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Detecting Differential Memory Performance Among Spanish-speaking Patients with Temporal Lobe Epilepsy

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Abstract

There is relatively little research pertaining to neuropsychological assessment of Spanish-speaking individuals with intractable temporal lobe epilepsy (TLE). The current study examined verbal and visual memory performances in 38 primarily Spanish-speaking patients with TLE (Right = 15, Left = 23) of similar epilepsy duration to determine if lateralizing differences can be found using verbal and nonverbal memory tests. On a test specifically designed to assess auditory learning and memory among Spanish-speaking individuals, the Spanish Verbal Learning Test (SVLT), patients with left TLE performed significantly worse than patients with right TLE. In contrast, no significant differences in story or visual memory were seen using common memory tests translated into Spanish. Similar to what has been found in English speakers, these results show that verbal memory differences can be seen between left and right sided TLE patients who are Spanish-speaking to aid in providing lateralizing information; however, these differences may be best detected using tests developed for and standardized on Spanish-speaking patients.

Keywords

Temporal Lobe Epilepsy; memory; Spanish-speakers

1. Introduction

1.1 Memory Pattern among English-speakers with TLE

Temporal lobectomy is an effective treatment for many patients with intractable, well-localized temporal lobe epilepsy (TLE). Routine evaluations of surgical epilepsy candidates often include assessment of memory function as part of a broader neuropsychological evaluation to provide additional information regarding lateralization/localization of patients' seizure disorders, and/or risk of memory decline with surgery. Specifically, differential performance on verbal and visual memory measures as well as other neuropsychological tests may implicate relative dysfunction of one temporal lobe. Neuropsychological assessments have been found to be most accurate in identifying patients whose seizure focus lies in the left temporal lobe as verified using EEG and neuroimaging findings^[1–5]. The tests that have demonstrated the most clinical utility in discriminating patients with left and right temporal lobe epilepsy have targeted

verbal learning and memory functions. For instance, Formisano et al.^[1] demonstrated that patients with clear left temporal lobe lesions had lower verbal memory scores on the Logical Memory subtest of the Wechsler Memory Scale-Revised (WMS-R)^[6] than patients with right temporal lobe lesions. Likewise, Moore and Baker^[5] found that discrepancy scores can be useful in discriminating left from right TLE patients, as patients with left TLE demonstrated better nonverbal than verbal WMS-R index scores. Differential verbal memory patterns in individuals with lateralized TLE have also been elicited using verbal learning tasks. Hermann and colleagues^[4] found that patients with left TLE showed significantly poorer performance on learning and recall trials of the California Verbal Learning Test (CVLT)^[7] than patients with right TLE.

Hawkins (1998)^[2] examined the data presented in the Wechsler Memory Scale-Third Edition technical manual (WMS-III)^[8] to demonstrate the sensitivity of the memory indices to lateralized brain dysfunction. These data revealed lower auditory than visual memory scores for patients who had undergone left hippocampectomy, and lower visual memory scores for right hippocampectomy patients. However, the visual memory scores of patients with left hippocampectomies were also impaired, which is in keeping with previous studies examining memory functioning in TLE patients.^[1,4,9] The authors posited that this demonstrates modality-specific effects and a greater sensitivity of visual memory to brain compromise. Wilde and colleagues^[9] reported similar findings in a combined TLE sample, as group differences were only found for the auditory memory index with decreased visual memory seen in both TLE groups. Furthermore, Wilde et al. reported that although material-specific memory differences can be seen in patients with TLE, the differences are of limited predictive utility as group differences can only be obtained when auditory versus visual memory discrepancy scores are unusually large.

In contrast to the utility of some verbal memory measures in identifying material specific memory deficits, nonverbal memory tests have not consistently been found to discriminate individuals with left and right TLE, with only a few studies reporting differential nonverbal memory with respect to left and right TLE.^[10] The vast majority of research on this topic converges on the absence of differential performance between patients with right and left TLE on nonverbal memory tasks.^[1,5,9,11–13] For example, Barr et al. examined performance on the Rey-Osterrieth Complex Figure Test (ROCF)^[14–15] and the Visual Reproduction subtest of the WMS-R in patients with right and left TLE, and found no differences in terms of nonverbal memory ability between the groups.

1.2 Memory Pattern for Spanish-speakers with TLE

While support for the differential memory performance in English-speaking patients with TLE is strong, little research has been done to examine the pattern of memory function using conventional neuropsychological measures in Spanish-speaking patients with TLE. To date, only one study has examined the neuropsychological performance of Spanish-speakers with TLE. Oddo et al. (2003)^[16] studied a well characterized sample of Spanish-speakers with TLE, and described them as either having normal memory (35%), verbal memory deficit (30%), visual memory deficit (24%), or both verbal and visual memory deficits (11%). Unfortunately, the manner in which the authors derived these groups does not allow for the inspection of individual test performance to determine whether Spanish-speaking patients with TLE demonstrate material specific memory deficits. Therefore, this study cannot shed much light on whether Spanish-speakers with lateralized TLE show a similar pattern of memory performance as English-speaking counterparts.

1.3 Neuropsychological Evaluation for Spanish-speakers with TLE

The need for neuropsychological research with this population is imperative, as Hispanics are the fastest growing minority in the United States, and a number of them have intractable epilepsy. However, very few tests, such as the Escala de Inteligencia Wechsler para Adultos (EIWA),^[17] EIWA-III,^[18] and the Spanish Verbal Learning Test (SVLT),^[19] were developed for and normed with Spanish-speakers.

The typical assessment procedure used when evaluating Spanish-speaking patients introduces error in a number of ways. For one, the administration of neuropsychological measures used often involve tests written in English and normed on English-speaking individuals. This practice often involves translation of test instructions and items from English into one of many dialects of the Spanish language, and therefore is vulnerable to translation errors and cultural bias of stimuli. These potential confounds may negatively impact test results of Spanish-speaking patients, especially on tests of verbal memory functioning.

Additionally, translation of tests developed for use with English-speakers may introduce cultural and/or linguistic biases when translated into Spanish. For example, some English words are comparatively used more frequently in English than Spanish and vice versa, and certain words are acquired at an earlier age in one language, and later in another.^[20–22] These linguistic differences render certain words more or less salient than others, and may bias language oriented neuropsychological instruments if translated from one language to another. Therefore, although translating neuropsychological tests may be common clinical practice due to the relative lack of published tests in Spanish, it is not an optimal way of evaluating this population empirically. Also, due to the scarcity of neuropsychological instruments that are normed with Spanish-speakers, there is little empirical data from which to base valid conclusions and interpretations. Instead, interpretation of these tests are based on the respective original norms that underrepresent Hispanics and are derived in English. Therefore, evaluation of this population can be challenging.

The World Health Organization/University of California at Los Angeles Auditory-Verbal Learning Test (WHO/UCLA AVLT)^[23] is an example of a verbal learning test developed in English and subsequently translated into Spanish. The WHO/UCLA AVLT is a subtest of the larger Spanish neuropsychological battery, the Neuropsychological screening Battery for Hispanics (NeSBHIS)^[24]. However, the NeSBHIS was only partially developed with Spanish-speakers. Most of the tests in this battery were adapted from existing neuropsychological tests used with English-speakers and subsequently normed with Spanish-speaking individuals. The WHO/UCLA AVLT was developed in English using words that are considered universal concepts and later translated into different languages. While the development of the WHO/UCLA AVLT attempts to reduce the linguistic biases across cultures, it does not consider the frequency or saliency of the concepts used; therefore, it is not ideal for use with Spanish-speaking populations.

The SVLT is an example of a test that was written in Spanish and specifically developed to assess learning and memory for Spanish-speakers. The SVLT was developed in accordance with the procedures used to develop the CVLT. It consists of 16 carefully chosen items based on frequency and ease of semantic categorization. The task includes 5 learning trials in which the list is presented to the patient who is then directed to repeat the list back to the examiner in any order. This is followed by a delayed recall trial after a 3-minute interference task. Furthermore, the SVLT was standardized on 22 Spanish-dominant bilingual participants with mean age and education of approximately 30 and 12 years, respectively. Normative data are also available for English-dominant and balanced bilinguals, however there are no SVLT data available in the literature with regards to diagnostic populations (i.e., TLE).

In light of the growing need to evaluate the expanding Spanish-speaking epilepsy population, it is important to expand our knowledge of tests and procedures that might be useful in this group. The present study examined memory patterns of Spanish-speaking patients with lateralized TLE to determine the extent to which prior memory research findings with English-speaking TLE patients can be generalized to this population.

2. Method

2.1 Participants

Subjects included consecutive referrals from the epilepsy service at the University of Texas Southwestern Medical Center and/or Parkland Health and Hospital Systems who were diagnosed with intractable lateralized TLE. Subjects included 38 Hispanic individuals who spoke little to no English, had no prior knowledge of the study, and underwent neuropsychological evaluation as part of a comprehensive assessment of their seizure disorder. Participants were classified as having either right ($n = 15$) or left ($n = 23$) TLE based on results from their seizure work up, which included EEG, seizure semiology, MRI, SPECT, intracarotid amobarbital procedure (IAP; when available), and neuropsychological evaluation.

2.2 Instruments

Subjects were administered a detailed battery of common neuropsychological tests that included the SVLT and the Logical Memory (LM) and Visual Reproduction (VR) subtests from the WMS-R or the WMS-III and the ROCFT. The Raven Colored Progressive Matrices (RCPM)^[25] was utilized to estimate nonverbal intellectual ability

The SVLT was developed and standardized on Spanish-speaking individuals.^[19] It consists of a 16-item list-learning task in which five consecutive learning trials are given to the patient followed by a delayed recall trial. The standard administration of the SVLT utilized a 3 minute delay; however, this study utilized a 20 minute delay, as a longer delay interval may elicit larger differences in delayed recall ability. The longer delay is more consistent with commonly used memory tests, and will not spuriously impact the study's results, as participant performances' on the SVLT were not compared to published normative data. All other memory tests used to evaluate the patients in this study underwent a literal translation into Spanish by a bilingual doctoral/postdoctoral trainee, and back-translated, with any discrepancies corrected. Translated measures were administered in the standard manner in which they were developed. Logical Memory (LM) is a story memory test in which patients are asked to recall the details of short narratives immediately after hearing them and after a 30-minute delay. The ROCFT assesses visual memory by having patients draw a complex figure immediately after having copied the figure, and then again after a 15-minute delay. Visual Reproduction (VR) also assesses visual memory. For this task, patients are asked to draw a series of figures from memory immediately after viewing each figure and again after a 30-minute delay.

2.3 Procedure and Data Analysis

The current study utilized a two-group quasi-experimental design. The neuropsychological assessments were conducted by either a bilingual graduate student or post-doctoral fellow under the supervision of a neuropsychologist. Participants were seen as outpatients through the Neuropsychology Service at the University of Texas Southwestern Medical Center, or as inpatients in the Epilepsy Monitoring Unit at Parkland Health and Hospital Systems. Neuropsychological evaluation data were scored and interpreted according to their published test manuals and normative data. Scoring was reviewed by a psychometrist, and data were entered into a database by a second psychometrist.

Demographic data were analyzed to determine the homogeneity of samples in terms of age, sex, estimated intelligence, handedness, years of education, and duration of epilepsy. Differences between patients with RTLE and LTLE in terms of age, years of education, estimated nonverbal intelligence, and duration of epilepsy were analyzed using independent samples *t*-tests. Gender differences between groups were analyzed using a chi-square test.

Between group comparisons were made on raw test scores for the SVLT and ROCFT, and scaled scores were used for LM and VR subtest comparisons. Total items learned after 5 trials and number of items recalled on the fifth trial of the SVLT were used to measure verbal learning. Delayed recall performance for the SVLT was analyzed as a measure of verbal memory/retention. Immediate and delayed recall scores, and percent retention (i.e., percent of immediately recalled items that are recalled after a delay) were analyzed from the LM and VR subtests of the WMS-R/III. Likewise, complex visual memory was measured examining immediate and delayed recall performance on the ROCFT.

Neuropsychological data were analyzed using appropriate parametric tests. A multivariate analysis of covariance (MANCOVA) was used to detect verbal and visual memory differences between RTLE and LTLE groups on SVLT, LM, VR, and ROCFT variables while controlling for covariates found significant among univariate analyses of sample demographics.

3. Results

The LTLE group was significantly older than the RTLE group $t(36) = 2.35, p = 0.024$; however, there was no difference between groups with respect to duration of epilepsy $t(36) = -0.16, p = 0.877$. There were no significant differences between the right and left TLE groups for education $t(36) = -1.35, p = 0.187$, gender $\chi^2(1, N = 38) = 0.000, p = 1.00$, or nonverbal intellectual abilities as assessed by the RCPM $t(18) = 0.61, p = 0.952$. All participants were right handed (see Table 1). Age was treated as a covariate in subsequent analyses.

A MANCOVA showed significant differences between RTLE and LTLE on 3 of the 11 neuropsychological variables examined (see Table 2), which included all of the SVLT variables, after controlling for the effect of age. Specifically, tests of between-subjects effects showed SVLT performance was significantly different between the groups for fifth learning trial $F(1, 35) = 13.64, p = 0.002$, total words learned $F(1, 35) = 7.85, p = 0.012$, and delayed recall $F(1, 35) = 7.85, p = 0.007$, with the LTLE group performing lower than the RTLE group.

Verbal memory differences were not detected between groups using immediate recall, delayed recall, or retention scores of the translated version of the Logical Memory subtest of the WMS-R/WMS-III. Likewise, immediate recall, delayed recall, and retention variables from the Visual Reproduction subtest of the WMS-R/WMS-III did not differ between the groups, and no differences were seen between groups in immediate and delayed recall variables from the ROCFT (see Table 2).

4. Discussion

Results support the presence of verbal learning and memory differences between Spanish-speaking subjects with right and left TLE, with lower performances in the left TLE group on SVLT variables examined. Alternatively, no differences were found on the story memory task or any of the visual memory measures. These results are consistent with the body of existing literature regarding English-speaking individuals with TLE that show primary differences between lateralized TLE groups on verbal memory measures.^[1,2,4,5]

The lack of differences in LM subtest performance between left and right TLE groups is interesting, but not entirely unexpected. It is possible that a list-learning task is more sensitive

to verbal memory deficits in TLE than recall for story memory, as this finding has been reported in other patient populations. Beaty and colleagues (2004)^[26] found multiple sclerosis (MS) patients with cognitive impairment (i.e., MMSE<27) demonstrated greater story recall than list-learning recall on the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). Likewise, Brooks et al. (2006)^[27] found older individuals with executive dysfunction performed worse on CVLT-II total learning and short delay recall than those without executive dysfunction.

An alternative explanation of the disparate results between the SVLT and the Logical Memory subtest is that the latter did not detect differences between TLE groups in the present sample because it was not originally intended for use with Spanish-speakers, as it was merely translated into Spanish. The SVLT may have shown relatively greater sensitivity than the LM subtest because it was specifically designed for Spanish-speaking individuals. Examination of LM subtest scores between groups provides preliminary evidence for this explanation, as both left and right TLE groups performed worse than expected (i.e., below normal) on the LM subtest suggesting a linguistic/content bias may play a role in making learning & recall of the stories more difficult for Spanish-speakers. In contrast, the Logical Memory stimuli required translation from English to Spanish which may have introduced linguistic biases. The linguistic bias may have occurred because the WMS Logical Memory stories are inherently biased (i.e., utilize words or concepts that are less familiar to Spanish-speakers), or the bias was introduced by the translators who translated the stories from English into one of the numerous dialects of Spanish. Either of these mechanisms can introduce potential biases which may differentially lower subjects' performances. These findings are commensurate with the growing body of literature that tests developed for Spanish-speakers may be more sensitive to neurocognitive deficits than translated tests^[28–29], as the results suggest the SVLT is more helpful in identifying lateralized memory deficits than tests that have been translated into Spanish.

As expected, the present study did not find differences in visual memory performances between TLE groups. These results concur with previous studies finding that visual memory tests have limited lateralizing utility for groups of patients with TLE.^[1,5] One possible explanation of this consistent finding is that patients can verbalize visual images and therefore utilize verbal as well as visual means to commit the material to memory. Based on these findings, English and Spanish-speakers may employ a similar strategy to learn and recall complex nonverbal (visual) information.

It should be noted that the current study extended the SVLT delay period from 3 minutes to 20 minutes with the idea that the SVLT would have greater clinical utility for detecting memory degradation after a longer delay interval. According to Blake, Wroe, Breen, and McCarthy (2000),^[30] verbal memory tests are most sensitive to left temporal lobe lesions after a longer delay interval. The longer delay is more consistent with current clinical practices for memory evaluations, and did not appear to introduce error variance into delayed verbal memory scores.

Additionally, while participants in the present study appeared to be equivalent in terms of number of years of education, they may vary in terms of quality and content of education, as years of education in the United States does not bear a one to one relationship with years of education in many of the Latin countries. This is especially true for those with fewer years of education, as studies show the relationship between neuropsychological function and education is an accelerated curve, such that there are greater differences between people with 0 to 3 years of education and people with 3 to 6 years of education than people with 3 to 6 and 6 to 9 years of education. Furthermore, there is even less difference between groups of people with over 10 years of education.^[31–34] Approximately 40% of the total sample for this study had ≤ 6 years of education; therefore, caution should be used when generalizing findings from this investigation to more educated populations.

5. Conclusion

In conclusion, Spanish-speaking patients with lateralized TLE show a similar pattern of material - specific memory deficits that English-speaking patients have historically shown. Current results reveal that verbal memory differences can also be detected between Spanish-speaking patients with left and right TLE using a verbal learning and memory test developed for Spanish-speakers. Accordingly, presurgical neuropsychological evaluation of this population can aid in determining seizure lateralization/localization by identifying material specific deficits. The present study may also serve as a point of reference for future research in this area, as it appears neuropsychological instruments developed for and standardized on Spanish-speakers may be the most effective means of evaluating this population. Investigations to determine whether tests developed for Spanish-speakers have greater sensitivity or specificity than translated tests are warranted.

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Table 1

Demographic Data for Right and Left Temporal Lobe Epilepsy Groups

Demographic Variables	Right TLE	Left TLE
	n = 15	n = 23
	<u>M</u> (SD)	<u>M</u> (SD)
Age (years)	32.9 (8.3)	40.4 (10.5) *
Education (years)	8.5 (4.0)	7.0 (3.1)
Duration (years)	23.9 (9.3)	23.4 (11.3)
Raven Colored Progressive Matrices	23.2 (7.2)	23.4 (5.5)
Sex (% female)	66%	66%

Note. No significant differences between groups on any variable.

TLE = Temporal Lobe Epilepsy.

*
p< .05

Table 2
Neuropsychological Data for Right and Left Temporal Lobe Epilepsy Groups

Variables	Right TLE	Left TLE	p
	n = 15 <u>M</u> (SD)	n = 23 <u>M</u> (SD)	
SVLT 5 th Trial	12.1 (2.0)	9.3 (2.7)	<0.01
SVLT Total	49.5 (9.1)	38.9 (9.2)	0.01
SVLT Delay	10.7 (2.4)	7.4 (2.7)	<0.01
Logical Memory I ^a	7.0 (2.2)	5.2 (3.8)	0.29
Logical Memory II ^a	6.9 (1.8)	4.9 (3.0)	0.19
Logical Memory % Retention	69.8 (17.2)	55.6 (22.6)	0.27
Visual Reproduction I ^a	5.3 (1.4)	4.5 (2.4)	0.51
Visual Reproduction II ^a	6.1 (2.0)	5.8 (2.6)	0.93
Visual Reproduction % Retention	54.1 (20.6)	45.3 (26.9)	0.67
ROCFT Immediate (36 possible points)	14.9 (5.6)	12.4 (5.4)	0.87
ROCFT Delay (36 possible points)	15.5 (5.7)	11.65 (5.6)	0.47

Note. Values represent raw scores, unless otherwise notated.

TLE = Temporal Lobe Epilepsy. SVLT = Spanish Verbal Learning Test. ROCFT = Rey-Osterrieth Complex Figure Test.

^a = Scaled Score (Mean = 10; Standard deviation = 3). Significant probability values in bold, $p < .05$ after controlling for age.