [7]. As with other medically unexplained physical symptoms (MUPS) [8], PNES have a significant impact on rates of disability and psychopathology and are associated with reduced psychological functioning, lower life satisfaction, and health-related quality of life, compared with those without PNES [9,10]. As PNES lie at the interface between neurology and psychiatry, care is often fragmented and are associated with repeated investigations and unnecessary treatments [7,11,12]. The direct costs to the healthcare system are high, costing an estimated USD$100 to $900 million per year in the United States [13]. Therefore, diagnosing and managing PNES early is important to avoid iatrogenic harm, such as the

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potentially adverse effects of antiepileptic drugs (AEDs) [11] and optimize healthcare utilization and outcomes.

Internationally, the social and clinical characteristics of people with PNES or PNES comorbid with ES have been found to be heterogeneous and with possible cultural differences [14–19]. As no prior work has been undertaken in New Zealand, the aim of the present study was to describe the demographic, social, and clinical characteristics of patients with video-EEG documented PNES presenting to a tertiary care center in New Zealand over a five-year period. In the current study, impairments in social functioning and medical and psychiatric comorbidities were hypothesized to be present at higher rates in PNES in comparison with those with ES.

2. Methods

2.1. Study population

Following ethics approval from the Health and Disability Ethics Committee (HDEC; Ethics ref: 15/STH/162), 267 video-EEG and data-EEG recordings of patients assessed at the telemetry unit of the Neurology department at Auckland City Hospital over a five-year period between the start of January 2011 and end of December 2015 were retrospectively analyzed. The catchment area for neurology services at Auckland District Health Board (DHB) included the metropolitan Auckland-region, Northland, Bay of Plenty, Waikato, Lakes, Tairawhiti, Whanganui, and Hawkes Bay District Health Boards, covering a population of approximately 1.69 million people [20]. Patients with PNES, ES, or combined PNES and ES documented by video-EEG and aged 18 years and above were included in the study. For cases (regarded as the group with PNES), those with PNES or PNES coexisting with ES confirmed on video-EEG telemetry were recruited, i.e., the lack of ictal epileptiform activity during video-EEG telemetry was necessary. For controls, those with ES only were recruited.

Patients were excluded if they were aged less than 18 years or had a diagnosis of dementia, incomplete clinical histories, and were being worked up for stereotactic neurosurgery. Gender, cultural background, and medical or psychiatric comorbidity did not affect inclusion. People in the group with PNES were matched 1:1 to ES controls based on age and gender.

2.2. Study factors

Hospital electronic patient record systems and written notes (both medical and psychiatric) were reviewed in the study population. Records were reviewed for demographic, medical, neurological, psychiatric, and social information. Demographic variables included age, gender, ethnicity, religion, employment, and access to disability benefits. Social variables including marital status, living conditions, and major life stressors were also detailed.

2.3. Neurological data

Clinical neurological data included age at first seizure onset, seizure semiology, head injury at any point, antiepileptic medications, and doses prior to video-EEG. Video- and data-EEG and computed tomography (CT) or magnetic resonance imaging (MRI) neuroimaging data were reviewed. Other variables included neurosurgical interventions, a family history of epilepsy or PNES, handedness, number of presentations to medical/neurological services, and medical comorbidities. Psychogenic nonepileptic seizures and ES were diagnosed based on a history of epileptic or nonepileptic seizures confirmed by video-EEG or data-EEG reviewed by a neurologist showing unequivocal seizures on electroencephalographic grounds. Those with abnormal EEG recordings, including epileptiform activity, but with no observed seizures or events during recordings were excluded.

2.4. Psychiatric data

Psychiatric data collected included personal history (including a history of abuse and neglect), recent or distal traumatic experiences, and a family history of psychiatric disorder. Past and current psychiatric diagnoses, referral to psychology or psychiatric services during inpatient admission or at point of discharge, treatment, who diagnosed the psychiatric disorder, as well as substance use were also detailed. Psychiatric illness was diagnosed based on the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) [21].

2.5. Descriptive statistics

IBM Statistics SPSS Version 22.0. (Armonk, NY: IBM Corp.) was used to summarize the sociodemographic characteristics and medical and psychiatric variables. Kolmogorov–Smirnov tests were used to assess normality. When data were normally distributed, t-tests were used; however, when data were not normally distributed, analysis of variance (ANOVAs) were applied. A p-value threshold of 0.05 was chosen for statistical significance.

3. Results

3.1. Patient demographics and characteristics

Of the 267 patients reviewed, 22 patients were aged under 18 years, and 12 people had suspected PNES but did not have any typical events during video-EEG monitoring and were therefore excluded. Fifty-nine adults had nondiagnostic results and were also excluded from the study, while 108 had ES. The final sample was 66 people with PNES or PNES + ES (regarded as the group with PNES in this study) and 66 with ES only. Table 1 shows key demographic variables.

3.2. Neurological data

In those with ES, initial diagnosis was made by a neurologist for 43 people, by a pediatrician for 9, and by a pediatric neurologist for one person. Data were unavailable for 13 people. For those with PNES, initial diagnosis was made by a neurologist for 36 people, by a pediatrician for two people, and by a general practitioner (GP) for one person. Information was unavailable for 27 people.

Thirty-four people with PNES were on AEDs. Of those, 18 were prescribed AEDs as monotherapy and 16 as polytherapy (mean number of medications was 1.8).

Sixteen people with PNES had suffered a head injury; eight were in motor vehicle accidents, seven suffered head trauma, and one experienced both. One person suffered over 100 head injuries. Twenty-four people with ES suffered a head injury, and two were in motor vehicle accidents. Eleven people with PNES underwent neurosurgical interventions, primarily tumor resection, compared with 22 with ES. Postoperatively, one person in each group developed epilepsy.

Table 1
A summary of the demographic variables of those in the groups with PNES versus ES.

Demographics	PNES (n = 66)	ES (n = 66)	p-Value
Mean age	38 (18–76)	36 (18–69)	0.644
Mean age at onset	27	19	0.005*
Mean time to V-EEG (months)	3	4	0.928
Male	22 (33.3%)	22 (33.3%)	0.202
Female	44 (66.7%)	44 (66.7%)	
Disability benefit	20 (30.3%)	16 (24.2%)	0.241
Ethnicity			0.768
New Zealand European	33 (50%)	43 (65.2%)	
Māori	17 (25.8%)	7 (10.6%)	
Pacific Islander	5 (7.6%)	6 (9.1%)	
Other	11 (16.7%)	10 (15.2%)	

* $p < 0.05$.

Those with PNES underwent an average of 1.2 neuroimaging investigations, including CT, MRI, and X-ray, compared with 2.0 for those with ES. Both groups experienced frequent seizures, with 28% of those with PNES and 18% of those with ES experiencing seizures daily. The average number of presentations to neurological services at Auckland DHB over the study period was 1.4 for those with PNES and 2.3 for those with ES, respectively. Table 2 shows neurological variables.

Those with PNES and ES had similar access time to video-EEG monitoring, at three and four months, respectively. Those with PNES had higher levels of medical comorbidity with 61 people having one or more medical conditions, compared with 43 people with ES. Presentation to neurology services was less frequent in those with PNES, with 10 people presenting to orthopedic, cardiology, general medicine, pediatric, or respiratory services. Of those with ES, one person did not present further to neurology.

3.3. Psychiatric data

In those with PNES, 41 people had psychiatric comorbidities, while 33 of those with ES had psychiatric comorbidities. The key finding is depression was the most common psychiatric diagnosis in both groups, affecting 26% of those with PNES and 32% of those with ES. Anxiety was the second most common psychiatric diagnosis in both groups. This was followed by posttraumatic stress disorder, other functional neurological disorders, personality disorder, and alcohol/substance abuse. Approximately half of the people within each group used substances regularly, while four people with PNES were diagnosed with alcohol or substance dependence disorder. Table 3 shows the psychiatric diagnoses in both groups.

Seventeen people with PNES reported a family history of psychiatric disorder, and 11 had a family history of epilepsy. Twenty people with ES reported a family history of psychiatric disorder, and 11 had a family history of epilepsy.

Of those with PNES, 49 were prescribed psychotropics, 9 attended community mental health services, 16 psychotherapy, and 4 had access to pain services and counseling. Of those with ES, almost all (65) were prescribed psychotropic medication, 14 received psychotherapy, and 7 counseling. Those with ES were significantly more likely than those with PNES to be on psychotropic medication ($p = 0.034$). For both groups with PNES and ES, when psychological therapies were accessed, these were in the form of cognitive behavioral therapy, dialectical behavioral therapy, or mindfulness.

3.4. Social data

Twenty people with PNES had a history of ongoing abuse, such as domestic violence, while 9 people with ES had a history of ongoing abuse. People with PNES experienced stressors more frequently than those with ES, with 47 and 32 people, respectively reporting a range of stressors. Health, interpersonal relationships, and financial stressors were most frequently reported. Additionally, a similar number of people in both groups experienced childhood traumatic events, with 27 in the group with PNES compared with 25 with ES. Those with PNES also more frequently reported being single or unmarried, at 25 people compared with 14 people with ES.

Table 2
A comparison of the neurological variables between groups with PNES and ES.

Neurological variables	PNES (n = 66)	ES (n = 66)	p-Value
Number of presentations over 5 years	1.4	2.3	0.945
Average number of neuroimaging tests	1.2	2.0	0.669
Diagnosis by neurologist	36 (54.6%)	43 (65.2%)	0.254
Average number of antiepileptic drugs (AEDs)	1.8	2.0	0.036*
Medical comorbidities	61 (92.4%)	41 (62.1%)	0.089
Seizure frequency			0.339
Daily	28 (42.4%)	18 (27.3%)	
Weekly	15 (22.7%)	16 (24.2%)	
Monthly	10 (15.2%)	30 (45.5%)	
Other	13 (19.7%)	2 (3.0%)	

* $p < 0.05$.

Table 3
Clinical diagnoses in the groups with PNES and ES.

Psychiatric diagnoses	PNES	ES
Any type of psychiatric disorder	41 (62.1%)	33 (50%)
Depression	17 (25.8%)	21 (31.8%)
Anxiety	17 (25.8%)	8 (12.1%)
Posttraumatic stress disorder	10 (15.2%)	2 (3.0%)
Functional neurological symptom disorder	6 (9.1%)	1 (1.5%)
Adjustment disorder	4 (6.1%)	3 (4.6%)
Personality disorder	4 (6.1%)	3 (4.6%)
Alcohol addiction or substance abuse	4 (6.1%)	–
Bipolar disorder	3 (4.6%)	3 (4.6%)
Somatic symptom and related disorders	2 (3.0%)	2 (3.0%)

4. Discussion

In this study, we examined the clinical characteristics of, and medical and psychiatric comorbidities associated with PNES in patients presenting to neurological services at a tertiary hospital in New Zealand. A five-year cohort of 132 adults was retrospectively recruited, and a number of variables were increased in PNES, including female gender and age at first seizure onset. Impairments were found in social functioning, including higher rates of disability, abuse, and stressors, compared with those with ES. Overall, however, both groups had high rates of comorbid psychiatric and medical disorders. Consistent with our hypothesis, psychiatric disorders were more prevalent in the group with PNES; however, there were higher rates of depression and psychotropic prescribing in the ES group compared with PNES.

The mean age at onset of PNES in the current study was approximately eight years later than ES and consistent with what is reported in the literature [17]. Indeed, several studies have reported a diagnostic delay of up to seven years (and sometimes longer) for those with PNES in comparison with ES [22,23]. One explanation is that ES is diagnosed based on clinical suspicion [24] rather than necessarily by data or video-EEG. Additionally, PNES are heterogeneous and have a variety of symptoms and signs, none of which are pathognomonic, thereby making PNES more likely to be missed or misdiagnosed. Diagnostically, there have been recent updates to PNES classification whereby it was regarded as a form of somatoform disorder in DSM-IV [21]. In the latest iteration (DSM-V), it is still found within the somatic symptom and related disorders chapter; however, there has been a move away from confirming the absence of medical etiology [25]. The implication is that PNES will potentially be more readily diagnosed, but this change will require further evaluation longitudinally.

Further, a disconnect exists between the way patients and neurologists conceptualize PNES whereby people with PNES tend to have an external health-related locus of control and are more aware of seizure-associated physical symptoms than emotional symptoms, whereas neurologists perceive PNES as being more of a psychological than physical condition [26–28]. There is also patient resistance to accepting the diagnosis of PNES and clinicians not suspecting PNES early enough or attempting several trials of AEDs to manage seizure activity [11,29]. Avbersek et al. and La France and colleagues have suggested frameworks for identifying clinical signs and diagnostic certainty of PNES that will potentially help clinicians diagnose PNES earlier [2,30].

Approximately a third of the sample with PNES and a quarter of those with ES were on disability benefits. Though this finding was not of significance statistically, it shows that those with PNES are potentially more impaired in the most productive years of their life relative to those

with ES. Additionally, there was a greater proportion of those with PNES who were single or unmarried relative to ES in the current sample. These impairments in functioning might indicate that people with PNES are generally more debilitated, and there are implications both to direct and indirect healthcare costs. The findings in the current study are similar to findings in other work internationally [16,18].

In terms of psychiatric comorbidity in the current study, this was more frequent in those with PNES (62%) compared with 50% of those with ES. The presence of elevated rates of psychiatric disorders in both those with PNES and ES in the current study relative to that seen in the general population suggests high psychiatric morbidity in these populations. Depression was the most commonly reported comorbidity in people with PNES, as well as higher rates of post-traumatic stress disorder (PTSD) and personality disorders, compared with controls, consistent with other studies [12]. Rates of PTSD were approximately fivefold in those with PNES compared with ES. While higher rates of sexual and physical abuse were found in those with PNES consistent with other work [31], factors such as personality traits, emotional regulation, and coping skills, which have been linked to PTSD severity [26], were not examined in the current study. The proportion of those with PNES with personality and anxiety disorders in the current study is in line with other work [16,18], but the rates of depression are much lower possibly suggesting differences in the samples studied. However, consistent with other work, there are high rates of psychiatric comorbidity in PNES [19].

Although there were high rates of psychiatric morbidity in people with PNES in the current study, under half of the study population were referred to psychiatric services following diagnosis and only a quarter were engaging in psychotherapy, highlighting unmet need in terms of early diagnosis and access to and provision of psychiatric services. Also, though people with PNES had high rates of psychiatric disorder, more people with ES were on psychotropics, while 52% of people with PNES were on AEDs suggesting suboptimal treatment of underlying psychological or psychiatric needs. As PNES lie at the interface between neurology and psychiatry, care is often fragmented [32]. For example, a study evaluating the management of PNES in the United Kingdom found that 93% of respondents, including neurologists, epileptologists, psychiatrists, and psychologists, considered psychotherapy to be the treatment of choice [33]. While over half reported referring people with PNES to psychological or psychiatric services for follow-up, up to 20% of patients received no neurological follow-up after diagnosis. In the United States, up to three quarters of patients diagnosed with PNES are referred to psychiatric services [34], which may reflect differing views on the utility of psychotherapy, pharmacological therapy, ease of access as well as health system differences. Indeed, there are differences internationally with regard to the willingness and capacity of psychiatric services in managing PNES, which in turn may affect outcomes for those with PNES [35].

In 2018, the PNES Task Force of the International League Against Epilepsy published a survey encompassing 63 countries and found that PNES were a diagnostic and therapeutic problem globally [36]. Moreover, a lack of simple and reliable diagnostic procedures was found, and though psychotherapy was regarded as instrumental, there were barriers in the provision of this. Possible solutions were suggested in the diagnosis, management, and study of PNES, but these recommendations need consistent international adoption [36]. Additionally, commonalities have been found across MUPS, which can present in any organ system [8], and PNES can potentially be evaluated in terms of a wider framework with regard to etiological mechanisms, cognitive factors, symptom burden, comorbidities, clinician–patient relationships, treatments, treatment outcomes, and cultural contributors. Fortunately, there is increasing awareness that in order to address the complex issues underlying PNES, different models of care are needed including patient-centered care and closer collaboration between neurology, psychiatric, and multidisciplinary services [37]. While comprehensive services may be provided at specialized epilepsy centers, however, integrated neurological and psychiatric services may not be widely available internationally, and in New Zealand, such integration is lacking. This may be partly due to the burden of PNES not being established but also how services have been historically funded and configured to function in isolation. By better understanding both medical and non-medical concerns of those with PNES and through better communication between medical and psychiatric services [35], services can more appropriately target their needs.

This is the first study carried out in New Zealand to assess the symptomatology and clinical presentations associated with PNES. In the study catchment area, Māori and Pacific Island ethnicity comprised 23% and 5%, respectively of the general population [38], which reflects New Zealand's ethnic makeup. Unexpectedly, the sample contained no people of Asian ethnicity, although they comprise at least 7% of the population in the study catchment area and 23% of people living in the Auckland region [38]. This is possibly due to stigma or the presentation (or not at all) of psychosocial distress to other clinical services. Understandably, there are differences in how PNES may present, and cultural factors should be taken into consideration [8,17]. A strength of this study is that cases included in the final sample were diagnosed by the gold standard level of diagnostic certainty [2] as well as verification by a neurologist. A further strength was the inclusion of age- and gender-matched controls, providing a comparison population for cases and allowed the examination of relevant clinical and sociodemographic variables. Methodological limitations included a limited sample size due to applying stringent diagnostic criteria, the retrospective sampling, with missing or incomplete variables on occasion. It is also possible that psychiatric diagnoses were underestimated, as diagnoses were not always undertaken by psychiatrists. This is an important consideration as services are currently configured such that clinical specialties and assessment or management of PNES are not integrated. Additionally, although those with PNES had more frequent seizures, they presented less frequently to neurological services. It is possible that those with PNES present to other services such as their GP or general medical services instead of specialist neurological services. However, as data were collected from hospital electronic records in the current study, presentation to GPs and services outside the hospital were not collected.

The findings provide strong evidence for psychiatric morbidity in both populations with PNES and ES, respectively. There are several psychosocial factors contributing to the expression of PNES and also are possible consequences of PNES. Addressing these with integrated psychiatric, psychological, or social input while working closely with neurology may help improve outcomes [39] such as improving overall functioning and reducing iatrogenic harm (e.g., AEDs). Future directions include expanding this study across New Zealand, as well as collaborating with tertiary epilepsy centers elsewhere such as across Australasia to potentially share data. Knowledge of PNES characteristics can also help guide future service development and provision so that a more targeted approach can be offered in addressing the high levels of morbidity.

Declaration of competing interest

Drs. Walker, No, Sundram and Miss Campbell have nothing to disclose.

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