Personality Development in the Context of Intractable Epilepsy

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Objectives: To investigate the developmental time frame of epilepsy onset on adult personality traits of neuroticism and extraversion and to consider their role in adjustment to intractable epilepsy.

Design: Prospective, preoperative and postoperative survey of the psychological and psychosocial effects of intractable epilepsy and its surgical treatment. Data from the preoperative phase are reported.

Setting: Comprehensive Epilepsy Program (CEP), Austin Health.

Patients: Sixty adult patients with focal epilepsy undergoing inpatient monitoring. Groups of patients with epilepsy onset in different developmental periods were empirically derived and compared with each other and with normative personality data from 1571 cases.

Main Outcome Measures: Scores on the Eysenck Personality Questionnaire Revised–Short Form; the Beck Depression Inventory–II; the State-Trait Anxiety Inventory (state form); and the Austin CEP Interview, a semistructured interview providing in-depth psychosocial assessment.

Results: Patients with onset of epilepsy during the self-defining period of adolescence had higher neuroticism scores relative to normative data (95% confidence interval, 0.16 to 3.57) and other patients (−0.46 to −5.63). High neuroticism, particularly when accompanied by lower extraversion, predisposed to poor adjustment to intractable epilepsy as reflected by impaired mood ($P < .01$) and difficulties with family functioning (48% of patients).

Conclusions: These data provide initial evidence that onset of chronic neurologic illness in adolescence influences the development of adult personality traits. We also found a relationship between personality and adjustment to chronic epilepsy. The findings are relevant to the provision of psychologically informed neurologic care.

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THERE HAS BEEN LIMITED RESEARCH ON THE EFFECT OF CHRONIC NEUROLOGIC ILLNESS ON THE DEVELOPMENT OF SELF-IDENTITY. CHRONIC EPILEPSY PROVIDES A USEFUL MODEL BECAUSE IT IS COMMON AND CAN OCCUR AT ANY PHASE OF LIFE. LIVING WITH MEDICALLY INTRACTABLE EPILEPSY HAS BEEN ASSOCIATED WITH LOWERED LEVELS OF SELF-CONFIDENCE AND PERSONAL AUTONOMY, PSYCHOSOCIAL DIFFICULTIES, AND REDUCED QUALITY OF LIFE. MECHANISMS UNDERPINNING THESE ASSOCIATIONS HAVE BEEN UNDEREXPLORED, IN PART BECAUSE OF THE ASSUMPTION THAT THEY REFLECT MEDICAL SYMPTOM STATUS.

There is, however, considerable heterogeneity in the extent to which individuals with chronic epilepsy experience disruption of psychosocial functioning and perceive themselves as disabled by the condition. This may be explained in part by the role of chronic illness in self-identity; some individuals view themselves as inferior or different from others and unable to fulfill their potential or roles in life. The seminal work of Erikson identified the period of adolescence as the most formative in identity development. It occurs against the backdrop of identity formation across the lifespan within the individual’s broader psychosocial context. It is conceivable that onset of illness during adolescence may particularly effect development of the self and one’s subsequent psychosocial functioning.

Erikson proposed that health is a key biological aspect of self-identity. In keeping with this, health status has been linked to certain characteristics of the self, namely, the personality traits of neuroticism and extraversion. Neuroticism is typically characterized by the tendency to experience negative emotional states including anxiety, depression, anger, and hostility. High levels of neuroticism have been consistently associated with greater report-
ing of medical symptoms, reduced psychosocial functioning, and heightened psychological distress. Conversely, high extraversion is typically characterized by high levels of positive emotion, personal warmth, and sociability and has been associated with greater psychological well-being and life satisfaction.\(^7\)

In light of these associations, in the present study, we sought to examine the way in which characteristics of the self develop in the context of a common neurologic illness, that is, epilepsy. In particular, we explored the influence of the developmental time frame of epilepsy onset on the 2 most recognized personality traits of neuroticism and extraversion and considered their role in psychosocial adjustment to chronic epilepsy.

**METHODS**

**PARTICIPANTS**

Sixty individuals were recruited to participate in a 2-year prospective longitudinal study examining the psychological and psychosocial effects of chronic epilepsy and its surgical treatment. The study was conducted within the Comprehensive Epilepsy Program (CEP) of Austin Health (Heidelberg, Victoria, Australia), between March 5, 1998, and August 12, 2005. Participants were recruited from patients undergoing inpatient characterization of intractable complex partial seizures for consideration of neurosurgical treatment. As part of routine clinical management, all patients undergo thorough medical and psychosocial assessments.\(^8\) Participants also completed a range of psychological questionnaires.

Inclusion criteria were age 18 years or older, no history of neurosurgery, Full Scale IQ score of 80 or higher, and functional level of English that permitted completion of the questionnaires. The study was approved by the Human Research Ethics Committees of Austin Health and the University of Melbourne, and all participants gave written informed consent. Of the 60 participants recruited, 3 were excluded from the analyses because of missing questionnaire data, resulting in a final sample of 57 participants (30 men). Of these, 32 participants were financially independent (30 were employed) before surgery and 39 were partnered or married. The mean (SD; range) values for the sample were as follows: age, 35 (10.8; 18-60 years), years of educational achievement, 12 (2.6; 8-18 years), and Full Scale IQ score, 97 (10.1; 80-117).

**PSYCHOLOGICAL ASSESSMENT**

Participants completed the Eysenck Personality Questionnaire Revised–Short Form. This widely used measure of personality is based on a 3-factor model and contains 48 items: 12 each for Neuroticism, Extraversion, Psychoticism, and the Lie scale items. It has high reliability for the Neuroticism and Extraversion scales.\(^9\)\(^10\) To interpret patient personality traits relative to those of the general population, we used normative data derived from 1571 adults (693 men) stratified for age.\(^9\)

Measures of mood and psychosocial functioning were used as indicators of patient adjustment to intractable epilepsy. Mood was assessed using the Beck Depression Inventory–II and the State-Trait Anxiety Inventory (state form).\(^11\)\(^12\) The Beck Depression Inventory–II is a 21-item self-report questionnaire that measures the severity of depression based on criteria of the Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition).\(^11\) Each item is rated on a 4-point Likert-type scale, yielding a maximum score of 63 (cutoff scores: ≤13, no depression; 14-19, mild depression; 20-28, moderate depression; and ≥29, severe depression). The State-Trait Anxiety Inventory (state form) measures current levels of anxiety from 20 items rated on a 4-point Likert-type scale, yielding a maximum score of 80 (population mean [SD], 35.48 [10.51]). Both measures are sensitive to mood disturbance in patients with chronic epilepsy.\(^11\)\(^13\)

The Austin CEP Interview explores all aspects of a patient’s psychosocial functioning and adjustment to epilepsy and its treatment through extensive interview of the patient and relevant family members. It is routinely administered by the treating clinical neuropsychologist in the CEP and has shown high interrater agreement.\(^1\) For this study, variables indicative of general psychosocial adjustment were coded from the interview. Specifically, overall adjustment, family dynamics, and social functioning were each coded (1, unimpaired; 2, impaired) on the basis of any difficulties reported by the patient or family members.

**STATISTICAL ANALYSIS**

Initial analysis of the data revealed that they were suitable for parametric analyses, which were performed using commercially available software (SPSS 13 For Mac OS X, SPSS, Inc, Chicago, Illinois), with P≤.05 (2-tailed) set as the criterion of statistical significance. To empirically group participants according to age at seizure onset, a hierarchical cluster analysis was performed using the Ward method.\(^16\) \(x^2\) Analyses and independent \(t\) tests were used to compare the patients according to medical variables. To determine the extent to which patient personality traits differed from the general population data, the mean Neuroticism and Extraversion scores in the seizure-onset groups were compared with the mean of each scale using 1-sample \(t\) tests. Differences in personality between the seizure-onset groups were then examined using 1-way analysis of variance with planned orthogonal contrasts comparing patients with seizure onset during adolescence with those with seizure onset during other developmental phases. To examine the influence of personality traits on adjustment to intractable epilepsy, patients with Neuroticism and Extraversion scores above the mean of the normative data (high neuroticism and high extraversion) were compared with those with scores at or below the mean (low neuroticism and low extraversion) for the mood and psychosocial variables using multivariate analyses of variance and \(x^2\) analyses.

**RESULTS**

**IDENTIFYING DEVELOPMENTAL PERIODS OF SEIZURE ONSET**

Visual inspection of the dendrogram obtained from hierarchical cluster analysis showed 4 empirically derived
developmental clusters of seizure onset within the data. These clusters demonstrated distinct age ranges that naturally mapped onto 4 phases of development across the lifespan, namely, infancy (0-3 years), childhood (6-12 years), adolescence (13-21 years), and adulthood (>21 years). The medical characteristics of these developmental groups did not differ according to a history of febrile convulsions, estimated seizure frequency, or the experience of secondarily generalized seizures before surgery, and the laterality or site of the seizure focus (P > .05 for all comparisons; Table). Patients with mesial temporal seizure foci did not differ from those with nonmesial foci insofar as level of neuroticism or extraversion (P > .05 for both comparisons).

**DEVELOPMENTAL INFLUENCE OF SEIZURE ONSET ON PERSONALITY**

The infant, child, and adult developmental seizure-onset groups exhibited mean Neuroticism scores comparable to normative data (P > .05 for all comparisons) (Figure 1). In contrast, seizure onset during the self-defining period of adolescence was associated with higher Neuroticism scores than in the general population (P < .05). All groups had mean Extraversion scores comparable to the norm (P > .05 for all comparisons; Figure 1).

The group with adolescent seizure onset had a higher mean Neuroticism score than the group with infancy seizure onset (P = .02), whereas there was no difference between the groups with adolescent and childhood seizure onset or adolescent and adult seizure onset (P > .05; Figure 1). For Extraversion scores, there were no significant differences between the developmental seizure-onset groups (P > .05 for all comparisons; Figure 1).

**ROLE OF PERSONALITY IN ADJUSTMENT TO INTRACTABLE EPILEPSY**

Assessing the influence of personality traits on adjustment to intractable epilepsy revealed that patients with high neuroticism and low extraversion had higher depression ratings (P = .004; Figure 2). Patients with high neuroticism and low extraversion had higher depression scores. Scores higher than 13 on the Beck Depression Inventory–II indicate depressive symptoms.11

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### Table. Medical Characteristics of the 4 Developmental Seizure-Onset Groups

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Infancy (n=12)</th>
<th>Childhood (n=14)</th>
<th>Adolescence (n=17)</th>
<th>Adulthood (n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Febrile convulsion</td>
<td>5 (41.7)</td>
<td>5 (35.7)</td>
<td>3 (17.7)</td>
<td>3 (21.4)</td>
</tr>
<tr>
<td>Seizure frequency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily</td>
<td>1 (8.3)</td>
<td>5 (35.7)</td>
<td>6 (35.3)</td>
<td>2 (14.3)</td>
</tr>
<tr>
<td>Weekly</td>
<td>8 (66.7)</td>
<td>6 (42.9)</td>
<td>7 (41.2)</td>
<td>8 (57.1)</td>
</tr>
<tr>
<td>Monthly</td>
<td>3 (25.0)</td>
<td>3 (21.4)</td>
<td>4 (23.5)</td>
<td>4 (28.6)</td>
</tr>
<tr>
<td>Secondarily generalized seizures</td>
<td>5 (41.7)</td>
<td>6 (42.9)</td>
<td>9 (52.9)</td>
<td>7 (50.0)</td>
</tr>
<tr>
<td>Laterality of seizure focus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left</td>
<td>10 (83.3)</td>
<td>9 (64.3)</td>
<td>11 (64.7)</td>
<td>9 (64.3)</td>
</tr>
<tr>
<td>Right</td>
<td>2 (16.7)</td>
<td>5 (35.7)</td>
<td>6 (35.3)</td>
<td>5 (35.7)</td>
</tr>
<tr>
<td>Site of seizure focus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temporal</td>
<td>9 (75.0)</td>
<td>10 (71.4)</td>
<td>14 (82.3)</td>
<td>11 (78.6)</td>
</tr>
<tr>
<td>Extratemporal</td>
<td>3 (25.0)</td>
<td>4 (28.6)</td>
<td>3 (17.7)</td>
<td>3 (21.4)</td>
</tr>
</tbody>
</table>

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Figure 1. Box-and-whisker plots of the Neuroticism and Extraversion scores of the 4 developmental seizure-onset groups relative to normative means based on 1571 cases.9

Figure 2. Estimated marginal means show the interaction between Neuroticism, Extraversion, and Depression scores. Patients with high levels of neuroticism (above the general population) and low levels of extraversion (at or below the general population) had higher depression scores. Scores higher than 13 on the Beck Depression Inventory–II indicate depressive symptoms.11
low neuroticism (mean [SD], 35.74 [8.28]; P = .05). The psychosocial variables indicated that 16 of 33 patients with high neuroticism (48%) experienced difficulties with family dynamics in the context of living with intractable seizures compared with 3 of 24 patients with low neuroticism (13%) (P = .004). There were no other significant psychosocial effects (P > .05 for all comparisons).

The findings of the present study provide initial evidence of the effect of chronic neurologic illness on the development of characteristics of the self. The data showed that patients with onset of regular seizures during adolescence had higher Neuroticism scores in adulthood compared with normative data, whereas scores in the remaining 3 seizure-onset groups (infancy, childhood, and adulthood) did not differ from those of the general population. We also found that higher Neuroticism scores, particularly when accompanied by lower Extraversion scores, predisposed to poorer adjustment to intractable epilepsy as reflected by impaired mood and family functioning.

Previous research has suggested that, although personality is relatively stable over the lifespan, it can change in response to both genetic and environmental factors. It is well recognized that the developmental period of adolescence can be a time of turbulent change in which individuation of the self is a key developmental task. In achieving this task, the individual may discard aspects of identity derived from parents and significant others, allowing the self to emerge through a process of “identity crisis.” This process occurs in the context of physical and secondary sexual changes as well as experimentation with new roles, in particular, those relating to social and vocational identities. One interpretation of our data is that onset of chronic seizures during this turbulent period poses challenges to successful resolution of identity tasks because of the prominence of uncertainties in physical health, predisposing to higher levels of the neuroticism trait. In contrast, seizure onset during infancy was associated with lower Neuroticism scores, possibly reflecting that these individuals have lived with seizures all of their life. In this sense, they may have fully incorporated epilepsy into the self, “knowing no difference.” This finding warrants more detailed research investigation.

The findings of the present study are consistent with research outside of the field of epilepsy that shows a relationship between higher neuroticism and dysfunctional family dynamics, which, in turn, have been associated with poorer overall adjustment and higher levels of depression. More recently, high neuroticism has been proposed as a strong risk factor for major depression, acting as a potential marker for genetic liability for depression. The association between neuroticism and depression has been linked to common neurobiological mechanisms including neuroendocrine changes in hypothalamic-pituitary-adrenal function, neuroanatomical changes in the mesial temporal lobe and anterior cingulate cortex, and alterations in neurotransphin and serotonergic systems. Similar alterations in neurobiological mechanisms have been proposed to account for the high comorbidity of depression in patients with temporal lobe epilepsy. Although the present study did not systematically investigate the contribution of neuroticism to the comorbidity of depression and temporal lobe epilepsy, most patients (44 of 57 [77%]) had a diagnosis of temporal lobe epilepsy, providing an important avenue for future research.

Of further interest was the finding that patients with higher neuroticism were more likely to experience symptoms of depression only if they also had lower extraversion. An interaction between high neuroticism and low extraversion (introversion) has been reported to account for genetic liability to certain psychiatric disorders such as social phobia. In the present study, extraversion seemed to be protective against the adverse effects of high neuroticism, lessening adjustment difficulties. Furthermore, the lack of difference between the developmentally based seizure-onset groups in Extraversion scores comparative to each other and the normative data highlights the selectivity of the effect of illness onset on the development of characteristics of the self. In particular, it points to the influence of illness on features of self-identity that fundamentally mediate the expression of psychological distress.

An individual’s adjustment to chronic neurologic illness can be considered in terms of indicators of risk or vulnerability to difficulties and resilience in the face of such difficulties. In the present study, indicators of vulnerability to poor adjustment included the extent to which epilepsy affected the development of the self, with onset of regular seizures during the self-defining period of adolescence posing the greatest risk as seen by higher levels of neuroticism. Higher levels of neuroticism predisposed to greater levels of psychological distress, notably, anxiety and depression, and impaired family functioning. In the context of these risk factors, extraversion seemed to act as a marker of resilience, buffering the risk of depression. Clinically, the findings are relevant to understanding patient adjustment to common neurologic illnesses such as epilepsy. They have implications for the provision of psychologically informed treatments by providing insight into the role of chronic neurologic illness in the development of the self.

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Author Contributions: Dr Wilson had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Wilson. Acquisition of data: Wilson and Wrench. Analysis and interpretation of data: Wilson, Wrench, McIntosh, Bladin, and Berkovic. Drafting of the manuscript: Wilson and Wrench. Critical revision of the manuscript for important intellectual content: Wilson, Wrench, McIntosh, Bladin, and Berkovic. Sta-
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REFERENCES