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Memory Decline Following Epilepsy Surgery: Can We Predict Who Will Pay the Price?

Postoperative Memory Prognosis in Temporal Lobe Epilepsy Surgery: The Contribution of Postictal Memory

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Objective: The prediction of verbal memory decline after temporal lobe epilepsy (TLE) surgery remains difficult at an individual level. We evaluated the prognostic value of postictal memory testing in predicting the postoperative verbal memory function. Methods: Sixty-three consecutive patients were included in the analysis who underwent TLE surgery at our center with preoperative interictal/postictal and postoperative memory testing. Verbal memory was evaluated using the Rey Auditory Verbal Learning Test (RAVLT). We used reliable change indices with 90% confidence interval (90% RCIs) to evaluate a significant postoperative memory decline. The sensitivity (Sn), specificity (Sp), positive predictive value (PPV), negative predictive value (NPV), area under the curve (AUC), and accuracy (ACC) were calculated. The analysis was performed for all patients with TLE and for the subgroup with hippocampal sclerosis (HS). Results: Patients with left TLE (n = 31) had lower verbal memory scores on RAVLT than right TLE at 3 months (57% vs 78%) and 12 months (53% vs 78%) after surgery. The 90% RCI was estimated to be a loss of 4 out of 15 items. The predictive value was Sn = 42%, Sp = 84%, PPV = 39%, NPV = 86%, AUC = 0.630, and ACC = 76% to predict a verbal memory decline in the whole group (n = 63). In patients with HS (n = 41), the postictal verbal memory test had Sn = 50%, Sp = 88%, PPV = 50%, NPV = 88%, AUC = 0.689, and ACC = 81% to predict a significant postoperative decline. Significance: Postictal memory is a noninvasive bedside memory test that can help predict the postoperative verbal memory decline in patients with HS with an overall ACC of 81%.

Commentary

Success rates for epilepsy surgery are well known. Until recently, success following surgery was defined primarily in terms of seizure reduction. However, more attention is now placed on the inclusion of cognitive and behavioral functioning as primary defining features of epilepsy and as important factors considered within the definition of surgical outcome.[1] With that in mind, it has been determined that a cognitive "price" is paid by up to 40% of patients undergoing surgery, regardless of the resulting level of seizure control.[2] It is thus important for surgical treatment teams to have effective methods of determining which surgical candidates are at risk for paying this important price, so that effective preventative strategies can be developed and implemented.

What we know thus far is that the rate of memory decline is highest in patients undergoing left (dominant) temporal lobe resections. The primary approach to identifying risk for memory decline has been to evaluate the presurgical functional status of the lobe to be resected, with a greater degree of postoperative memory impairment observed in those individuals with the highest level of presurgical functioning. To date, the functional integrity of the temporal lobe has been evaluated through a variety of methods, including the Wada test and both structural and functional imaging methods, with varying levels of success in using those data for predicting postsurgical memory outcome.[3] A number of studies have also examined the predictive use of presurgical neuropsychological testing in multivariate models combined with other clinically relevant variables.[2]

Others have incorporated systematic observation of specific postictal behaviors into the presurgical workup. Using Todd's phenomenon as an explanatory model, the assumption is that a specific pattern of neurological or behavioral impairments resulting from postictal inhibition can be used to help lateralize or localize the seizure focus. Prior studies using these methods have demonstrated that identification of postictal behaviors such as motor functioning or language impairment can be useful in lateralizing the seizure focus.[4] Results from memory testing performed during the immediate postictal period have also been used as a means of identifying the laterality of the seizure focus.[5,6] To date, analysis of postictal behaviors has not

been performed in any systematic manner to predict postsurgical outcome.

In a previous investigation, coauthors of the current article demonstrated that postictal verbal memory testing, conducted through a simple modification of a standard list-learning technique, could be employed as a useful bedside tool to help identify the laterality of the seizure focus in epilepsy surgery candidates.[7] In analyses performed at the group level, it was demonstrated that postictal memory testing was superior to interictal memory testing in correctly identifying the laterality of the seizure focus, with indications that postictal findings were also correlated with postsurgical memory functioning. The primary aim of the current investigation was to examine the efficacy of using this method of testing for identification of presurgical outcome in individual patients.

In the current study, Sveikata and colleagues used the original 15-item version of the Rey Auditory Verbal Memory Test in a routine neuropsychological test battery administered at least 24 hours following the last seizure in 74 patients with temporal lobe epilepsy (TLE) undergoing presurgical evaluations. The standard evaluation was accompanied by testing performed postictally using a shortened 10-item version. Performances on these tests were classified according to level of impairment on the basis of unpublished normative data. The results of presurgical memory testing, performed both interictally and postictally, were used to predict postoperative memory performance following surgical treatment that included a resection of medial temporal lobe structures in a total of 33 patients. Postoperative changes in memory functioning were defined by the use of reliable change indices. Predictions of postoperative decline were evaluated through a combination of logistical regressions, receiver operating characteristic curves, and computation of positive and negative predictive value indices.

The results showed that the left TLE group (n = 31) obtained lower verbal memory test scores than the right TLE group (n = 32), with equal effect sizes obtained through interictal (Cohen d = 0.38) and postictal (Cohen d = 0.36) testing. However, based on the results of the logistic regression, the postictal tests had a higher value than the interictal tests in prediction of postsurgical memory decline. The postictal test data predicted decline with a sensitivity (Sn) level of 42% and a specificity (Sp) of 84% (area under the curve [AUC] = 0.630). A somewhat higher level of classification was obtained in patients with a preoperative diagnosis of hippocampal sclerosis (Sn = 50%, Sp = 88%, AUC = 0.689). The overall classification rate for identifying postsurgical memory decline was reported as 81%.

While this study describes a new approach to predicting postsurgical memory decline in individual patients, it is unclear whether the results provide any demonstrable improvement over existing methods. From a neuropsychological perspective, the methodology described in this paper raises a number of questions about the standardization of the modified testing methods and use of norms.[8] While the authors demonstrate that the postictal test results provide higher classification values than standard interictal testing, there is no mention of whether differences between the methods are statistically significant or whether the postictal results are demonstrated by any other means to be superior to those obtained through conventional testing. In fact, the classification rate of 81% obtained in this study is very similar to the rate of 82% accuracy reported in a recently published study using a multivariate approach with standard neuropsychological testing.[9]

More importantly, in terms of clinical practice, it is unclear whether the results of this study are strong enough to warrant addition of the modified test procedures described in this study to existing methods currently in use for postictal assessment in patients undergoing video electroencephalogram monitoring. A standardized ictal testing battery, including brief bedside measures of language and memory, was recently developed and studied in patients undergoing monitoring in multiple centers.[10] The results showed that, with trained staff, postictal testing could be initiated at an approximate mean of 30 seconds following the seizure start with an overall successful completion rate of 93%. To attain a status of widespread usage, it will be necessary to demonstrate in future research that the postictal memory testing procedure described in this study provides a more effective means of predicting postsurgical memory decline than what is obtained through existing testing methods.

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References

1. Wilson SJ, Baxendale S. The new approach to classification: rethinking cognition and behavior in epilepsy. *Epilepsy Behav*. 2014;41:307-310.
2. Baxendale S, Thompson P.Red flags in epilepsy surgery: identifying the patients who pay a high cognitive price for an unsuccessful surgical outcome. *Epilepsy Behav*. 2018;78: 269-272.
3. Dulay MF, Busch RM. Prediction of neuropsychological outcome after resection of temporal and extratemporal seizure foci. *Neurosurg Focus*. 2012;32(3):E4.
4. Dupont S, Samson Y, Nguyen-Michel VH, et al. Lateralizing value of semiology in medial temporal lobe epilepsy. *Acta Neurol Scand*. 2015;132(6):401-409.
5. Andrewes DG, Puce A, Bladin PF. Post-ictal recognition memory predicts laterality of temporal lobe seizure focus: comparison with post-operative data. *Neuropsychologia*. 1990;28(9): 957-967.
6. Pegna AJ, Qayoom Z, Gericke CA, Landis T, Seeck M. Comprehensive postictal neuropsychology improves focus localization in epilepsy. *Eur Neurol*. 1998;40(4):207-211.

7. Vulliemoz S, Prilipko O, Herrmann FR, et al. Can postictal memory predict postoperative memory in patients with temporal lobe epilepsy? *Epilepsia*. 2012;53(10):e170-e173.
8. Lezak MD, Howieson DB, Bigler ED, Travel D. *Neuropsychological Assessment*. 5th ed. New York, NY: Oxford University Press; 2012.
9. Ljunggren S, Andersson-Roswall L, Imberg H, Samuelsson H, Malmgren K. Predicting verbal memory decline following temporal lobe resection for epilepsy. *Acta Neurol Scand*. 2019; 140(5):312-319.
10. Beniczky S, Neufeld M, Diehl B, et al. Testing patients during seizures: a European consensus procedure developed by a joint taskforce of the ILAE—Commission on European Affairs and the European Epilepsy Monitoring Unit Association. *Epilepsia*. 2016; 57(9):1363-1368.