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Patients' Perceptions of Memory Functioning Before and After Surgical Intervention to Treat Medically Refractory Epilepsy

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Abstract

Summary: Purpose: One risk associated with epilepsy surgery is memory loss, but perhaps more important is how patients perceive changes in their memories. This longitudinal study evaluated changes in memory self-reports and investigated how self-reports relate to changes on objective memory measures in temporal or extratemporal epilepsy patients who underwent surgery.

Methods: Objective memory (Wechsler Memory Scale–Revised) and subjective memory self-reports (Memory Assessment Clinics Self-Rating Scale) were individually assessed for 136 patients ∼6 months before and 6 months after surgery. A measure of depressive affect (Beck Depression Inventory–2nd Edition) was used to control variance attributable to emotional distress.

Results: Despite a lack of significant correlational relationships between objective and subjective memory for the entire sample, significant correlations between objective memory scores and self-reports did emerge for a subset of patients who evidenced memory decline. Differences also were found in the subjective memory ratings of temporal lobe versus extratemporal patients. Temporal lobe patients rated their memories more negatively than did extratemporal patients and were more likely to report significant improvements in their memory after surgery.

Conclusions: In general, patients were not accurate when rating their memories compared to other adults. However, patients with significant declines in their memories were sensitive to actual changes in their memories over time relative to their own personal baselines.

Surgical intervention is a well-established treatment for patients with medically refractory seizure disorders. However, one common risk associated with surgery is memory loss (1–5). Extensive research effort has been dedicated to understanding the factors that contribute to predicting which patients may be at risk for memory decline after surgical intervention, particularly after temporal lobe resections (6–15). Whereas studies of memory functioning in patients with epilepsy have typically focused on patients with temporal lobe seizure foci, limited evidence exists that nontemporal regions also are involved in the formation of memories in patients with epilepsy (16,17). Although statistically significant changes on psychometric memory tests can provide important information regarding cognitive outcomes after surgical intervention, the extent to which patients perceive and are affected by potential changes in their memory abilities as a result of surgery may be even more relevant to consider when evaluating surgical outcome.

In studies that have specifically examined memory self-reports in patients with epilepsy, findings have generally supported relationships between memory abilities and memory self-perceptions. Patients describe themselves as having less efficient memory abilities than do healthy adults (18–22), and the accuracy of their beliefs is corroborated by relatives or others who know them well (18,20,22,23). However, results have been mixed with regard to how accurate patients' subjective ratings are when compared with actual performance on objective memory tests. Corcoran and Thompson (24) examined 60 patients with epilepsy, 30 of whom had memory complaints (based on a response to a single item about memory nuisance on the Head Injury Postal Questionnaire), and 30 of whom had no memory complaints. Several neuropsychological measures assessing memory, intellectual functioning, verbal naming, planning, and problem solving were administered to the participants. Significant relationships were found between memory complaints on the questionnaire and performance on figure and story memory tests. In a more recent study, Helmstaedter and Elger (18) also documented positive relationships between memory self-reports on the Subjective Memory Questionnaire and objective performances on neuropsychological measures of verbal memory, word fluency, and vocabulary in a group of 45 patients with temporal lobe epilepsy.

In contrast, Vermeulen et al. (21) found that epilepsy patients whose epilepsy was medically managed and who were referred for an evaluation secondary to memory complaints (n = 71) rated their memory much more poorly than did epilepsy patients who were surgical candidates (n = 31), despite similar levels of performance on actual memory tests. Based on high correlations between a measure of neuroticism and memory self-reports, these authors argued that chronic illness and emotional functioning were more strongly related to memory self-perceptions than was actual memory functioning. Other studies also suggested that patient characteristics may mediate the relationships between subjective and objective memory, as Helmstaedter et al. (19) found that patients with good memory abilities on neuropsychological tests provided more accurate ratings of their memory than did patients with poor memory abilities.

Whereas the previously discussed studies all focused on memory self-reports at one point in time, other research has examined the impact of surgical treatment on epilepsy patients' judgments about their memory. In cross-sectional studies, patients who have previously undergone anterior temporal lobectomy and who are questioned about their memory abilities after surgery often report improvements in their abilities (20,23), particularly when rating nonverbal memory experiences (20) or after sclerotic hippocampal tissue has been resected from the speech-dominant hemisphere (23). Thus surgery does not appear to result in a global increase in memory concerns on the part of epilepsy patients. When the same issue was examined at the individual level in another cross-sectional study, strong correlations were documented between postsurgical memory abilities and postsurgical memory complaints (25), supporting a relationship between objective and subjective memory in patients who have undergone surgical intervention. However, in more appropriate longitudinal study designs, patients' self-reports have been found to be more favorable than actual changes in memory abilities. For example, in a series of repeated-measures analyses of variance, McGlone (26) discovered that memory complaints generally remained stable or improved postsurgically, in contrast to declines in performance on material-specific memory tests. More recently, Sawrie et al. (27) used standardized regression-based change scores derived from data collected on nonsurgical epilepsy control patients to define decline on both objective and subjective memory tests. They found that only 3% of left anterior temporal lobectomy patients and 7% of right anterior temporal lobectomy patients showed significant declines in their subjective memory scores from baseline to 1 year after surgery, whereas ~50% and 28%, respectively, showed significant declines on objective memory measures. In both of these studies, correlations between objective and subjective measures were small in magnitude. However, factors that did appear to influence memory self-reports in both studies included postsurgical depression and seizure outcome. Depression was associated with less favorable memory self-perceptions, whereas a good surgical outcome corresponded to more optimistic ratings of postoperative memory functioning. Taken together, the results of these longitudinal studies generally suggest that patients who have undergone surgery to treat their epilepsy are not good at recognizing the changes in their memory abilities that result from the procedure.

Although this literature has questioned the accuracy of patients' subjective memory reports after surgery and repeatedly documented the finding that epilepsy patients' memory self-reports improve after surgery even though their actual memory abilities decline, clinical experience often suggests that patients who evidence a significant decline in their memory do complain of memory loss after surgery. This lack of agreement between clinical experience and documented research results may reflect the inclusion of patients both with and without postsurgical memory changes in the same correlational analyses. If patients without significant memory change are inaccurate at judging their memories both before and after surgery, relationships between changes in self-reports and changes in memory will be low. Specifically, when a large number of patients show stable or improved memory abilities after surgery, the weak relationships between objective and subjective memory in this subset of patients may mask more substantial correlations in patients who actually experience a decline in their memory. The group of patients whose memory declined may be able to use their personal baseline as a foundation against which to form their postsurgical memory judgments, increasing the accuracy of their postsurgical self-reports. To address this issue, one goal of the current study was to investigate the relationships between scores on subjective and objective memory measures in a large enough patient sample to allow separate correlation analyses to be conducted for patients who showed a significant decline in memory versus those who evidenced stable postoperative memory abilities. Different patterns of correlational relationships were expected for these two groups of patients. In particular, significant relationships between self-reports and actual memory abilities were anticipated for patients who evidenced a significant change in their memory, but not for those with stable memory abilities. This pattern of results would more closely resemble that commonly encountered in practice and would reflect an ability on the part of patients to respond to significant changes in their memory by altering their memory self-perceptions. Because depression has been shown to share significant relationships with both memory self-reports and actual memory test performances, Beck Depression Inventory–2nd Edition scores were covaried in correlational analyses to control for the potential confounding influence of depression on other relationships of interest.

To date, the studies that have examined postsurgical memory self-reports either cross-sectionally (18–20,22,23,25) or on a longitudinal basis (26,27) have focused on patients who have undergone temporal lobe resections. Only the study by Corcoran and Thompson (24) on nonsurgical epilepsy patients directly addressed memory judgments in patients with seizure foci outside of the temporal lobes. Results suggested that site of seizure focus (temporal vs. frontal) did not differentiate epilepsy patients with memory complaints from those who did not complain of memory difficulties. However, the study included only five patients with frontal lobe foci, making conclusions about the impact of extratemporal seizure foci on memory self-reports difficult to reach. No studies have systematically investigated differences in memory self-reports provided by patients with temporal lobe epilepsy versus those with extratemporal seizure foci both before and after surgical intervention. Thus the second goal of the current study was to address this issue in a large group of epilepsy patients who underwent surgical intervention for medically refractory epilepsy. Because temporal lobe epilepsy is more highly associated with memory difficulties than is epilepsy arising from extratemporal foci, temporal lobe patients were expected to provide more negative self-evaluations about their memory before surgical intervention than were extratemporal patients. In addition, because temporal resections are frequently associated with decline in memory functioning (1–5), temporal lobe patients were anticipated to demonstrate a larger decline in their memory self-reports from before to after surgery than were patients undergoing extratemporal resections.

METHOD

Participants

Participants for the study included 136 patients with medically refractory epilepsy who underwent surgery to treat their seizure disorders. Patients ranged in age from 18 to 54 years (mean, 33.32 years; SD, 8.43 years) and had completed between 7 and 21 years of formal education (mean, 12.90 years; SD, 2.26 years). Full-Scale IQ scores ranged from 68 to 127 (mean, 93.98; SD, 11.60) on the Wechsler Adult Intelligence Scale–Revised (WAIS-R) during the presurgical evaluation. Men (48%) and women (52%) were fairly equally represented, but the majority of participants were right-handed (85%). The average age at onset of medically refractory seizures was ∼14 years (mean, 13.93 years; SD, 10.97 years; range, 1–44 years), and, on average, patients had had uncontrolled seizures for 19½ years (mean, 19.64 years; SD, 10.86 years; range, 1–48 years) at the time of their preoperative evaluations. Approximately half of the patients (54%) underwent left-hemisphere resections, whereas the other half (46%) underwent right-hemisphere surgeries. Seizure-free status was accomplished in 64% of patients. Seventeen percent experienced one or two seizures during medication adjustments, and 19% continued to have frequent seizures during the postsurgical follow-up period.

Eighty-nine percent (n = 121) had epilepsy believed to arise from their temporal lobes, and the remainder of the patients had extratemporal seizure foci resected (n = 15). Of these, two underwent parietal resections, and 13 underwent frontal resections (two of whom had surgeries that extended beyond the frontal lobe into temporal or parietal regions). As a group, temporal patients were significantly older than extratemporal patients [mean, 33.93 years; SD, 8.49; vs. mean, 28.47 years; SD, 6.21 years; $F(1, 134) = 5.80$, $p < 0.05$]. Otherwise, the two groups did not differ on demographic or epilepsy characteristics, including years of formal education, gender, handedness, presurgical full-scale IQ scores, age at onset of seizures, duration of epilepsy, side of seizure focus, or surgical outcome. In addition, no significant differences emerged in the patients' scores on the Beck Depression Inventory–2nd Edition during either the presurgical or the postsurgical evaluation.

Procedures and materials

The study consisted of a retrospective review and analysis of data collected in the course of routine clinical care and recorded in a registry approved by the Cleveland Clinic Institutional Review Board. All patients underwent an extensive neuropsychological assessment and completed questionnaires regarding their emotional functioning and memory as part of a comprehensive presurgical evaluation and again as part of their standard postsurgical clinical care. Patients were seen ~6 months before (median, 6.0 months; range, 0–29 months) and 6 months (median, 6.0 months; range, 3–12 months) after surgery, with actual test–retest intervals ranging from 6 to 35 months (median, 12.0 months).

At each assessment point, all patients were individually administered the Wechsler Memory Scale–Revised, according to standardized procedures, and the Beck Depression Inventory–2nd Edition. In addition, memory self-perceptions were evaluated by using the Memory Assessment Clinics Self-Rating Scale (MAC-S; 28). The MAC-S was selected for use in this study based on several characteristics of the measure. This questionnaire is quite comprehensive in the specific memory domains it assesses and elicits memory self-reports across several types of memory situations that commonly pose difficulty for patients with epilepsy and that theoretically should be mediated by either left- or right-hemisphere brain regions (e.g., remembering names, verbal directions, spatial locations). It is fairly simple and fast to administer (not too lengthy), and the response scales are consistent across items to minimize confusion on the part of patients who are completing it. Normative data are available (29) and allow patient responses to be compared with those typically made by healthy adults of similar age, and the details of the factor structure of the scale have been described in the literature (28).

The MAC-S is a 49-item questionnaire. Twenty-one items ask respondents to rate their ability to remember various types of information [e.g., “the date and day of the week,”“details of holidays or special occasions of your childhood,”“what you read in the newspaper 1 day ago,” or “where you have put objects (such as keys) in the home or office”]. Responses to these items are summed to comprise the Ability scale. The Frequency scale consists of 24 items that measure how often individuals feel they demonstrate forgetful behavior (e.g., “call someone you recently met by the wrong name,”“forget an appointment or other event that is very important to you,”“forget the name of a familiar object,” or “forget an entire event, such as attending a party or having a visitor”). The remaining four items stand alone and are not collapsed onto another scale. These four critical items assess general memory ability (General Memory), change in memory relative to “the best it has ever been” (Decline), speed of recall (Memory Speed), and degree of concern or distress about memory (Distress). For all items and scales, higher scores reflect a more positive view of memory (i.e., fewer memory complaints or concerns).

The factor structure and psychometric characteristics of this questionnaire have been described elsewhere (28,29). Factor analyses have supported the composition of the two primary scales and have suggested that each scale can be divided into five separate factors. However, for the purposes of this study, responses were considered only at the scale level to maximize reliability and minimize the number of analyses conducted (and potential inflation of significant results based on chance alone). Test–retest reliability on the MAC-S is generally high, particularly for the two primary scales (Ability r^2= 0.88; Frequency r^2= 0.89). As expected, reliability is more limited for the single critical items, and a decision was made not to use the Memory Speed item for this study because of its low documented reliability ($r^2 < 0.50$). The other three critical items were all deemed sufficiently reliable (General Memory $r^2 = 0.73$; Decline $r^2 = 0.64$; Distress $r^2 = 0.64$) to be included as dependent variables in the study. Available normative data (29) were used to convert scores on the Ability and Frequency scales into age-corrected z-scores.

RESULTS

Memory outcome

Table 1 summarizes the presurgical and postsurgical memory test performances of temporal versus extratemporal patients who underwent left versus right surgical resections. A series of 2 (Time: pre- vs. postsurgery) × 2 (Focus: temporal vs. extratemporal) × 2 (Side of Surgery: left vs. right) repeated-measures analyses of variance (ANOVAs) was used to examine patterns of memory scores across the test–retest interval. A significant main effect of Time emerged for the General Memory Index [$F(1, 132) = 4.76$, $p < 0.05$]. This result indicated that patients performed better on immediate memory measures before surgery than afterward, but this effect was not mediated by the location of the seizure focus being within or outside of temporal lobe regions or by the side of surgery. No significant main or interaction effects were obtained when scores on the Delayed Memory Index were submitted to similar analyses.

For the purposes of later analyses that compared changes in actual test performances with changes in self-reports, z-scores of change were calculated by using standardized regression-based norms developed from published data collected on the performances of epilepsy patients tested twice without undergoing surgery in the interim (30). z-scores ≤ -1 were considered indicative of a decline in memory (n = 50; 37%), and z-scores ≥ 0 were considered reflective of stable or improved memory (n = 28; 21%). Patients earning z-scores between –1 and 0 were excluded from the analyses investigating individual memory outcomes because they evidenced mild declines in their memory, but the amount of decline they experienced was too small to assure that the changes observed were not attributable to chance (30). At the same time, their inclusion in the “stable” group was thought inappropriate, given that their memory did change in a negative direction from before to after surgery. Thus they were not included in either the decline or the stable memory group. With this system of classification, approximately one third of the sample evidenced statistically significant memory decline from before to after surgery, and approximately one fifth showed stable or improved memory abilities across time.

Seizure focus and side-of-surgery effects on memory self-reports

A 2 (Time) × 2 (Focus) × 2 (Side of Surgery) repeated-measures ANOVA examining patients' scores on both the Ability and the Frequency scales of the MAC-S failed to result in any significant main or interaction effects (see Table 2). When critical items were analyzed in the same manner (also shown in Table 2), the main effect associated with Time emerged as significant for each of the critical items except General Memory. Specifically, significant Time effects were found on the items assessing Decline [$F(1, 132) = 7.49$, $p < 0.01$] and Distress [$F(1, 132) = 9.01$, $p < 0.01$]. Thus as a group, patients reported that their memory was closer to the best it had ever been and less distressing after surgery relative to their preoperative self-reports. Additionally, a significant main effect of Focus was found for both the General Memory item [$F(1, 132) = 4.15$, $p < 0.05$] and for the Distress item [$F(1, 132) = 3.99$, $p < 0.05$]. These results reflected the fact that temporal lobe patients rated their memory as worse in general and as causing more concern than did extratemporal lobe patients. The lack of significant interaction effects involving Focus suggested that this difference was consistent from before to after surgery and that it did not depend on whether surgery was performed on the left or the right hemisphere, although the small number of extratemporal patients included in this study may have limited the power of these analyses to detect meaningful interactions.

Changes in self-reports also were investigated at an individual level by using a series of χ^2 analyses. Patients were classified as having complaints if their score on either MAC-S scale (Ability or Frequency) was more than one standard deviation below the mean for their age or if they endorsed the lowest possible response on either the General Memory (<5th percentile) or the Distress (<16th percentile) critical items. Responses to the Memory Decline item were not used for the purpose of classifying patients because of the high base rates (~30%) with which neurologically normal individuals choose the lowest response option on this item. Thus in the context of this study, the term *complaints* reflects subjective memory reports that fall below a one-SD cutoff, which may or may not correspond to patients' spontaneously sharing concerns about their memory in a clinical setting. However, this method of classifying patients has the advantage of using objective and standardized criteria for defining memory concerns.

The most common finding was for patients to have no complaints about their memory either before surgery or afterward. Sixty-six (49%) of 136 participants were in this category, with left-hemisphere (n = 33; 28 temporal, five extratemporal) and right-hemisphere (n = 33; 29 temporal, four extratemporal) patients equally represented. Thirty-two (24%) of 136 patients endorsed concerns about their memory both before and after surgery, and this group also was evenly split between patients who underwent left (n = 16; 15 temporal, one extratemporal) versus right (n = 16; 15 temporal, one extratemporal) resections. Twenty-six (19%) patients evidenced improvements in their memory self-reports after surgery, whereas only 12 (9%) had new complaints after surgery. Temporal patients were more likely to demonstrate an improvement in their memory self-reports than to develop new complaints after surgery, regardless of whether they underwent left-hemisphere (13 improved vs. eight with new complaints) or right-hemisphere (11 improved vs. two with new complaints) resections. This pattern was not apparent for the extratemporal patients. Two extratemporal patients (both of whom underwent left-hemisphere resections) had new complaints after surgery, and two (one left- and one right-hemisphere patient) demonstrated an improvement in their memory self-reports. χ^2 analyses revealed the improvement in self-reports to be significant for both left- [$\chi^2(1) = 7.12$; $p < 0.01$] and right-hemisphere [$\chi^2(1) = 17.15$; $p < 0.001$] temporal lobe patients, but not for left- [$\chi^2(1) = 0.18$; $p > 0.05$] or right- [$\chi^2(1) = 2.92$; $p > 0.05$] hemisphere extratemporal patients.

Seizure outcome effects on memory self-reports

A series of 2 (Time: Pre- versus Postsurgery) × 2 (Outcome: Seizure Free versus One or More Seizures) repeated measures ANOVAs were used to examine whether patients' self-reports were influenced by the outcome of their surgery. The main effect associated with Outcome was not significant for any of the MAC-S variables. Likewise, the interaction between Time and Outcome failed to reach statistical significance in any of the analyses.

When changes in self-reports for patients with different seizure outcomes were investigated at an individual level by using a series of χ^2 analyses, improvements in self-reports were apparent for both patients who were seizure free after surgery [$\chi^2(1) = 9.30$; $p < 0.01$] and those who experienced one more seizures after surgery [$\chi^2(1) = 14.83$; $p < 0.001$]. Thus seizure outcome did not significantly affect changes in memory complaints across time.

Relationships between memory self-reports and objective memory test performances

Correlations between memory scores and memory self-reports on the two MAC-S scales before surgery and after surgery were calculated based on data from the entire sample of patients to examine relationships between actual memory abilities and perceived memory skills. In addition, correlations between changes in memory across the test–retest interval and changes in self-reports across time were investigated. Pearson correlation coefficients, as well as partial correlation coefficients (with Beck Depression Inventory–2nd Edition scores partialed), are displayed in Table 3.

Before surgery, no significant correlations were identified between actual memory scores and memory self-reports. After surgery, scores on the Ability scale of the MAC-S correlated significantly with actual performance on the Delayed Memory Index. However, no significant results were found when changes in self-reports were correlated with changes in memory test scores. In all analyses, results were identical regardless of whether the variance accounted for by self-reported depression on the BDI was partialed out of the relationships between memory and memory self-reports.

Table 4 displays the correlations between self-reported Ability and Frequency after surgery, changes in self-reported Ability and Frequency from before to after surgery, and postsurgical memory scores. Results are reported for the entire sample, as well as separately for those patients who evidenced stable memory after surgery (defined as a mean level or higher change score based on normative data; z-score ≥ 0) and those patients who demonstrated memory decline after surgery (defined as a change score at least 1 SD below expectation based on normative data; z-score ≤ -1). Consistent with the previous analysis, when responses from the entire sample were considered, self-reported Ability during the postsurgical assessment correlated significantly with Delayed Memory.

Although none of the correlations reached significance for the stable memory group, a number of significant correlations were identified, particularly between actual memory performances after surgery and changes in self-reports across time, for those patients who demonstrated memory decline after surgery. This pattern of correlations indicates that patients who had a decline in their memory were aware of the negative impact that surgery had on their abilities and adjusted their memory self-ratings to reflect more accurately their residual abilities.

DISCUSSION

In contrast to other longitudinal studies in the literature that have examined the relations between subjective memory judgments and objective memory performances in epilepsy patients who have undergone surgical intervention to treat their seizure disorders (26,27), results from the current study demonstrate that patients who experience a significant decline in their memory abilities are accurate at forming relative judgments regarding their postsurgical memory skills. Conducting separate correlational analyses for subsets of patients whose memory declined versus those whose memory remained stable or improved allowed these significant relationships to emerge.

When data from the entire sample were considered, relatively low correlations emerged between scores on memory measures and memory self-assessments. This indicates that patients' perceptions of their memory functioning relative to other individuals are not particularly accurate. This finding is not surprising, given the vast literature documenting rather weak relationships between memory self-appraisals and actual memory abilities. However, for patients who experienced a significant decline in their memory, self-reports were adjusted to reflect a recognition of the change in their memory abilities. Thus patients are sensitive to changes in memory over time, even though they are poor at rating their memory in direct comparison with other adults their age. As such, memory complaints in patients with epilepsy likely represent accurate perceptions of change relative to a personal baseline of functioning rather than absolute memory ability at any given time. These results lend credence to self-reports, particularly in clinical settings in which individuals are likely to have experienced a meaningful decline in their memory, and suggest that longitudinal rather than cross-sectional studies may be required to understand how individuals form judgments regarding their cognitive functioning.

The difference between these results and those previously documented by other researchers is unlikely to reflect significant differences in the types of patients included or the methods used. When analyses were completed in the same manner as in other studies, previous findings were replicated. Specifically, similar to the findings of McGlone (26), as a group, patients in this study evidenced a significant decline in their immediate memory from before to after surgery, but patients judged their memory to be significantly better and less distressing after surgery compared with their baseline self-reports. Additionally, when standardized regression-based norms (30) were used to examine each individual's memory outcome in a manner similar to that used by Sawrie et al. (27), ~37% of the patients demonstrated a significant decline in their objective memory test performances, whereas only 12 (9%) of 136 patients had new memory complaints after surgery, and 26 (19%) patients who had complaints about their memory before surgery no longer demonstrated complaints during their postsurgical evaluation. As mentioned previously, correlational analyses also failed to reveal significant relationships between subjective and objective memory measures in the group of epilepsy patients as a whole. Thus the results of the current study appeared consistent with those previously documented until the data were examined separately for patients who did or did not evidence memory decline after surgery. When the memory self-reports of patients with temporal lobe epilepsy were contrasted with those of patients with extratemporal epilepsy, temporal lobe patients rated their memory as worse and as more distressing than did patients with extratemporal seizure foci. At the group level, these differences in self-perceptions appeared consistent across presurgical and postsurgical evaluations, although the current study may have lacked power to detect significant interaction effects because of the small number of extratemporal patients included (n = 15). In contrast to the expected pattern of greater postsurgical decline in subjective memory in temporal than in extratemporal patients, when the data were examined at the individual level, patients who underwent temporal, but not extratemporal, resections showed a significant incidence of improved self-reports after surgery in χ^2 analyses.

Only one study has previously examined differences in memory self-reports for temporal versus extratemporal patients (24). Although Corcoran and Thompson failed to find significant differences between these two groups of patients, this might have been due to a lack of statistical power to detect significant results, as only five extratemporal patients were included in their sample. Memory complaints also were defined very differently in that study (responses to one item on a mailed questionnaire) compared with the current one, which used a lengthier, norm-referenced subjective memory assessment. Although the current study also included a more diverse group of extratemporal patients than the purely frontal patients included in Corcoran and Thompson's sample, the majority of extratemporal patients examined here (87%) also had primarily frontal involvement. Thus the types of patients included are unlikely to account for the disparate results of these two studies.

Limitations

When interpreting the results of this study, several limitations must be considered. This research was retrospective and did not involve a control group of nonsurgical epilepsy patients. Therefore the possibility that some of the changes in memory self-reports across time are secondary to epilepsy, rather than surgery, cannot be ruled out. In addition, the retrospective nature of this research necessitated that norms previously published in the literature be applied to the patients in this study. The normative data used to age-correct scores and to assess change over time on objective and subjective measures were created on independent samples. Thus the measures of pre- to postsurgical change may not be directly comparable to one another, nor do the normative data for the subjective measure take into account the effects of epilepsy on test scores. Future studies using parallel control group data from epilepsy patients tested twice on both objective and subjective memory measures without undergoing surgery in the interim (27) would allow regression-based change scores or reliable change indices to be calculated for both types of measures and could improve the reliability of comparisons across these two types of instruments.

Unlike previous studies, this research included patients with both temporal and extratemporal seizure disorders of a variety of etiologies. However, the number of extratemporal patients with available data was limited. Thus as mentioned earlier, the lack of significant findings (particularly the lack of interaction effects) when temporal patients were compared with extratemporal patients could reflect a lack of power for detecting true underlying differences. Keeping this in mind, the differences that were found between these two types of patients suggest that continued research in this area is warranted.

Finally, it should be noted that memory self-reports may not provide a more ecologically valid reflection of patients' functioning in their everyday lives than do neuropsychological test results (19). Thus patients' decreased concern about their memory after surgery, despite the presence of documentable memory decline, does not rule out the possibility that they are encountering significant cognitive difficulties in the course of their everyday activities. Alternatively, objective memory measures are not perfectly reliable and assess only a small sample of the kinds of memory abilities that may be used in the course of daily activities. Thus patients' self-reports may be an accurate reflection of their residual memory skills after surgery, despite the limited correlations with performances on standardized tests. Although many patients in this sample demonstrated an awareness of postsurgical memory decline, current results do suggest that few patients are troubled or distressed by what they perceive as new memory problems after surgery, a result that should be reassuring to those who work closely with these patients.

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TABLE 1. *Memory test performance before and after surgery for patients undergoing left- or right-hemisphere resections on temporal or extratemporal seizure foci*

	Temporal				Extratemporal			
	Left (n = 65)		Right (n = 56)		Left (n = 8)		Right (n = 7)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
General[a]	87.83	83.71	92.68	92.30	88.38	81.62	93.14	90.00
	(14.63)	(15.22)	(16.46)	(17.13)	(22.51)	(20.51)	(20.28)	(18.90)
Delayed	85.08	83.77	89.80	89.86	89.38	87.50	89.71	89.14
	(15.96)	(15.66)	(17.17)	(16.85)	(21.51)	(23.13)	(21.94)	(20.60)

[a]The main effect of Time (pre- vs. post- surgery) was significant.

TABLE 2. *Memory self-reports before and after surgery for patients undergoing left- or right-hemisphere resections on temporal or extratemporal seizure foci*

	Temporal				Extratemporal			
	Left (n = 65)		Right (n = 56)		Left (n = 8)		Right (n = 7)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Ability	−0.04	−0.11	−0.15	−0.13	0.22	0.17	0.13	−0.09
	(0.89)	(0.92)	(0.92)	(1.06)	(0.73)	(0.74)	(0.69)	(0.76)
Frequency	−0.32	−0.32	−0.40	−0.19	0.08	−0.27	0.01	0.42
	(1.03)	(1.05)	(1.05)	(1.25)	(1.26)	(1.63)	(1.45)	(1.03)
General[b]	2.55	2.77	2.61	2.75	3.38	3.38	3.00	2.71
	(0.94)	(0.90)	(0.76)	(0.98)	(1.19)	(0.92)	(1.15)	(1.11)
Decline[a]	2.03	2.58	2.11	2.80	2.62	2.88	2.43	2.71
	(0.83)	(1.01)	(0.89)	(1.10)	(1.06)	(1.25)	(0.79)	(0.76)
Distress[ab]	2.40	2.74	2.68	3.52	3.00	3.50	3.29	3.71
	(1.25)	(1.09)	(1.13)	(1.19)	(1.31)	(1.07)	(1.38)	(1.25)

[a]The main effect of Time (pre- vs. post-surgery) was significant.
[b]The main effect of Focus (temporal vs. extratemporal) was significant.

TABLE 3. *Correlations between memory self-reports and actual test scores before surgery and after surgery and correlations between changes in test scores over time*

	General memory	Delayed memory
Before surgery		
Ability	0.01 (−0.04)	0.00 (−0.03)
Frequency	0.03 (−0.03)	−0.12 (−0.06)
After surgery		
Ability	0.16 (0.11)	0.25** (0.23**)
Frequency	0.12 (0.05)	0.17 (0.14)
Presurgery to postsurgery change		
Ability	−0.04 (−0.05)	0.05 (0.08)
Frequency	−0.04 (−0.09)	−0.10 (−0.08)

Coefficients in parentheses are partial correlation coefficients with Beck Depression Inventory–2nd Edition scores partialed.
**$p < 0.01$ 2nd Edition.

TABLE 4. *Correlations between self-reported ability and frequency scores after surgery, changes in self-reported ability and frequency scores over time, and postsurgical memory performance*

	Ability	Frequency	Ability change	Frequency change
Whole sample (n = 136)				
General memory	0.16 (0.11)	0.12 (0.06)	0.08 (0.05)	0.06 (0.02)
Delayed memory	0.25** (0.23**)	0.17 (0.15)	0.14 (0.12)	0.05 (0.03)
Patients without memory decline (n = 28)				
General memory	0.01 (−0.06)	0.04 (0.03)	0.10 (−0.06)	0.06 (0.08)
Delayed memory	0.31 (0.26)	0.35 (0.38)	0.19 (0.09)	0.14 (0.18)
Patients with memory decline (n = 50)				
General memory	0.26 (0.25)	0.17 (0.14)	0.30* (0.33*)	0.32* (0.33*)
Delayed memory	0.33* (0.37*)	0.15 (0.17)	0.36* (0.40**)	0.29* (0.32*)

Coefficients in parentheses are partial correlation coefficients with Beck Depression Inventory–2nd Edition scores partialed.
*$p < 0.05$
**$p < 0.01$