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RESEARCH ARTICLE

Personality and Mental Health

Influence of personality profile in patients with drug-resistant epilepsy on quality of life following surgical treatment: A 1-year follow-up study

Elena Iurina[1] | **Eva Bailles**[2] | **Mar Carreño**[3,4,5] | **Antonio Donaire**[3,4,5] | **Jordi Rumià**[3,4] | **Teresa Boget**[3,4,5] | **Núria Bargalló**[4,5] | **Xavier Setoain**[3,4,5,6] | **Pedro Roldan**[3,4] | **Estefanía Conde-Blanco**[3,4,5] | **María Centeno**[3,4,5] | **Luis Pintor**[3,4,5,7]

[1]Department of Psychiatry and Forensic Medicine, Autonomous University of Barcelona (UAB), Barcelona, Spain

[2]Mental Health Service, Nostra Senyora de Meritxell Hospital, Les Escaldes, Andorra

[3]Clinical Institute of Neurosciences, Hospital Clinic of Barcelona, Barcelona, Spain

[4]Epilepsy Unit, Hospital Clinic of Barcelona, Barcelona, Spain

[5]Biomedical Research Institute August Pi i Sunyer (IDIBAPS), Hospital Clinic of Barcelona, Barcelona, Spain

[6]Biomedical Imaging Group, Biomedical Research Networking Center in Bioengineering, Biomaterials and Nanomedicine (CIBER-BBN), Barcelona, Spain

[7]Department of Medicine, University of Barcelona (UB), Barcelona, Spain

Correspondence
Elena Iurina, Department of Psychiatry and Forensic Medicine, Autonomous University of Barcelona (UAB), Barcelona 08007, Spain.
Email: iurinaelena1990@gmail.com

Abstract

The objectives of this study are to determine the influence of personality profile in patients with drug-resistant epilepsy on quality of life (QoL) after surgical treatment and compare the results with a non-surgical control group at the 1-year follow-up. We conducted a prospective, comparative, controlled study, including 70 patients suffering from drug-resistant epilepsy. Demographic, psychiatric, neurological, and psychological data were recorded at the baseline and at the 1-year follow-up. Assessment of personality dimensions was performed using the NEO-FFI-R questionnaire; severity of anxiety and depression were assessed by the Hospital Anxiety and Depression Scale (HADS), and QoL was evaluated using the QOLIE-31. At the 1-year follow-up, comparing the control and the surgical groups, we detected differences in scores of most items of QoL, which were higher in those patients who had undergone surgery. High levels of Conscientiousness and Openness to experience at the baseline in patients who underwent surgery predicted better post-surgical outcomes in the QoL scores, whereas high neurotic patients showed worse QoL results. Postoperative changes in QoL in patients were associated with the personality profile at the baseline. QoL measures significantly improved in the surgical group compared with the non-surgical group but were not associated with baseline or postoperative seizure frequency at 1 year.

INTRODUCTION

Epilepsy is associated with a high burden on health care and low quality of life (QoL) index in patients (Deleo et al., 2020). Not only the disease itself, but the social stigma, side effects of anti-seizure medications, high level of psychiatric, and other clinical comorbidity contribute to the low level in QoL scores in patients (Paschal

et al., 2007). However, QoL depends on individual perception, which, in turn, develops from an individual's personality (Ramanaiah et al., 1997). Personality profile correlates with the QoL of patients suffering from epilepsy according to the literature (Rassart et al., 2020; Rose et al., 1996; Shamsi et al., 2020).

Surgical therapy is a treatment of choice in refractory epilepsy cases, which can lead to a seizure-free outcome and improve QoL. If the personality profile in patients suffering from epilepsy influences their QoL during the disease, it can also affect the QoL perception following recovery due to surgical treatment. Indeed, the results of the research of *Rose and colleagues* (Rose et al., 1996) showed that preoperative neuroticism had an important influence on postoperative psychosocial adjustment and health-related QoL, which did not depend on the postoperative seizure outcome. Patients with high neuroticism and low extraversion were predisposed to greater depression after surgery; high neuroticism was also associated with disrupted family dynamics following surgical treatment (Wilson et al., 2010).

This study aims to determine the possible contribution of personality profile in patients with drug-resistant epilepsy to changes in the QoL following surgical treatment and to compare the results with the non-surgical control group at the 1-year follow-up.

METHODS

Design

A prospective, comparative, controlled study was carried out in which a surgical group of drug-resistant epilepsy patients was compared with a control group, composed of refractory epilepsy patients treated with anti-seizure medications. Both groups were followed up during 1 year after being included in the study.

Setting and participants

This study was conducted at the Hospital Clinic of Barcelona from November 2013 to May 2018 and was approved by the Hospital Ethics Committee. Subjects were recruited from our Epilepsy Unit of the Neurology Service, which receives referrals from the whole of Spain because our center is one of the hospitals in Spain, where patients can receive surgical treatment of refractory epilepsy. The flow chart in Figure 1 shows the recruitment process.

A statistical software to calculate sample size was used (SPSS Sample Power 3.0.1, Armonk, NY: IBM Corp.). We assumed that the mean difference in QOLIE-31 scores is 7.3 (corresponding to means of 52.9 in

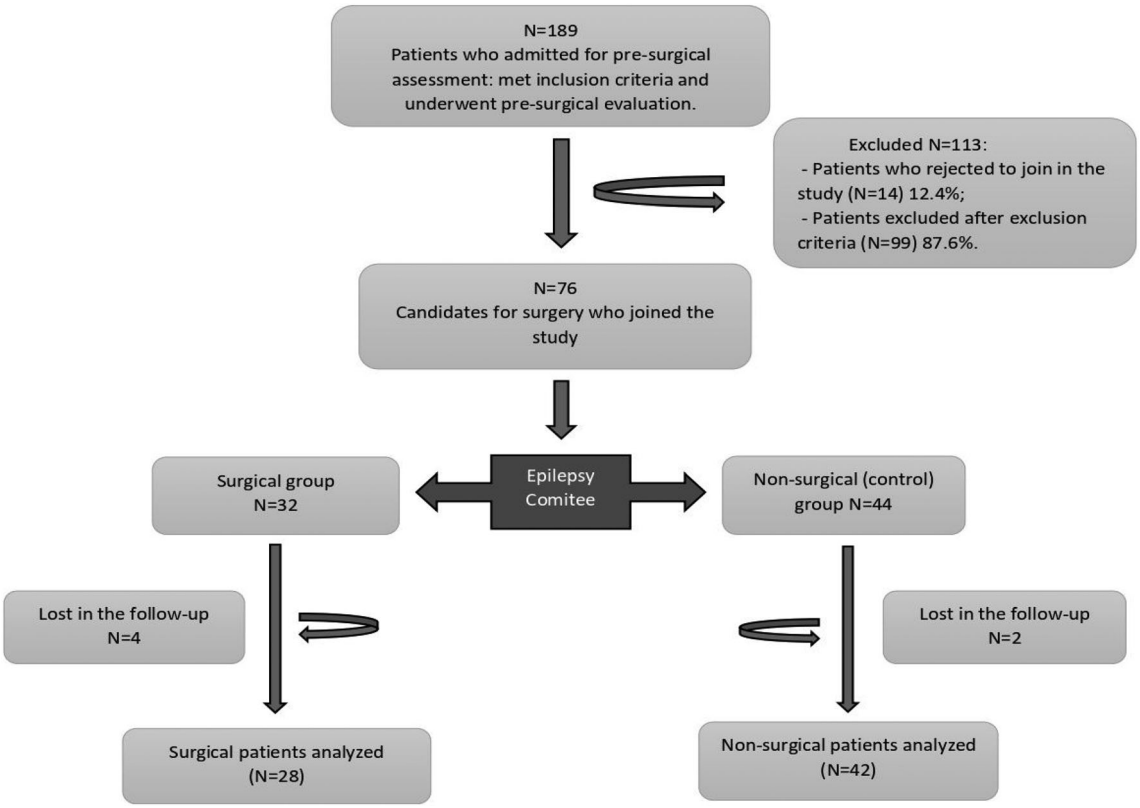

FIGURE 1 Flow chart showing the recruitment process

surgical group versus 45.6 in non-surgical group) and the pooled within-group standard deviation is 10.8 (based on SD = 10.2 and $N = 69$ in surgical group and SD = 12.2 and $N = 29$ in control group) (Elliott et al., 2012). A maximum acceptable error of 5% was applied. We obtained a sample size of 39 cases for each group with an 80% confidence.

Our sample size (28 and 42 patients in each group) has the statistical power of 73%.

The general evaluation protocol consisted of the following points: All participants signed informed consent; the patients were evaluated to confirm the diagnosis of refractory epilepsy according to the International League Against Epilepsy protocol (Scheffer et al., 2017) and were assessed for the possibility of surgical intervention. Suitability for surgery was decided by the epilepsy committee at a weekly meeting based on the complete protocol outcomes, such as results of clinical examination, neuropsychological tests, video-EEG, magnetic resonance imaging (MRI) with gadolinium, and invasive methods like brain electrodes surgically implanted in a cortical subdural way, or with depth electrodes. The most important exclusion criteria were a failure to determine accurately the epileptogenic focus or to find an epileptogenic zone pretty enough dangerous to foster severe functional damage after surgery. Anyway, every patient is always evaluated in a personalized manner.

Inclusion criteria of the study were the following: age 18 years or older, no history of neurosurgery, a full-scale IQ score of 70 or higher, absence of serious medical pathology except epilepsy, including dementia, schizophrenia or other chronic psychosis, and non-epileptic psychogenic seizures. Patients who presented with any of the following comorbidities were excluded: severe medical pathology, severe dementia, nonepileptic seizures, previous surgery for epilepsy, and intellectual disability that would prevent patients answering all questionnaires on their own. Those, who met the inclusion criteria of the study, but had contraindications for the surgical treatment according to the decision of the multidisciplinary team of the Epilepsy Committee, formed the control group.

Clinical assessments

Demographic, clinical, psychiatric, and psychological variables were collected. The demographic data collection sheet included age, gender, education, occupation, and marital state; clinical data included information about etiology of epilepsy, localization, and lateralization of epileptogenic foci, number of seizures at the beginning of the disease, number of seizures in the last 6 months, and age of the epilepsy onset. The Spanish version of Hospital Anxiety and Depression Scale (HADS) was applied for evaluating depression (HAD-D) and anxiety (HAD-A) (Herrero et al., 2003). It contains 14 items, 7 of which are for self-assessing the level of depression and 7 for anxiety. Every subscale should be scored by the patient from 0 to 3 according to the severity of the item. Accordingly, the patient can score from 0 to 21 points on each scale. More than 10 points out of 21 in every subscale is considered as a probable indicator of clinical anxiety or depression.

Evaluations of personality dimensions and QoL were performed by a clinical psychologist using NEO-FFI-R (Aluja et al., 2005), and the Spanish version of the QOLIE-31 scale was applied to evaluate the QoL in the patients (Torres et al., 1999).

The revised NEO Five-Factor Inventory (NEO-FFI) is a short version of the Revised NEO Personality Inventory (NEO-PI-R) questionnaire and has 60 items (12 per domain) for self-assessing the five major personality dimensions: neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness. The patient had to indicate his/her degree of agreement with the statement using a score from 0 to 4 from "total disagreement" to «totally agree», respectively. The minimum score for each domain is 0, and the maximum is 48.

The QOLIE-31 is a valid and reliable measure of QoL in patients with epilepsy. It is a self-reported questionnaire comprising two factors (emotional and psychological effects and medical and social effects), seven subscales, and 31 items. Items are measured on 4- to 6-point Likert scales, with a maximum total score of 100. Higher scores indicate a better QoL.

These measures were given during routine clinical follow-up as part of psychological and psychiatric assessment at 12 months.

Procedure

All patients with drug-resistant epilepsy who decided to undergo surgery were admitted for a wider study to which they gave informed consent. Patients were referred for admission to the neurology ward for a 1-week evaluation. After presurgical evaluation, the committee board made a decision on the suitability or not of surgical intervention.

Those, who had contraindications for surgical intervention, formed the control group and underwent all assessment procedures at the same time intervals, respectively, to the surgical intervention group at the baseline and 1 year after surgery. During the follow-up period, patients were maintained on a stable medication regimen. The postoperative evaluation at the 1-year

TABLE 1 Sociodemographic variables at baseline and differences between groups

	Whole sample group ($n = 70$)			Surgical group ($n = 28$)			Control group ($n = 42$)			Differences between surgical and control group, p value
	%	Mean	SD	%	Mean	SD	%	Mean	SD	
Sociodemographic										
Age		36.94	10.93		35.00	8.49		38.24	12.22	0.195
Gender:										
Women	55.7			53.6			57.1			0.810
Men	44.3			46.4			42.9			
Education:										
Basic education	45.7			46.4			45.2			0.898
Secondary education	37.1			39.3			35.7			
Higher education	17.1			14.3			19			
Occupation:										
Inactive	28.6			14.3			38.1			0.075
Housewife/student	21.4			21.4			21.4			
Active	50			64.3			40.5			
Marital state:										
Married	57.1			64.3			52.4			0.576
Separated/widow/ers	12.9			7.1			16.7			
Single	28.6			28.6			28.6			
No data	1.4			0			2.4			
Neurologic										
Idiopathic etiology	60.0			64.3			57.1			1.000
Type of seizures:										
No seizures	1.4			0			2.4			0.649
Focal onset impaired awareness seizures	50.0			57.1			45.2			
Other focal onset seizures	15.7			14.			16.7			
Unknown onset tonic–clonic seizures	20			14.3			23.8			
Generalized seizures	10.0			14.3			7.1			
Locus:										
Temporal	57.1			64.3			52.4			0.693
Extratemporal	24.3			25.0			23.8			
Unestablished	15.7			10.7			19			
Hemisphere:										
Right	44.3			42.9			45.2			0.406
Left	37.1			46.4			31			
Bilateral	12.9			7.1			16.7			
Unknown	1.4			0			2.4			
		193.6	180.34		139.57	120.77		229.62	204.46	0.068

TABLE 1 (Continued)

	Whole sample group ($n = 70$)			Surgical group ($n = 28$)			Control group ($n = 42$)			Differences between surgical and control group, p value
	%	Mean	SD	%	Mean	SD	%	Mean	SD	
Age (month) of epilepsy onset										
Number of seizures at the baseline (per month)		21.11 Median:7.0; IQR: 25.5	35.71		26.04 Median: 9.0; IQR: 25.8	37.52		17.83 Median:6.0; IQR: 16.0	34.52	0.040*
Psychiatric assessment										
HADS scale:										
HADS-depression		3.93	3.41		4.59	4.09		3.49	2.86	0.308
HADS-anxiety		6.59	3.52		7.33	3.89		6.10	3.21	0.203
Psychological assessment:										
QOLIE:										
Seizure worry		45.65	9.67		45.17	9.51		45.72	10.05	0.734
Overall quality of life		45.78	8.33		44.06	8.91		46.76	7.95	0.157
Emotional well-being		46.08	10.01		46.41	10.83		45.68	9.68	0.824
Energy/fatigue		50.45	8.34		49.12	8.50		50.89	8.02	0.277
Cognitive function		47.17	11.64		44.56	11.54		48.65	11.70	0.125
Medication effects		48.40	9.33		47.78	9.37		48.73	9.67	0.647
Social functioning		42.67	9.39		40.82	10.15		43.68	8.82	0.179
Total quality of life		44.40	9.77		42.26	10.12		45.90	9.49	0.140
NEO:										
Neuroticism		25.53	6.85		26.66	6.90		24.78	6.77	0.264
Extraversion		26.61	5.90		25.87	6.30		27.10	5.65	0.395
Openness to experience		27.55	6.27		27.46	6.51		27.60	6.19	0.923
Agreeableness		32.73	5.07		33.82	5.36		32.00	4.79	0.141
Conscientiousness		32.48	5.90		33.45	6.95		31.84	5.86	0.267

Note: Groups are similar to each other in presurgical evaluation in demographic, psychiatric, neurological, and neurosurgical variables, except the number of seizures per month—this variable was higher in the surgical group.

Abbreviation: IQR, interquartile range.

*$p < 0.05$. **$p < 0.001$.

follow-up involved psychiatric evaluation (HADS) and clinical psychology assessment (QOLIE). Postsurgical seizure outcome was determined during the follow-up visits by the treating neurologist 1 year after surgical intervention.

STATISTICAL ANALYSIS

Statistical analysis was performed using Version 22 of SPSS for Windows, and differences were considered significant at $p < 0.05$.

Distributions of variables were examined by Kolmogorov–Smirnov test for the whole sample and by Shapiro–Wilk test for each group. Appropriate tests were applied for further analysis. Data were analyzed with an intention-to-treat approach to see if drop-out patients were different from the patients who finished the follow-up. Descriptive analysis of all variables was performed at the baseline. The group of controls and the surgical group were compared with detect initial differences between groups, using a Student's t test, Fisher's exact test, and Mann–Whitney U test, according to the type of every variable and its distributions. Also, both groups were

compared at the 1-year follow-up in HADS, QoL, and seizure frequency. Changes in mood, QoL, and seizure frequency at the 1-year follow-up were evaluated by Student's *t* test or Mann–Whitney *U* test. Those variables of mood and QoL tests, that reached statistical significance at the 1-year follow-up, were introduced into regression analyses. Pearson or Spearman correlation analysis was applied to determine the contribution of each variable of personality in changes in mood and QoL. We conduct an exploratory study aiming to discover potential correlations between personality at the baseline and changes in QoL after surgical treatment. Because the study is exploratory, we are rather interested in keeping the type II errors as low as possible; thus, we do not use any corrections for multiple testing.

RESULTS

Of 80 eligible patients, 70 completed the neuropsychiatric assessment at the 1-year follow-up. There were no statistical differences in sociodemographic, clinical, and neuropsychiatric variables between included patients and patients who did not complete the 1-year follow-up ($n = 10$). The final sample consisted of 28 patients who underwent surgery and 42 patients who were not suitable for the surgical treatment (control group).

Descriptive analysis at baseline and comparison between groups

Sociodemographic, clinical, and neuropsychiatric variables at the baseline in the whole sample and the differences between the groups are shown in Table 1: Groups are similar to each other in presurgical evaluation in demographic, psychiatric, and neurological variables, except the number of seizures per month—this variable was higher in the surgical group (Mean = 26.06, SD = 37.52) compared with the controls (Mean = 17.83, SD = 34.52; $p = 0.040$*).

As differences in the number of seizures at the baseline (per month) were found, a comparison was made whether this variable affects the QoL. No correlations between QoL items and the seizure frequency were found in both groups of patients at the baseline.

Table 2 shows association of personality and QoL at the baseline in whole sample of patients: A higher score of Neuroticism was associated with worse QoL, and higher scores in Extraversion and Openness to experience connected with better QoL.

Table 3 demonstrates association between HADS and QoL at the baseline in the whole sample: Higher scores of HADS were associated with worse QoL.

TABLE 2 Association of personality and QoL at the baseline. Whole sample. Pearson or Spearman correlation

	Neuroticism	Extraversion	Openness to experience	Agreeableness	Conscientiousness
Seizure worry	$r = -0.170$	$r = 0.165$	$r = 0.085$	$r = 0.148$	$r = -0.179$
	$p = 0.161$	$p = 0.175$	$p = 0.488$	$p = 0.226$	$p = 0.141$
Overall quality of life	$r = -0.118$	$r = 0.197$	$r = -0.192$	$r = 0.059$	$r = -0.015$
	$p = 0.334$	$p = 0.104$	$p = 0.114$	$p = 0.630$	$p = 0.901$
Emotional well-being	$r = -0.393$	$r = 0.064$	$r = 0.270$	$r = 0.102$	$r = 0.184$
	$p = 0.001$**	$p = 0.600$	$p = 0.025$*	$p = 0.404$	$p = 0.130$
Energy/fatigue	$r = -0.362$	$r = 0.185$	$r = -0.120$	$r = -0.062$	$r = 0.069$
	$p = 0.002$*	$p = 0.129$	$p = 0.324$	$p = 0.613$	$p = 0.576$
Cognitive function	$r = -0.358$	$r = 0.222$	$r = 0.108$	$r = 0.114$	$r = 0.159$
	$p = 0.002$*	$p = 0.067$	$p = 0.377$	$p = 0.352$	$p = 0.193$
Medication effects	$r = -0.229$	$r = 0.120$	$r = -0.075$	$r = 0.075$	$r = 0.059$
	$p = 0.058$	$p = 0.324$	$p = 0.540$	$p = 0.540$	$p = 0.628$
Social functioning	$r = -0.389$	$r = 0.269$	$r = -0.007$	$r = 0.116$	$r = -0.006$
	$p = 0.001$**	$p = 0.025$*	$p = 0.956$	$p = 0.344$	$p = 0.958$
Total QoL	$r = -0.460$	$r = 0.291$	$r = 0.078$	$r = 0.125$	$r = 0.064$
	$p = 0.000$**	$p = 0.015$*	$p = 0.523$	$p = 0.307$	$p = 0.601$

Note: A higher score of Neuroticism was associated with worse QoL, and higher scores in Extraversion and Openness to experience connected with better QoL.
Abbreviation: QoL, quality of life.
*$p < 0.05$. **$p < 0.001$.

TABLE 3 Association between HADS and QoL at the baseline. Whole sample

	Seizure worry	Overall quality of life	Emotional well-being	Energy/fatigue	Cognitive function	Medication effects	Social functioning	Total QoL
HADS-anxiety	$r = -0.365$**	$r = -0.049$	$r = -0.420$**	$r = -0.367$**	$r = -0.277$*	$r = -0.214$	$r = -0.341$**	$r = -0.435$**
	$p = 0.002$	$p = 0.696$	$p = 0.000$	$p = 0.002$	$p = 0.023$	$p = 0.082$	$p = 0.005$	$p = 0.000$
HADS-depression	$r = -0.328$**	$r = -0.051$	$r = -0.250$*	$r = -0.286$*	$r = -0.432$**	$r = -0.213$	$r = -,435$**	$r = -0.483$**
	$p = 0.007$	$p = 0.685$	$p = 0.041$	$p = 0.019$	$p = 0.000$	$p = 0.084$	$p = 0.000$	$p = 0.000$

Note: Higher scores of HADS were associated with worse QoL.

Abbreviation: QoL, quality of life.

*$p < 0.05$. **$p < 0.001$.

Changes in 1-year follow-up and their associations with mood, personality, and seizure frequency

The meanings of QoL, HADS, and seizure frequency at the 1-year follow-up and their difference from baseline to the 1-year follow-up for each group (surgical and non-surgical) were described independently. The seizure frequency variable indicates the number of seizures per month. Also, these variables were compared between our groups of patients. The results are shown in Table 4.

The majority of patients (22 of 28; 78.6%) from the surgical group became seizure-free in the 1-year follow-up.

Table 4 shows that at the 1-year follow-up comparing the control and the surgical group, we detected differences in most items of QoL, which were higher in postoperative patients. HADS scores were higher in the control group, compared with the surgical group at the 1-year follow-up. Differences were observed in the seizure frequency between our groups of patients with higher scores in the controls. Analyses were performed to explore the associations of QoL changes and personality at the baseline (Table 5).

Table 5 shows a high baseline level of Conscientiousness in postoperative patients predicted a better outcome in three of eight QoL subscales (Overall QoL: $r = -0.530$, $p = 0.004$**, Social functioning: $r = -0.418$, $p = 0,030$*; Total QoL: $r = -0.499$; $p = 0.008$**) and high baseline level of Openness to experience scale predicted better outcome to one subscale (Medication effects: $r = -0.500$, $p = 0,008$**); high baseline score of Neuroticism predicted worse QoL outcome in one of eight QoL subscale (Overall QoL: $r = 0.382$; $p = 0.049$*).

A comparison was made to show whether significant changes in QoL or HADS from the baseline measurement to the 1-year time point were depended on the seizure frequency at the baseline, at the 1-year follow-up, and pre-post differences seizures frequency (Table 6).

Table 6 demonstrates that an increase in HADA in the 1-year follow-up in the control group correlated with seizure frequency in the 1-year follow-up ($r = -0.318$; $p = 0.046$*). The surgical group increased in 7 of 8 QoL scales, some of which correlated with seizure variables. An increase in item Seizure worry negatively correlated with seizure frequency at the 1-year follow-up ($r = -0.394$; $p = 0.042$*); positive changes in Energy/fatigue were negatively correlated with the seizure frequency at the baseline ($r = -0.383$; $p = 0.048$*). Also, an increase of this subscale was associated with good post-surgical seizure outcome (we used a variable that indicated a difference in the seizure frequency from the baseline to the 1-year follow-up): $r = -0.423$, $p = 0.028$*.

TABLE 4 Quantitative changes in variables of interest at the 1-year follow-up

	Surgical					Control					
	Results		Differences (baseline-1 year)			Results		Differences (baseline-1 year)			Differences between groups, *p* value
	Mean	SD	Mean	SD	*p*	Mean	SD	Mean	SD	*p*	
QOLIE:											
Seizure worry	57.93	8.23	−13.07	11.28	0.000**	48.72	12.45	−2.75	10.83	0.121	0.003**
Overall quality of life	53.37	10.84	−9.74	12.86	0.001**	43.55	11.95	2.93	13.39	0.180	0.002**
Emotional well-being	52.89	11.22	−6.39	11.63	0.005**	44.51	12.01	1.38	12.89	0.507	0.008**
Energy/fatigue	56.19	9.61	−7.18	11.10	0.002*	49.39	9.19	1.74	12.20	0.378	0.007**
Cognitive function	48.35	10.62	−3.35	10.32	0.104	47.43	12.48	1.20	9.94	0.457	0.813
Medication effects	52.69	7.96	−5.10	9.27	0.008**	48.09	10.48	0.87	10.95	0.621	0.059
Social functioning	49.52	9.24	−9.22	9.66	0.000**	43.83	10.09	−0.79	9.64	0.960	0.034*
Total QoL	53.31	11.14	−10.19	10.86	0.000**	44.47	11.94	1.10	11.10	0.539	0.012*
HADS scale											
HADS-depression	3.53	3.32	1.36	3.47	0.146	5.28	3.99	−1.68	4.29	0.015*	0.018*
HADS-anxiety	5.35	4.08	1.9	4.23	0.116	7.93	4.39	−1.51	3.78	0.016*	0.037*
Seizure frequency	0.96 Median: 0.0	2.99 IQR: 0.0	−25.07	37.81	0.000*	15.56 Median: 5.0	21.21 IQR: 12.5	−2.68	25.54	0.866	0.000**

Note: "Results" column shows Mean and standard deviations (also "Median" and "IQR" for seizure frequency variable) of the variables at the 1-year follow-up. The "Differences" column indicates the differences between meanings at the baseline and at the 1-year follow-up. At the 1-year follow-up comparing the control and the surgical group, we detected differences in most items of QoL, which were higher in the patients who underwent surgery. HADS scores were higher in the control group, compared with the surgical group at the 1-year follow-up. Differences in the seizure frequency between our groups of patients were observed, with higher scores in the controls.

Abbreviations: IQR, interquartile range; QoL, quality of life.

*$p < 0.05$. **$p < 0.001$.

Favorable changes in the subscale Medication effects negatively correlated with the seizure frequency at the 1-year follow-up ($r = 0.437$, $p = 0.023$*).

DISCUSSION

The present study aims to determine the possible influence of the personality profile in patients with drug-resistant epilepsy on QoL following surgical treatment and to compare the results with the non-surgical control group at the 1-year follow-up.

The most important outcome of our study was that patients with high baseline levels of Conscientiousness and Openness to experience showed better QoL outcomes following surgical treatment at the 1-year follow-up, whereas patients with high levels of neuroticism performed worse in the postsurgical QoL results.

Studying the influence of personality (MMPI-2 and Neuroticism dimension only from the NEO questionnaire were applied) in patients with drug-resistant epilepsy on changes in the QoL following surgery, the authors (Derry & Wiebe, 2000; Rose et al., 1996) reported that the neuroticism negatively influenced the QoL after surgery. These results are in the line with our research. We also find that Neuroticism was a predictor of a poor postsurgical QoL.

TABLE 5 Association of personality profile at the baseline and changes in subscales of QoL in the surgical group

	Neuroticism	Extraversion	Openness to experience	Agreeableness	Conscientiousness
Changes in seizure worry baseline/1-year follow-up	$r = -0.171$	$r = -0.119$	$r = 0.218$	$r = 0.141$	$r = -0.354$
	$p = 0.395$	$p = 0.555$	$p = 0.276$	$p = 0.484$	$p = 0.070$
Changes in overall quality of life baseline/1-year follow-up	$r = 0.382$*	$r = -0.201$	$r = -0.085$	$r = -0.167$	$r = -0.530$**
	$p = 0.049$	$p = 0.314$	$p = 0.673$	$p = 0.405$	$p = 0.004$
Changes in emotional well-being baseline/1-year follow-up	$r = 0.150$	$r = -0.130$	$r = -0.014$	$r = 0.000$	$r = -0.107$
	$p = 0.456$	$p = 0.517$	$p = 0.943$	$p = 0.999$	$p = 0.595$
Changes in energy/fatigue baseline/1-year follow-up	$r = 0.209$	$r = -0.158$	$r = -0.310$	$r = -0.306$	$r = -0.258$
	$p = 0.295$	$p = 0.432$	$p = 0.116$	$p = 0.120$	$p = 0.194$
Changes in cognitive function baseline/1-year follow-up	$r = -0.030$	$r = -0.155$	$r = -0.171$	$r = -0.171$	$r = -0.449$
	$p = 0.881$	$p = 0.439$	$p = 0.394$	$p = 0.395$	$p = 0.019$*
Changes in medication effects baseline/1-year follow-up	$r = -0.144$	$r = 0.079$	$r = -0.500$**	$r = 0.038$	$r = -0.081$
	$p = 0.474$	$p = 0.695$	$p = 0.008$	$p = 0.850$	$p = 0.689$
Changes in social functioning baseline/1-year follow-up	$r = -0.161$	$r = 0.106$	$r = 0.024$	$r = -0.059$	$r = -0.418$*
	$p = 0.421$	$p = 0.597$	$p = 0.904$	$p = 0.769$	$p = 0.030$
Changes in Total QoL baseline/1-year follow-up	$r = 0.043$	$r = -0.125$	$r = -0.118$	$r = -0.141$	$r = -0.499$**
	$p = 0.832$	$p = 0.536$	$p = 0.558$	$p = 0.483$	$p = 0.008$

Note: Patients with high baseline levels of Conscientiousness and Openness to experience showed better QoL outcomes following surgical treatment at the 1-year follow-up, whereas patients high in Neuroticism showed worse QoL.
*$p < 0.05$. **$p < 0.001$.

A higher score of Neuroticism was associated with a worse QoL in patients at the baseline in our research. These results correlated with the results obtained by the other researchers in studies with people with epilepsy (Margolis et al., 2018; Rose et al., 1996).

Talking about high scores of Conscientiousness and Openness to experience as a predictor of better postsurgical QoL in other diseases we can refer to research (Stanisz et al., 2020) studied women after prophylactic adnexectomy: higher levels of conscientiousness, openness to experience, extroversion, and agreeableness were associated with better QoL outcomes following surgical treatment. At the same time, highly neurotic patients had lower QoL.

Highly conscientious patients suffering from cardiovascular diseases tend to display higher satisfaction with life in a longitudinal study in 9 months follow-up (Tabernero et al., 2019).

Why do people with high levels of neuroticism show low scores of QoL?

High levels of neuroticism are typically associated with pessimism, vulnerability to stress, and high negative affectivity (Afshar et al., 2015). Neurotic patients frequently use maladaptive coping strategies in dealing with illness-related challenges, such as avoidant or passive coping strategies.

It seemed that some personality traits, such as conscientiousness, openness to experience, extroversion, and agreeableness, protect the QoL in patients, and potentially favorable attributes can sometimes reinforce negative tendencies.

Indeed, according to the researches with healthy people, individuals high in Openness and Conscientiousness tend to engage in more adaptive and flexible coping in the face of stress (Lee-Baggley et al., 2005; Watson & Hubbard, 1996). People high in conscientiousness may achieve more goals, as they tend to persist when faced with illness-related constraints, potentially resulting in a better QoL. In addition, people high in conscientiousness are typically described as attentive, organized, and planful. Surgical treatment in particular, and the burden of the disease in general, suppose an increase in stress, and high levels of these personality features are predictors of good coping with stress in a longitudinal period.

These characteristics might make it more difficult for patients to cope with epilepsy-related factors like social isolation, restrictions in work and study activities, stigma, and many others and affect the QoL significantly.

This is confirmed by our results that QoL at the baseline was associated with personality and HADS but not with the seizure frequency. *Gilliam* (Gilliam, 2002) reported no association between seizure frequency and QoL in patients suffering from epilepsy.

TABLE 6 Association of significantly changed variables of interest and seizure frequency variables at the 1-year follow-up

Control group Spearman correlation			
	Seizure frequency at the baseline	**Seizure frequency at the 1-year follow-up**	**Changes in seizure frequency baseline/1-year follow-up**
Changes in HADA baseline/1-year follow-up	$r = -0.154$; $p = 0.342$	$r = -0.318$; $p = 0.046$*	$r = 0.269$; $p = 0.193$
Changes in HADD baseline/1-year follow-up	$r = -0.286$; $p = 0.073$	$r = -0.270$; $p = 0.092$	$r = -0.373$; $p = 0.066$
Surgical group			
	Seizure frequency at the baseline	**Seizure frequency at the 1-year follow-up**	**Changes in seizure frequency baseline/1-year follow-up**
Changes in seizure worry baseline/1-year follow-up	$r = 0.131$; $p = 0.515$	$r = -0.394$; $p = 0.042$*	$r = -0.053$; $p = 0.792$
Changes in overall quality of life baseline/1-year follow-up	$r = -0.131$ $p = 0.515$	$r = 0.260$ $p = 0.190$	$r = -0.199$ $p = 0.320$
Changes in emotional well-being baseline/1-year follow-up	$r = -0.250$ $p = 0.208$	$r = 0.119$ $p = 0.556$	$r = -0.333$ $p = 0.089$
Changes in energy/fatigue baseline/1-year follow-up	$r = -0.383$ $p = 0.048$*	$r = 0.232$ $p = 0.243$	$r = -0.423$ $p = 0.028$*
Changes in medication effects baseline/1-year follow-up	$r = -0.015$ $p = 0.941$	$r = 0.437$ $p = 0.023$*	$r = -0.134$ $p = 0.505$
Changes in social functioning baseline/1-year follow-up	$r = -0.097$ $p = 0.631$	$r = 0.246$ $p = 0.215$	$r = -0.198$ $p = 0.322$
Changes in total QoL baseline/1-year follow-up	$r = -0.201$ $p = 0.314$	$r = 0.307$ $p = 0.119$	$r = -0.324$ $p = 0.099$

Note: An increase in HADA in the control group correlated with seizure frequency in the 1-year follow-up. The surgical group increased in 7 of 8 QoL scales; some of which correlated with seizure variables.

Abbreviation: QoL, quality of life.

*$p < 0.05$. **$p < 0.001$.

Research (Endermann & Zimmermann, 2009) concluded that neuroticism had more impact on the QoL than seizure frequency in people with epilepsy.

Johnson et al. (2004) reported on seizure frequency reduces QoL but appears less powerful predictor of QoL than HADS. Differences with our results could appear because different approaches for evaluating seizure severity were used: Johnson and colleagues applied The Liverpool Seizure Severity Scale. Also, differences occur in the sample: Patients with temporal lobe epilepsy only were included in their study.

Some authors reported on the association of QoL with seizure frequency and depression (Mehta et al., 2014; Villeneuve, 2004). *Mehta with colleagues* (Mehta et al., 2014) reported on the association of 3 of 8 QoL scales with seizure frequency and 7 of 8 QoL scales with depression level. The authors evaluated seizure frequency by three levels (0, 1, or >1) rather than as a continuous variable. Also, the study is limited by the small sample size ($n = 31$).

Villeneuve (2004) reviewed articles evaluated quality-of-life scales for patients with drug-resistant partial epilepsy in his study. The analysis of the literature identified 22 articles focusing on the impact of epilepsy on QoL in adults. Different QoL scales were reviewed, and QOLIE-31 was applied in one reviewed study only. The author reported that being seizure free is necessary but not enough to have a good level of QoL. Also, the study concluded QoL scores were lesser in depressed patients, which is in the line with our results.

Thus, it seems that the QoL depends more on the individual perception of stress, and coping strategies, which is mediated by the personality characteristics and mood, than on objective clinical factors in patients suffering from severe chronic diseases, for example, seizure frequency in patients with refractory epilepsy.

LIMITATIONS

The main limitation of this study occurs due to the small sample size. Due to ethical reasons, the distribution for groups of surgical treatment or controls depended on the patient's suitability and was not randomized. All psychological and psychiatric data were self-reported.

CONCLUSION

People with epilepsy with high baseline levels of Conscientiousness and Openness to experience showed better QoL outcomes following surgical treatment at the 1-year follow-up, whereas patients high in Neuroticism showed a worse QoL. The findings of the study show clinical psychologists, psychiatrists, and patients that some personality features can have an impact on postsurgical QoL. People being evaluated for surgical treatment for epilepsy who are identified as having vulnerable personalities should be offered appropriate psychological support.

CONFLICTS OF INTEREST

None of the authors has any conflict of interest to disclose.

ETHICS STATEMENT

This study was conducted at the Hospital Clinic of Barcelona from November 2013 to May 2018 and was approved by the Hospital Ethics Committee.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author, Elena Iurina, upon reasonable request.

ORCID

Elena Iurina https://orcid.org/0000-0002-0518-7447
Eva Bailles https://orcid.org/0000-0002-0561-6328
Mar Carreño https://orcid.org/0000-0001-9347-275X
Antonio Donaire https://orcid.org/0000-0002-7167-9124
Jordi Rumià https://orcid.org/0000-0002-8755-8124
Núria Bargalló https://orcid.org/0000-0001-6284-5402
Xavier Setoain https://orcid.org/0000-0001-8675-971X
Estefanía Conde-Blanco https://orcid.org/0000-0001-7436-987X
María Centeno https://orcid.org/0000-0003-4801-4535
Luis Pintor https://orcid.org/0000-0002-8730-7296

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