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Predictive factors for a good prognosis following surgery for temporal lobe epilepsy: a cohort study in Spain

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ABSTRACT – *Objective.* To investigate the outcome of temporal lobe epilepsy surgery and identify the variables which predict a good prognosis with respect to seizures in postoperative follow-up after two and four years. *Methods.* This retrospective study included 115 selected patients who underwent surgery for temporal lobe epilepsy between 1996 and 2007. *Results.* In the second year after surgery 86.1% of patients had a good prognosis for seizure control (73.9% Engel class I and 12.2% Engel class II) and 89.2% (76.3% Engel class I and 12.9% Engel class II) in the fourth year. Sixty-four of 93 (68.8%) patients were free of disabling seizures (Engel class I) during the entire period and 78 (83.8%) had good prognosis (Engel class I and II). For the second year, logistic regression analysis revealed the following variables to be independently predictive of good seizure control: absence of two or more seizure episodes in the first year after surgery, normal postoperative video-EEG, and age at surgery of less than 35 years. In the fourth year, mesial temporal sclerosis, female sex and normal postoperative video-EEG were the predictive factors. For the group with a good prognosis in both the second and the fourth year, the predictive variables were: absence of two or more seizure episodes in the first year after surgery (OR: 13.762, CI 95%: 2.566-73.808, $p<0.002$) and normal postoperative video-EEG (OR: 16.301, CI 95%: 3.704-71.740, $p<0.001$). *Discussion.* This study illustrates the sustained benefit of temporal lobe epilepsy surgery. The multivariate logistic regression analysis failed to identify a good predictive model composed of preoperative variables alone, although it was possible to build such a model with either pre- and postoperative variables or only postoperative variables.

Key words: seizures, mesial temporal sclerosis, epilepsy surgery, prognosis, predictors, temporal lobe

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The incidence of epilepsy in industrialised countries ranges from 24 to 53 cases per 100,000 people per year, while developing countries report 77 to 114 cases per 100,000 people per year (Hauser, 1997). Despite an optimal therapeutic regimen with antiepileptic drugs (AEDs), between 30 and 40% of epileptic patients will be seizure-free for no more than five years; these patients have so-called "drug-resistant" epilepsy (Aicardi and Shorvon, 1997; Hauser and Hesdorffer, 2001). Between 10 and 15% of these patients are potential candidates for surgical treatment (Guberman and Bruni, 1999).

Resective epilepsy surgery is mostly carried out for cases of symptomatic focal epilepsy and 70 to 90% of patients who have undergone surgery suffer from mesial temporal lobe epilepsy (Jallon and Loiseau, 2001). Of the patients with temporal lobe epilepsy, 49 to 80% of adults are drug-resistant and mesial temporal sclerosis is the primary cause, being responsible for between 65% and 70% of cases (Zumsteg *et al.*, 2006).

Depending on when and how measurements were performed, as well as the surgical procedure carried out, seizure outcome after temporal lobe epilepsy surgery varies between authors. The study by McIntosh *et al.*, (2001), reported that 64% of patients did not experience seizures causing impairment of consciousness one year after surgery and, furthermore, 42% were seizure-free. Other authors (Foldvary *et al.*, 2000) obtained satisfactory results for the control of seizures (Engel class I and II) in 80% of patients in the second year of follow-up.

Recently, an increasing number of studies have attempted to identify predictive variables which will guarantee appropriate selection of candidates for surgery to obtain the best postoperative results. However, there is so far no agreement on the key variables. In Spain, Villanueva *et al.*, (2004) reported the outcomes of 41 patients, based on the prognostic factor analysis according to Engel and ILAE (International League Against Epilepsy) postoperative seizure control classifications. In contrast to other series, one study (Sola *et al.*, 2005) reported a low rate of temporal mesial sclerosis cases (14%).

The objective of this study was to investigate the outcome of temporal lobe epilepsy surgery carried out in our hospital and to identify variables which are predictive of good seizure control in the second and fourth year of follow-up.

Methods

We studied retrospectively a cohort comprised of patients suffering from drug-resistant temporal lobe epilepsy, who underwent surgery at the Epilepsy Unit of Cruces Hospital between January 1996 and December 2007. Epilepsy was considered to be drug-resistant when at least two antiepileptic drugs used alone, and in combination, had failed to control seizures (*table 1*).

Preoperative evaluation included: neurological, psychiatric and neuropsychological assessment, epilepsy protocol magnetic resonance imaging (MRI) using a 1.5 Tesla resonator, computer-assisted campimetry, and long-term video-electroencephalography (video-EEG) which included recording of at least two seizures. If results were not conclusive, additional tests were carried out such as monitoring using foramen ovale electrodes, subdural grids and strip electrodes, MRI with a 3 Tesla machine, as well as positron emission tomography (PET) or single photon emission computed tomography (SPECT) in critical and/or intercritical phases. Finally, an interdisciplinary committee (composed of neurologists, neuropaediatricians, neurophysiologists, neurosurgeons, neuroradiologists, a psychiatrist and a neuropsychologist) decided whether the patients were appropriate candidates for surgery.

Possible surgical approaches included anterior temporal lobectomy (sparing the superior temporal gyrus) with the removal of the amygdala and hippocampus, or in cases of vascular malformations, tumour or dysplastic tissue, lesionectomy with or without removal of the amygdala and hippocampus.

Postoperative follow-up was carried out after one, three and six months and then yearly. MRI monitoring, 24-hour video-EEG, computer-assisted campimetry, and neuropsychological assessment were performed preferentially within the first year after surgery. Patients were excluded from the study if they presented extratemporal lesions on neuroimaging, if they were not monitored during the first two years after surgery and if they underwent surgery without following the preoperative protocol.

The studied variables were: sex, age at onset of seizures, age at the time of surgery, duration of epilepsy, physical examination, history of febrile convulsions (Freeman, 1980) and central nervous system infections, MRI findings of the brain, surgical technique, laterality of surgery, year of surgery, average number of seizures per month in the year prior to surgery, presence of typical ictal semiology of mesial temporal epilepsy (Wieser, 2004), presence of aura (Blume *et al.*, 2001), pre- and postoperative intelligence quotient (IQ), neurophysiological parameters based on video-EEG, location of intercritical epileptiform activity, frequency, location and spread of the initial ictal pattern, result of the postoperative video-EEG, invasive and semi-invasive monitoring, surgical re-intervention for epilepsy, presence of two or more seizures in the first year after surgery (excluding

Table 1. Characteristics of the cohort of patients who underwent surgery for temporal lobe epilepsy betweeen 1996 and 2007 (n=115).

Variable		**Number of cases (%)**	**Average (DS)**
Sex	Female	68 (59.1)	
	Male	47 (40.9)	
Age at onset of epilepsy			Median: 9 yearsIR: 14 years
Age at surgery			35.60 (11.58) years
Duration of epilepsy			23.77 (11.56) years
Medical history	Abnormal neurological	4 (3.5)	
	CNS Infection	15 (13)	
	Febrile convulsion	35 (30.4)	
Laterality of surgery	Right	53 (46.1)	
	Left	62 (53.9)	
MRI findings	Normal	7 (6.1)	
	Mesial Sclerosis	77 (67)	
	DNET	5 (4.3)	
	Other tumours	5 (4.3)	
	VM (vascular malformation)	3 (2.6)	
	Cortical dysplasia	6 (5.2)	
	Dual pathology	2 (1.7)	
	Non-conclusive	10 (8.7)	
Surgical technique	Anterior temporal lobectomy with amygdalo-hippocampectomy	105 (91.3)	
	Lesionectomy with/without removal of amygdala and hippocampus	10 (8.7)	
Preoperative IQ	Global		97.07 (16.73)
	Verbal		96.80 (16.67)
	Manipulative		96.48 (16.65)
Postoperative IQ	Global		98.90 (16.27)
	Verbal		97.96 (16.83)
	Manipulative		99.56 (15.34)
Average number of seizures/month			Median: 6 IR: 8
Typical semiology of mesial TLE		58 (50.4)	
Aura		66 (57.4)	
Video-EEG location of interictal discharges	Unitemporal	74 (64.3)	
	Right	32	
	Left	42	
	Bitemporal (independent)	34 (29.6)	
	Multifocal	5 (4.3)	
	Normal	2 (1.7)	

Table 1. (*Continued*)

Variable		Number of cases (%)	Average (DS)
EEG frequency of initial ictal pattern	<5Hz	15 (13)	
	5-8Hz in the first 30 seconds	88 (76.5)	
	5-8Hz after 30 seconds	7 (6.1)	
	>8Hz	4 (3.5)	
	Irregular	1 (0.9)	
Video-EEG location of ictal pattern	Unitemporal	103 (89.6)	
	Right	48	
	Left	55	
	Synchronous bitemporal	3 (2.6)	
	Not temporal location	5 (4.3)	
	No lateral discharges noted	2 (1.7)	
	Diffuse	2 (1.7)	
Video-EEG spread of ictal pattern		58 (50.4)	
Monitoring with additional electrodes	Foramen ovale electrodes	13 (11.3)	
	Subdural strips	3 (2.6)	
Surgical re-intervention for epilepsy		6 (5.2)	
Postoperative video-EEG	Normal	71 (61.7)	
	Abnormal	44 (38.3)	
Two or more seizure episodes in the first year after surgery		31 (27)	
Good prognosis at year 2 after surgery		99/115 (86.1)	
Good prognosis at year 4 after surgery		83/93 (89.2)	

seizures within the first month), results of the postoperative classification in the second and fourth year after surgery, and presence of complications and/or sequelae.

More specifically, the duration of epilepsy was measured from the first non-febrile seizure until surgery. Based on MRI, mesial sclerosis was defined as the presence of at least two of the following features: hippocampal formation volume loss, temporal lobe atrophy with involvement of the parahippocampal gyrus, volume loss in three-dimensional volumetry of the hippocampus, and T2 signal hyperintensity. The category "other tumours" corresponded to low grade tumours, all of which had no substantial growth effects and no evidence of recurrence at consecutive follow-up visits. The variable "typical semiology of temporal mesial epilepsy" included the four following phenomena: aura, arrest of activity, automatisms, and impairment of consciousness. IQ was established using the Wechsler Intelligence Scale. The location of interictal epileptiform activity was considered to be "independent bitemporal" when the presence of such activity was detected in both temporal lobes regardless of the relative involvement of each lobe. By "surgical re-intervention", we refer to those cases in which the resection was enlarged in a second intervention due to failure to control seizures, attributed to an initial incomplete resection of the hippocampus. In postoperative follow-up, seizure status was assessed using the Engel classification system (Engel *et al.*, 1993).

The cases were drawn from the archives of the Epilepsy Unit and corresponding data extracted from clinical histories, after obtaining verbal and written informed consent. Data analysis was carried out using SPSS 16.0 statistical software.

For the bivariate analysis, the dependant variable "prognosis" was categorised in the following way: "Good prognosis" for Engel class I and II patients, and "poor prognosis" for Engel class III and IV patients. In addition, other data were converted to dichotomic variables: the "NMR findings" variable was transformed by contrasting mesial temporal sclerosis with other cases; pre- and postoperative IQ by comparing scores which were either less than, greater than or equal to 90; "location of interictal discharges and location of the initial ictal pattern in the video-EEG" by comparing cases of unilateral temporal focus with the other cases; "frequency of the initial ictal pattern in the video-EEG" by comparing relative frequencies of 5-8 Mhz; "year of surgery" by comparing before or during the year 2000 with later times points; "age at onset of epilepsy" by comparing patients under the age of 11 years old with those aged 11 and older; "age at surgery" by comparing those aged 35 years and under with those over the age of 35; and "duration of epilepsy" by comparing duration of less than 23 years with greater than or equal to 23 years. For the last three variables the average was used as the cut-off point.

Categorical variables were characterised using frequency distributions and percentages, while measures of central tendency, such as the mean and median, and variability, such as standard deviation (SD) or inter-quartile range (IR), were used for quantitative variables. The mean and standard deviation was calculated for less asymmetric distributions and the median and inter-quartile range were calculated for asymmetric distributions. The comparison of proportions between categorical variables was performed using Pearson's Chi-square coefficient and corresponding corrections, such as Fisher's correction, when the expected frequencies were less than five.

Univariate logistic regression analysis was undertaken to identify which variables were associated with a good prognosis in the postoperative follow-up of seizure status. The variables found to be associated with a good prognosis ($p<0.200$) were included in a non-automatic stepwise multivariate logistic regression. Of all these variables, the one with the highest p value was removed from the model, and the logistic regression was performed again using the remaining variables. This process was repeated, each time removing the variable with the highest p value. The process was complete when all the variables used in the model were significant ($p<0.05$). Results are expressed as OR (odds ratio) and 95% CI (95% confidence intervals). The robustness of the model was assessed on the basis of the area under the ROC curve and the model assumptions checked using the residuals.

The study was approved by the institution's Ethics Committee.

Results

The cohort from the Epilepsy Unit of Cruces Hospital comprised 115 patients who underwent resective surgery for the treatment of temporal lobe epilepsy between 1996 and 2007 (inclusive). All patients met the presurgical selection criteria (as explained above). The patient characteristics are shown in *table 1*.

The cases of dual pathology included those with mesial sclerosis and cortical dysplasia, both involving the temporal lobe. The most commonly used surgical technique was anterior temporal lobectomy with removal of the amygdala and hippocampus. Lesionectomy was carried out in three cases and lesionectomy with removal of the amygdala and hippocampus in seven. In the three cases where additional monitoring with subdural strips was required, foramen ovale electrodes were also used.

Using the Engel classification to assess the control of seizures, the following was identified: at two years after surgery (n=115), 85 (73.9%), 14 (12.2%), 14 (12.2%) and 2 (1.7%) patients were classified as Engel Classes I, II, III and IV, respectively and at four years after surgery (n=93), 71 (76.3%), 12 (12.9%), 8 (8.6%) and 2 (2.2%) patients were classified as Engel Classes I, II, III and IV, respectively. Two patients were lost in the follow-up by the end of the fourth year due to death (in one case from a neck neoplasm and the other from brain haemorrhage due to head trauma caused by seizures). Twenty patients did not complete the four-year follow-up as they underwent surgery after 2005; of these patients, 16 were classified as Engel class I, two as class II, two as class III and no patients as class IV, after two years.

Of the 93 patients studied at both follow-up points, 64 (68,8%) were classified as Engel class I for the entire period and 78 (83,8%) had good prognosis (Engel class I and II). The percentage of patients with good prognosis for postoperative seizure control according to the MRI findings is shown in *table 2*. The groups of patients with the worst results included patients suffering from focal cortical dysplasia and those with non-conclusive recorded events. Logistic regression analysis using the variables associated with good postoperative prognosis was performed for the second and fourth years, as well as for the group with good prognosis.

The variables associated with a good prognosis for control of seizures in the second postoperative year, with a value of $p<0.05$, were "absence of two or more seizure episodes in the first year after surgery" and "normal

Table 2. Percentage of cases with a good prognosis in postoperative follow-up.

	Second year	Fourth Year	Maintained across both years
MRI findings	n=115	n=93	n=93
Normal	85.7%	100%	85.7%
Mesial temporal sclerosis	89.6%	95.2%	87.3%
DNET	100%	100%	100%
Other tumours	80%	75%	75%
Vascular malformations	100%	100%	100%
Cortical dysplasias	50%	60%	50%
Dual pathology	100%	100%	100%
Non-conclusive	70%	60%	60%

Table 3. Logistic regression with results from the second year after surgery. Variables associated with a good postoperative prognosis.

	Univariate analysis[a]			Multivariate analysis[b,c]		
	OR	**CI 95%**	**p**	**OR**	**CI 95%**	**p**
Absence of two or more seizure episodes in the first year after surgery	33.765	7.018-162.452	<0.001	39.627	5.683-276.317	<0.001
Unilateral ictal temporal location	-	-	0.052	-	-	-
Age at surgery >35 years	-	-	0.186	5.931	1.006-34.982	0.049
Normal postoperative video-EEG	36.207	4.569-286.933	0.001	31.553	3.072-324.057	0.004
Reintervention surgery	-	-	0.180	-	-	-
Surgery after year 2000	-	-	0.107	-	-	-
Unilateral interictal temporal location	-	-	0.071	-	-	-
Temporal mesial sclerosis from MRI	-	-	0.127	-	-	-

[a]Values with $p<0.200$ are shown. The odds ratio and the confidence interval of 95% are only given for variables with $p<0.05$.
[b]Only variables from the final multivariate logistic regression model are shown. [c]Area under the ROC curve: 0.940.

postoperative video-EEG" in the univariate analysis. The other variables were not statistically significant. However, in addition to the two variables mentioned above, the variable "age at surgery over 35 years old" was also statistically significant in the multivariate analysis *(table 3)*.
With respect to the fourth year of follow-up, the univariate analysis showed four variables associated with a good prognosis with statistical significance: "absence of two or more seizure episodes in the first year after surgery", "unilateral ictal temporal location", "mesial temporal sclerosis", and "normal postoperative video-EEG". In the multivariate analysis, the first two of these variables were not included but another, the variable "female", was included *(table 4)*.
The univariate analysis showed that in the group with good prognosis in both the second and fourth year after surgery, the following variables had statistical significance: "absence of two or more seizure episodes in the first year after surgery", "unilateral ictal and

Table 4. Logistic regression with results from the fourth year after surgery. Variables associated with a good postoperative prognosis.

	Univariate analysis[a]			Multivariate analysis[b,c]		
	OR	CI 95%	P	OR	CI 95%	p
Absence of two or more seizure episodes in the first year after surgery[d]	7.860	1.851-33.379	0.005	-	-	-
Mesial temporal Sclerosis	5.736	1.368-24.049	0.017	15.163	2.335-98.450	0.004
Unilateral ictal temporal location	5.500	1.125-26.897	0.035	-	-	-
Female	-	-	0.177	6.415	1.025-40.135	0.047
Presence of Aura	-	-	0.124	-	-	-
Normal postoperative video-EEG	7.857	1.563-39.501	0.012	32.156	3.661-282.432	0.002
Age at onset of the first seizure epiosode >10years	-	-	0.181	-	-	-
Surgery after year 2000	-	-	0.155	-	-	-

[a]Values with p<0.200 are shown. The odds ratio and the confidence interval of 95% are only given for variables with p<0.05.
[b]Only variables from the final multivariate logistic regression model are shown. [c]Area under the ROC curve: 0.854.
[d]Removed from the multivariate analysis in the last step with p=0.066.

Table 5. Logistic regression for the subgroup with a good prognosis at both the second and fourth year after surgery.

	Univariate analysis[a]			Multivariate analysis[b,c]		
	OR	CI 95%	p	OR	CI 95%	p
Absence of two or more seizure episodes in the first year after surgery	19.911	5.070-78.188	<0.001	16.301	3.704-71.740	<0.001
Unilateral ictal temporal location	4.554	1.078-19.237	0.039	-	-	-
Intercritical unilateral temporal location	4.511	1.509-13.486	0.007	-	-	-
Normal postoperative Video-EEG	17.187	3.643-81.089	<0.001	13.762	2.566-73.808	0.002
Surgery after year 2000	-	-	0.153	-	-	-
Mesial Temporal Sclerosis	-	-	0.081	-	-	-

[a]Values with p<0.200 are shown. The odds ratio and the confidence interval of 95% are only given for variables with p<0.05. [b]Only variables from the final multivariate logistic regression model are shown. [c]Area under the ROC curve: 0.912.

interictal temporal location", and "normal postoperative video-EEG". In the multivariate analysis, only the first and last of these variables demonstrated $p<0.05$ *(table 5)*.

The values of the area under the ROC curve of the logistic regression models in the second and fourth year, and in the group which maintained a good postoperative prognosis, were 0.940, 0.854 and 0.912 respectively.

In relation to the sequelae and complications after surgery, contralateral homonym quadrantanopsia was the most common (43 patients), followed by paresis of

Table 6. Sequelae and/or complications associated with surgery for temporal lobe epilepsy.

Sequelae and/or complications	Number of cases
Quadrantanopsia	43
Verbal memory impairment	3
CSF fistula	3
CN III paresis	16
CN VI paresis	2
CN VII paresis	5
Persistent tinnitus	1
Haemorrhagic CVD	2
Ischaemic CVD	4
Dysphasia	10
Infection following craniectomy	1
Postoperative cavity	3
Anxiety	1
Psychosis	2
Depression	3
Personality disorders	3
Temporary hemiparesis with no evidence of ischaemic lesion on neuroimaging	2
Epidural haematoma requiring drainage	1

CSF: cerebrospinal fluid; CN: cranial nerve;
CVD: Cerebrovascular disease/

cranial nerves (23 cases) and dysphasia (10 patients). Ischaemic cerebrovascular (four patients) and haemorrhagic events including epidural haematoma (three cases) were considered to be severe complications. However, no deaths were associated with surgery. Moderate to severe persistent neurological deficits were seen in three patients, two with hemiparesis and one with dysphasia. All deficits, including those which were psychiatric, were seen before the second year *(table 6)*.

Discussion

The general characteristics of this cohort are similar to those of others (Salanova *et al*., 2002; Villanueva *et al*., 2004; Elsharkawy *et al*., 2009; Jaramillo-Betancur *et al*., 2009). For temporal lobe epilepsy surgery, we believe there still exists a significant delay before surgery, thus, all efforts should be made to warrant early identification of patients with potential drug-resistant epilepsy. This would allow appropriate referral to specialized epilepsy units in order to manage refractory cases correctly and without delay, and enable candidates who would benefit from surgical treatment to be selected. In addition, this study illustrates the high prevalence of mesial temporal sclerosis as preoperative pathology among patients with refractory temporal lobe epilepsy. The postoperative outcome of seizure control is consistent with, or marginally better than, the outcome reported by other authors (Tellez-Zenteno *et al*., 2005; Janszky *et al*., 2005). Our data are also similar to very recent reports (Elsharkawy *et al*., 2009), demonstrating continued benefit, two and four years after surgery. In our series, more than two thirds of patients were free of disabling seizures during the entire study period, and almost 84% were classified in the group with good prognosis (Engel class I and II). The percentage of patients with good prognosis at year four may even have been higher, since data are currently lacking from 20 patients who have not yet completed the four-year follow-up, 90% of whom had a good prognosis at the second year. Our positive results regarding the control of seizures after surgery are directly related to strict selection criteria and correlation between video-EEG monitoring and ictal semiology. It may be surprising that more patients had a good prognosis after four years than after two years. We assume that this is because we established the postoperative prognosis using the Engel classification, which is dynamic and based on the number of seizures in one period, and so may vary in the same patient from one period to another. We believe the cause may be multifactorial; possible reasons for this include antiepileptic drug adjustment and the "running-down" phenomenon.

Most publications regarding seizure prognosis after temporal lobe surgery have proposed measures of association with pre- and postoperative variables. Findings vary depending on the surgical protocols of the respective institution, the diagnostic tests available at the time, research design, and data analysis. Taken together, a fair comparison between different series is difficult.

In our series, we found an association between a good prognosis and the following variables, for at least one of the time periods analysed: absence of two or more seizure episodes in the first year after surgery, normal postoperative video-EEG, temporal unilateral intercrital localization, unilateral temporal ictal localization, female gender, and age 35 years or older. The first five of these variables have already been mentioned in other series (Armon *et al.*, 1996; Radhakrishnan *et al.*, 1998; Park *et al.*, 2002: Di Gennaro *et al.*, 2004; Janszky *et al.*, 2005; Cohen-Gadol *et al.*, 2006; Jeha *et al.*, 2006). However, the last of these variables has not been previously described, rather, other reports have suggested a worse prognosis with increasing age at surgery (Hennessy *et al.*, 2001; Janszky *et al.*, 2005). We have not been able to explain this finding. Moreover, this variable was identified from data from the second year, and not from the fourth year or the group of patients with good prognosis in both years, thus we are unable to provide an explanation for this identified association.

While the information relating to associations derived from the bivariate analysis is in itself useful, it would be more informative to produce a predictive model for postoperative results and this is why a logistic regression analysis was undertaken.

In our study, the multivariate logistic regression model could not be based on preoperative variables alone, for any of the cut-off points. The same difficulty was encountered in other reports (Uijl *et al.*, 2008) which, using only preoperative variables, did not succeed in establishing a good predictive model for postoperative seizure control. Furthermore, in our results, for the group with a good prognosis in the second postoperative year, the model only included postoperative variables, *i.e.* absence of two or more seizure episodes in the first year after surgery and normal postoperative video-EEG. However, the model still produced a high value for the area under the ROC curve (0.912), as did the models for the second (0.94) and fourth years (0.854), although confidence intervals were wide. Only the variable relating to normal postoperative video-EEG was present in all models, but the absence of two or more seizure episodes in the first year after surgery was also present in two models (in the four-year postsurgical follow-up it was removed from the multivariate analysis in the last step; p=0.066), and more importantly, in the model of good prognosis at both the second and fourth years. Therefore, we suppose that it may be an important variable associated with good prognosis. One reason that may explain why we were unable to identify a model based on preoperative variables may be due to the fact that the presurgery study was not completely homogeneous for all patients, since, for some patients, specific studies such as deep electrodes were carried out (as described in the methods). However, postsurgical follow-up was the same for all patients (24-hour video-EEG monitoring and control of seizures reported in consecutive visits). Another reason may be the limits of the preoperative basic studies, *i.e.* semiology, neuroimaging with a 1.5 Tesla resonator and long-term video-EEG monitoring.

The sample size of our study may have limited the possibilities of finding an association between some other variables and a good prognosis. Because the majority of patients who undergo temporal lobe epilepsy have good prognosis (as in other series), the group of patients with poor outcome is small, hence confidence intervals are wide. A larger sample may have produced a better fit for the confidence intervals of our predictor variables. Nevertheless, the area under the ROC curve is high in all the models.

We therefore believe that we have developed a reliable predictive model for sustained good prognosis over a period of three years. Although not useful as a preoperative tool since it is comprised of postoperative variables, this may be used as a predictive model for patient monitoring, as both variables may be measured in the early postoperative period (one year after surgery). In this way, the results of this model could be considered when deciding whether to reduce or withdraw antiepileptic drugs and even with respect to the daily life of patients (such as considering whether they should drive a vehicle). Furthermore, the variables included in our models may be considered in studies attempting to establish a predictive model for the postoperative control of seizures, including a larger number of patients to overcome the limitation imposed by the sample size.

Finally, we must consider surgical re-intervention, sequelae and/or complications. Re-intervention was deemed appropriate when failure to control seizures was associated with an incomplete resection of the hippocampus. In relation to this, the surgeon's experience plays a crucial role since the majority of these cases occurred during the initial part of the surgeon's learning curve. After re-intervention, all patients were seizure-free on follow-up. All the side effects appeared in the first two years of the follow-up. Haemorrhagic cerebrovascular events can be considered to have occurred by chance, as there was no anatomical correlation between the haemorrhage and the epileptogenic lesion site. There was spontaneous remission of paresis of cranial nerves. In our series, moderate or severe neurological persistent deficits only occurred in three patients (two with hemiparesis and one with dysphasia). Psychiatric sequelae were, in all cases, controlled with medication. Personality disorders and memory and language impairment are among the risks to be weighed up for each patient (Hermann *et al.*, 1991; Behrens *et al.*, 1997; Blumer *et al.*, 1998; Salanova *et al.*, 2002; Tanriverdi, 2009). □

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