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The Personality Assessment Inventory as a Tool for Diagnosing Psychogenic Non-epileptic Seizures

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SUMMARY

Using 184 subjects with valid PAI profiles and VEEG confirmed diagnoses of epileptic seizures (ES; N=109) or psychogenic non-epileptic seizures (PNES; N=75), we present the diagnostic test performance of the PAI PNES Indicator and other PAI scales when used to differentiate PNES from ES.

Subjects with PNES reported significantly higher somatic, conversion, depressed, anxious, and suicidal symptoms. As a diagnostic tool, the PNES Indicator does not add additional accuracy beyond the conversion subscale (SOM-C). The somatization (SOM-S) and physiological depression (DEP-P) subscales perform as well as the SOM-C subscale. The SOM-C scale (cut point ≥ 70) was 58.7% sensitive and 83.5% specific at diagnosing PNES. Assuming a 30% prevalence of PNES, the SOM-C scale has a positive predictive value of 60.4% and negative predictive value of 82.5%. Overall, the PAI SOM-C subscale does not appear more accurate than other psychometric tests used to differentiate PNES from ES.

Keywords

PAI; Pseudoseizures; Diagnosis; Somatoform Disorders

Inpatient video EEG (VEEG) monitoring is the gold standard for diagnosing psychogenic non-epileptic seizures (PNES) (Sundaram et al., 1999). Because it is often unavailable and expensive, other tools have been studied to aid in the diagnosis of PNES. Due to reliability and low cost, personality tests such as the Minnesota Multiphasic Personality Inventory (MMPI) have been studied extensively as diagnostic tools for PNES. Recently, the Personality Assessment Inventory (PAI) (Morey, 1991) has also been studied in this capacity.

The 344-item PAI provides results along 22 non-overlapping clinical scales (such as depression, anxiety, and somatization) based on the Diagnostic and Statistical Manual of Mental Disorders (DSM) (Morey, 1991). The somatic complaints scale (SOM) items represent concerns about overall physical functioning and health. There are three somatic complaint subscales: conversion (SOM-C), somatization (SOM-S), and health concerns (SOM-H).

Three studies have been published using the PAI to distinguish patients with PNES from those with epileptic seizures (ES) (Mason et al., 2000; Pritchard et al., 2002; Wagner et al., 2005). Wagner et al. used the PAI to create the “PNES Indicator” by subtracting the SOM-H subscale from the SOM-C subscale. A score above zero suggests PNES while zero or below indicates ES based on the idea that PNES patients present with greater conversion symptoms relative to overall health concerns (*la belle indifférence*). In their sample (PNES=26, ES=15), the PNES Indicator was 84% sensitive and 73% specific at differentiating PNES from ES.

Our objective is to replicate the Wagner study using a larger sample size in addition to addressing the performance of other PAI scales as PNES diagnostic tools.

METHODS

Subjects

235 subjects who completed both the PAI and VEEG monitoring at the University of Washington Regional Epilepsy Center between May 2003 and September 2007 were considered for this study. Patients receiving VEEG monitoring may not have completed the PAI due to reading below a sixth-grade level (using the Wide Range Achievement Test-Revised), discharge prior to completion, or refusal. Of the 235, 118 had ES, 85 had PNES, 10 had both ES and PNES, 19 were indeterminate, and three had “other” diagnoses. Only subjects with ES or PNES and valid PAI profiles were included (N=184; ES=109, PNES=75). All but 12 subjects in this study also completed the Wechsler Adult Intelligence Scale-3rd revision (WAIS-III).

19 subjects (ES=9, PNES=10, $\chi^2(1)=1.0$, $p=0.32$) were excluded for invalid PAI profiles. A PAI profile was invalidated if any of the four validity scales was invalid using the high score from the PAI manual (inconsistency ≥ 73 , infrequency ≥ 75 , negative impression ≥ 92 , or positive impression ≥ 68). Four were invalid due to inconsistency, four due to infrequency, five due to negative exaggeration, three due to positive exaggeration, and three due to multiple invalid tests. Those with invalid profiles had lower mean full-scale IQs than those with valid profiles (84.5 vs. 92.2, $t=-2.31$, $p=0.02$) but did not differ on mean age, percentage female, or average years of education. Profiles invalid due to a positive impression ($n=4$) only came from patients with epilepsy (Fisher’s exact=0.03), while other reasons for invalidity did not differ between groups.

All subjects provided informed consent and the institutional review board approved the use of the testing results for research purposes.

Statistical Analysis

PAI scales and subscales significantly different between PNES and ES subjects ($p<.001$) were analyzed as diagnostic tools using VEEG as the gold standard. For each scale, a receiver operating characteristic (ROC) curve was created by plotting the sensitivity and specificity pairs for each possible cut point. Rough standards have been created for interpreting the area under the ROC curve: 0.9–1 (excellent); 0.8–0.9 (good); 0.7–0.8 (fair); 0.6–0.7 (poor); 0.5–0.6 (fail) (Tape, 2008). A chi-square statistic was calculated to compare ROC curves for different diagnostic scales. A significant test ($p<0.05$) would indicate that one test is better than the other.

Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were examined for each test after choosing an optimal cut point from the ROC curve. For the PNES Indicator, the ≥ 1 cut point was chosen. For other scales, the optimal cut-point was considered to be the one we felt maximized both sensitivity and specificity. Attempts at combining variables to improve overall classification accuracy were not successful.

Statistical analyses were performed using Intercooled Stata version 10.0 (StataCorp LP, College Station, TX). Two-sample t-tests were used to compare continuous data and Pearson chi-square tests were used to compare group differences in nominal variables.

RESULTS

Table 1 shows that those with PNES were more likely to be female but there were no differences between groups by age, education, or IQ. Subjects with PNES scored significantly higher than ES subjects on the SOM, SOM-C, and SOM-S scales. Subjects with PNES reported significantly higher levels of anxiety, depression, suicidal thinking, and physical symptoms of anxiety or depression compared to ES subjects. There were no group differences on any of the other PAI scales or subscales. The only clinically elevated scores on any of the PAI scales were the SOM-C and SOM scores for the PNES subjects.

Table 2 details PNES Indicator and PAI scale diagnostic test performance. The PNES Indicator was 58.7% sensitive and 85.3% specific in identifying PNES. Multiple cut-offs for SOM-C demonstrate the trade-off between sensitivity and specificity required when choosing a diagnostic cut point. Using the standard clinical cut-off of ≥ 70 , the SOM-C subscale has a nearly identical performance to the PNES Indicator. Lowering the SOM-C cut point to ≥ 60 increases the sensitivity to 83% but decreases specificity to 53% (47% false positives). The SOM-C scale has 100% specificity at cut point ≥ 114 . No other scale or subscale provides improved classification accuracy over the SOM-C subscale.

Based on the ROC curve area, the PNES Indicator, SOM-C, SOM-S, and DEP-P subscales perform in the “fair” range while the other scales perform poorly. Statistical comparison of the ROC curves showed no difference between the SOM-C subscale and the PNES Indicator ($\chi^2(1)=1.3$, $p=0.26$), SOM-S subscale ($\chi^2(1)=2.2$, $p=0.14$), or DEP-P subscale ($\chi^2(1)=0.92$, $p=0.34$). The SOM-C subscale was significantly better than the SOM scale ($\chi^2(1)=9$, $p=0.003$), DEP scale ($\chi^2(1)=6.8$, $p=0.01$), and ANX-P scale ($\chi^2(1)=5.9$, $p=0.02$).

The Supplemental Table demonstrates the PPV and NPV of the SOM-C test (using cut points of ≥ 60 and ≥ 70) in hypothetical populations where the prevalence of PNES ranges from 0.5% to 40%. Using either cut-point, as the prevalence of PNES decreases, the positive predictive value becomes very small while the NPV becomes very large.

DISCUSSION

Patients with PNES present to epileptologists with physical manifestations of seizures that stem from psychological distress and not from electrical seizure activity. It is no surprise, then, that our comparison of PNES to ES subjects using the PAI found significantly more conversion, somatic, physical depression, and physical anxiety symptoms in PNES subjects. However, in this large, independent sample, we did not find that subjects with PNES had relatively lower levels of health concerns. For that reason, our analysis did not replicate the Wagner et al results. Instead, we found that the PNES Indicator is no more useful than the conversion subscale when differentiating subjects with PNES and ES and have added to evidence indicating that *la belle indifférence* is not a standard clinical feature of conversion disorders (Stone et al., 2006). Further, we found that the SOM-S and DEP-P subscales performed as well as the conversion subscale. This suggests that subjects presenting with PNES are not a homogenous group easily differentiated from those with ES by a single PAI scale or subscale. This also demonstrates the importance of replicating small studies before presented tools (like the PNES Indicator) are used in practice.

In this population, using a cut point of ≥ 70 , the SOM-C subscale is 58.7% sensitive and 83.5% specific when differentiating PNES from ES. In comparison, the SOM-C subscale does not

appear more sensitive or specific than other non-VEEG diagnostic modalities (such as the MMPI, MMPI-II, or observation of ictal characteristics) at differentiating PNES from ES (Cuthill & Espie, 2005).

The data in the Supplemental Table detail the fact that when condition prevalence decreases, the PPV will decrease while the NPV increases. When using the PAI SOM-C subscale as a diagnostic tool for PNES, the prevalence of PNES in the population being tested would need to be quite high for a positive result on the PAI SOM-C to be clinically useful. The high NPV in populations with low prevalence of PNES is not helpful as the condition already has a low pre-test probability of being present indicating community-based screening for PNES with the PAI would be impractical.

Given this information, using psychometric tests as diagnostic tools may be very valuable in groups where the pre-test probability of PNES is high. One example is a study that found a sensitivity of 80% and specificity of 81% when combining the MMPI-II and clinical information into a diagnostic tool (Schramke et al., 2007). Overall, the best opportunity for accuracy may be the formulation of a neuropsychologist whose skill combines clinical and test information (Fargo et al., 2008).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Demographic Data and PAI Scale and Subscale Scores Between Diagnostic Groups

	PNES (N=75)	ES (N=109)	Test Statistic
Average Age, years	38.6 ± 10.6	35.9 ± 13.1	t = -1.46
Education, years	12.6 ± 2.2	12.7 ± 2.8	t = 0.28
FSIQ	90.4 ± 13.4	93.4 ± 13.2	t = 1.46
White	65 (86.7%)	95 (87.2%)	$\chi^2(1) = 0.01$
Number Female	58 (77%)	66 (61%)	$\chi^2(1) = 5.69^*$
Somatization (SOM)	72.6 ± 13.2	64.0 ± 10.8	t = -4.84 ^{***}
• Conversion (SOM-C)	73.5 ± 15.7	60.0 ± 11.8	t = -6.66 ^{***}
• Somatization (SOM-S)	67.8 ± 14.4	57.6 ± 11.4	t = -5.34 ^{***}
• Health Concerns (SOM-H)	68.5 ± 10.8	68.1 ± 10.8	t = -0.3
Anxiety (ANX)	61.1 ± 13.8	55.8 ± 9.6	t = -3.06 ^{**}
• Cognitive (ANX-C)	57.8 ± 12.8	54.8 ± 10.6	t = -1.73
• Affective (ANX-A)	59.5 ± 14.0	55.8 ± 10.9	t = -2.03 [*]
• Physiological (ANX-P)	63.1 ± 13.7	55.6 ± 8.9	t = -4.5 ^{***}
Anxiety Related Disorders (ARD)	58.6 ± 14.7	53.2 ± 11.4	t = -2.82 ^{**}
• Obsessive-Compulsive (ARD-O)	51.9 ± 10.9	49.3 ± 10.5	t = -1.64
• Phobias (ANX-P)	56.2 ± 12.0	52.0 ± 9.6	t = -2.64 ^{**}
• Traumatic Stress (ANX-T)	60.4 ± 17.5	55.0 ± 12.1	t = -2.47 [*]
Depression (DEP)	65.7 ± 13.4	59.1 ± 12.1	t = -3.45 ^{***}
• Cognitive (DEP-C)	61.4 ± 12.7	57.7 ± 12.7	t = -1.98 [*]
• Affective (DEP-A)	59.7 ± 13.5	56.3 ± 11.7	t = -1.82
• Physiological (DEP-P)	67.7 ± 12.1	59.1 ± 10.7	t = -5.05 ^{***}
Suicidal (SUI)	56.8 ± 15.4	52.3 ± 11.2	t = -2.27 [*]

Data are n (%) or mean ± SD

p<0.001**
p<0.01*
p<0.05

Table 2

Diagnostic Test Performance of the PNES, SOM-C, SOM, SOM-S, and DEP-P Indicators

	Cut Point	Area under ROC Curve	Sensitivity [95% CI]	Specificity [95% CI]	PPV [/] [95% CI]	NPV [/] [95% CI]
PNES	≥ 1	0.79	58.7% [46.7 -- 9.9]	85.3% [77.3 -- 91.4]	73.3% [60.3 -- 83.9]	75% [66.4 -- 82.3]
SOM-C	≥ 60	0.75	82.7% [72.2 -- 90.4]	53.2% [43.4 -- 62.8]	54.9% [45.2 -- 64.2]	81.7% [70.7 -- 89.9]
	≥ 65	0.75	69.3% [57.6 -- 79.5]	67.0% [57.3 -- 75.7]	59.1% [48.1 -- 69.5]	76.0% [66.3 -- 84.2]
	≥ 70	0.75	58.7% [46.7 -- 69.9]	83.5% [75.2 -- 89.9]	71% [58.1 -- 81.8]	74.6% [65.9 -- 82]
	≥ 75	0.75	49.3% [37.6 -- 61.1]	90.8% [83.8 -- 95.5]	78.7% [64.3 -- 89.3]	72.3% [64 -- 79.6]
SOM	≥ 70	0.69	56% [44.1 -- 67.5]	73.4% [64.1 -- 81.4]	59.2% [46.8 -- 70.7]	70.8% [61.5 -- 79]
SOM-S	≥ 70	0.70	45.3% [33.8 -- 57.3]	81.7% [73.1 -- 88.4]	63% [48.7 -- 75.7]	68.5% [59.7 -- 76.3]
DEP	≥ 60	0.64	62.7% [50.7 -- 73.6]	61.5% [51.7 -- 70.6]	52.8% [41.9 -- 63.5]	70.5% [60.3 -- 79.4]
DEP-P	≥ 70	0.71	49.3% [37.6 -- 61.1]	86.2% [78.3 -- 92.1]	71.2% [56.9 -- 82.9]	71.2% [62.7 -- 78.8]
ANX-P	≥ 60	0.66	57.3% [45.4 -- 68.7]	67.9% [58.3 -- 76.5]	55.1% [43.4 -- 66.4]	69.8% [60.1 -- 78.3]

[/] PPV = positive predictive value; NPV = negative predictive value. Both PPV and NPV calculated with prevalence of 41% [95% CI: 34% -- 48.2%]