Cognitive Functioning in Depressed Geriatric Patients With a History of ECT

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Cognitive functioning in depressed geriatric patients, some with a history of ECT, was assessed with the Trail Making B test. Depressed patients over the age of 65 who had had at least one prior series of ECT performed more poorly on the test than did older patients with no history of ECT and younger depressed patients regardless of their ECT history. The groups did not differ in severity of depression. Careful assessment of elderly patients' history of ECT will allow for more informed decisions about the current use of ECT and an understanding of the cognitive status of these patients.

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Electroconvulsive therapy (ECT) is currently a favored treatment for severe depression in the elderly (1, 2). The physiological changes that accompany the aging process can produce an increased sensitivity to pharmacological side effects and toxicity that precludes widespread use of antidepressants in this population (3, 4). Although no long-term adverse effects of ECT have been documented, transient retrograde and anterograde amnesia often occur, especially with bilateral electrode placement (5–7). Fraser (1) reported finding transient deficits in learning and longer recovery time (marked by confusion and disorientation) in older depressed patients following a series of bilateral ECT compared with younger depressed patients. He attributed the longer duration of postictal confusion to the potential cumulative effect of ECT in the elderly.

The temporary deficits in new learning (short-term memory) following recent bilateral ECT have been extensively reported (5). Attentional deficits (usually associated with depression) and short-term memory deficits (dysfunction usually associated with the ECT amnestic syndrome, anterograde) have been reported for both younger and older depressed patients (8). However, the prolongation in the elderly patient of the acute organic brain syndrome that typically is seen immediately after ECT administration raises the possibility that the depressed elderly patient may react differently to an accepted form of treatment. Thus, older patients often display more prolonged confusion and disorientation than do younger patients.

Potentially confounding the clinical observation that cognitive recovery is slow-paced for the depressed aged individual is the likelihood that these patients have already received ECT in previous hospital admissions. There are reports that an extended history of ECT (say, 50 or more treatments) may produce longer-lasting cognitive dysfunction (5, 9). A history of ECT typically aids the clinician in determining how useful ECT may be for treatment during the current admission. However, there is little empirical evidence about the impact of a history of ECT on subsequent recovery time from a current psychiatric illness or on the individual's ability to assimilate side effects of both ECT and medication.

We retrospectively examined the possible effects of past ECT administration in a sample of depressed elderly patients who were scheduled to receive ECT during their current admission. We compared their performance on the Trail Making B test (10), a neuropsychological measure of organic brain dysfunction, with that of younger depressed individuals who also were scheduled for ECT. We took a history of ECT for each patient so that performance related to age could be distinguished from performance related to a history of ECT.

METHOD

The sample for this study was drawn from inpatients at the Carrier Foundation with a diagnosis of major depressive disorder or schizoaffective disorder according to *DSM-III* criteria who were scheduled to receive ECT and who had agreed to participate in another research study involving drug effects on ECT (11). Twenty patients (13 women and seven men) were age 65 or over, with an average (±SD) age of 69.7±3.76 years. Forty-one patients (29 women and 12 men) were under age 65, with an average age of 41.7±12.45

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years. No patient had received ECT for at least 3 months before the current hospital admission.

As part of an ongoing study comparing bilateral and nondominant unilateral ECT, we administered a test battery designed by one of us (H.M.P.) to assess cognitive functioning to each patient 3 to 6 hours before his or her first ECT treatment. The test battery included two measures of attention, four of short-term memory (two verbal and two nonverbal), and two of long-term memory (one verbal and one nonverbal). In addition, the Trail Making B test from the Halstead-Reitan Neuropsychological Battery (12) was included to assess confusion and more general cognitive functioning than is measured by the other tests in the battery. Since the Trail Making B test was designed to be sensitive to "organic brain dysfunction" and reflects impairment associated with several different brain locations, it is useful as a screening instrument for the longer-lasting cognitive deficits due to ECT that might be expected in the aged (10).

The Trail Making B test requires basic motor and spatial skills, the ability to count and to follow a complex plan, and cognitive flexibility. Each patient is instructed to connect numbers and letters in sequential order beginning with number 1, then proceeding to letter A, number 2, letter B, and so forth. The patient is interrupted and corrected when an error is made, then instructed to proceed from that point. Total completion time, including time for corrections, is recorded in seconds.

Cognitive functioning can also be affected by severity of depression (13), especially in elderly patients suffering from pseudodementia (14). In addition to making a *DSM-III* diagnosis, a psychiatrist completed the Hamilton Rating Scale for Depression and the Brief Psychiatric Rating Scale (BPRS). The patients were asked to complete the Beck Depression Inventory and the SCL-90-R (15).

Following data collection, we assessed the patients' history of ECT through chart review. Patients were rated as having had none, one, or two or more previous ECT series, and we noted how long it had been since the last ECT series. Information was based on patient reports at admission, typically corroborated by a relative. We could only verify these reports when the treatment had been previously administered at Carrier, which was the case for approximately 54% of ECT series reported. Three patients (two older and one younger) could not be specific about the actual number of series and were conservatively assigned to having had one prior series. All except two younger patients with a history of ECT gave the specific date of their last ECT series. These two patients were included in all the analyses except the one comparing younger and older patients in time elapsed since last ECT. Electrode placement and the number of treatments per series in prior admissions were largely unrecorded. Chart review was conducted without knowledge of the results of the Trail Making B test, and the reviewer was unaware of the purpose of this study.

RESULTS

Of the 20 older depressed patients, only five (25%) had not received any prior ECT. In contrast, 23 (56%) of the younger depressed patients had no prior ECT. Not surprisingly, older depressed patients were significantly more likely to have received previous ECT treatments ($\chi^2=5.24$, df=1, $p<.02$).

According to psychiatrist ratings, the older patients were not more depressed than the younger ones. On the Hamilton depression scale, older patients had a mean (±SD) of 19.60±7.28 compared with a mean of 20.22±7.24 for younger patients; on the BPRS, older patients scored an average of 36.10±9.23 while younger patients scored an average 37.17±9.00. Older patients rated themselves as less depressed than the younger patients did, with a mean on the Beck inventory of 22.92±14.17 for older patients versus 31.45±12.29 for younger ones ($t=2.28$, df=52, $p<.05$, two-tailed) and means on the SCL-90-R of 1.18±0.66 for older patients and 1.67±0.74 for younger ones ($t=2.28$, df=50, $p<.05$, two-tailed).

The most important findings assessing the effects of age and history of ECT were evaluated by two-way analysis of variance, with the number of seconds required to complete the Trail Making B test as the dependent variable. This analysis, illustrated in figure 1, yielded a significant interaction ($F=3.27$, df=2, 55, $p<.05$). That is, the length of time required to complete the test increased if the patient both was over the age of 65 and had a history of ECT. Specifically, cognitive functioning was more deficient in the depressed patients in the presence of two factors: age and history of ECT.

Two-tailed t tests were conducted on the data measuring performance on the Trail Making B test for both older and younger patients who had received one prior series of ECT; older patients had a mean (±SD) score of 386.40±218.21 seconds versus 231.25±95.63 seconds for the younger patients ($t=1.9$, df=11, $p<.10$). For patients who had received at least two series of ECT, older patients had a mean score on the test of 535.50±326.99 seconds versus 202.10±109.39 seconds for younger patients ($t=4.4$, df=18, $p<.005$). In both cases the older patients required more time to complete the test.

Older patients with no history of ECT had a mean score of 218.40±64.46 seconds, which was significantly less time than that needed by older patients with a history of ECT, who had a mean score of 485.80±296.03 seconds ($t=3.08$, df=18, $p<.01$). The two groups did not differ significantly in mean age (±SD) (69.80±4.09 years versus 69.67±3.79 years, respectively). In addition, older depressed patients with no history of ECT (mean score=218.40 seconds) were more likely to perform in the same way as the younger depressed patients with no prior ECT (mean score=166.61±98.49 seconds) as well as those younger depressed patients with prior ECT (mean=215.06±101.60 seconds). There were no significant

FIGURE 1. Performance on Trail Making B Test by Age and Amount of Prior ECT

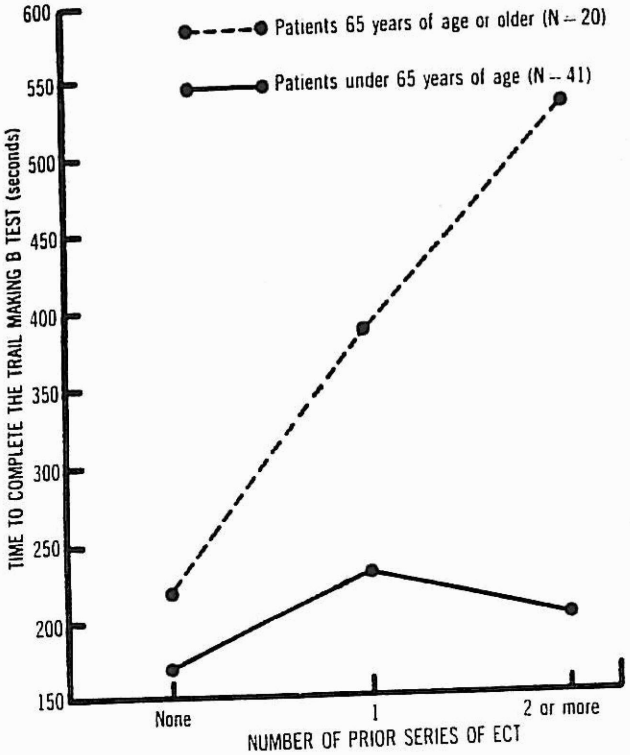
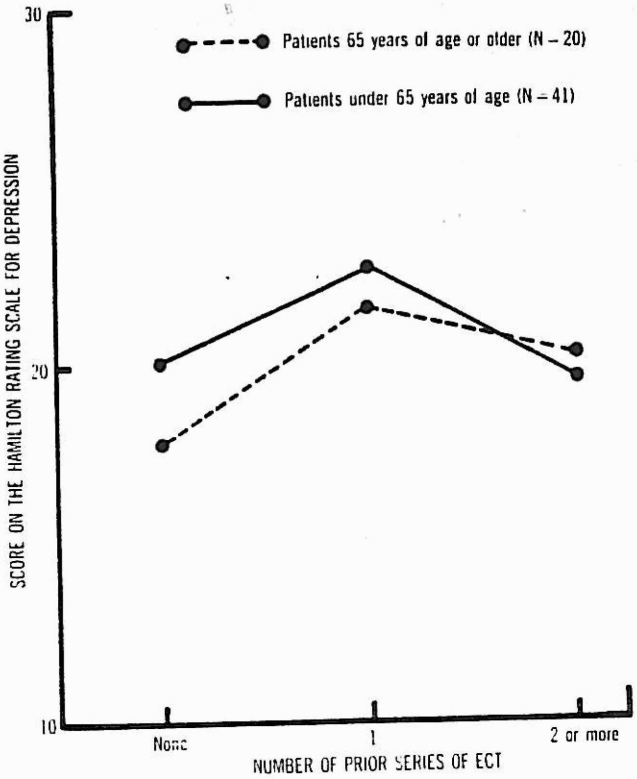


FIGURE 2. Severity of Depression Found on the Hamilton Rating Scale at Time of Admission by Age and Amount of Prior ECT



differences between younger patients with and without a history of ECT in the amount of time needed to complete the B test.

Because there were only five patients over age 65 with no history of ECT, the results, although statistically significant, may capitalize on chance factors. Therefore, we did a regression analysis assessing the relative effects of age and prior ECT on test performance (the dependent variable) for all 61 patients, so that age was treated as a continuous rather than a dichotomous variable. Severity of depression at the time of testing as measured by the Hamilton depression scale was covaried to equate severity of depression across all ages. There still was a significant interaction ($F=3.42$, $df=1, 57$, $p<.07$) between age and prior ECT, indicating that as the patients got older (not necessarily over 65 years) and had a history of ECT, deficits in cognitive functioning became more pronounced.

Although we expected an age differential in cerebral impairment only on the Trail Making B Test, we did a similar analysis on the other tests in the cognitive battery. For all ages, prior ECT did correlate with the short-term verbal memory tests but not with the tests of attention or long-term memory. Significant main effects for prior ECT were found on the paired associates test ($F=4.85$, $df=1, 59$, $p<.05$) and the short story test ($F=3.00$, $df=1, 55$, $p<.08$) from the Wechsler Memory Scale (16). There was no differential effect for the older individual.

Differences in cognitive functioning due to both age and history of ECT are important only if these deficiencies cannot be attributed to more severe depression in the older patient with a history of ECT. A two-way analysis of variance assessing severity of depression at admission (based on the psychiatrist's rating on the Hamilton depression scale) was performed on the sample who had completed the Trail Making B test according to age and amount of prior ECT a patient had received. As illustrated in figure 2, of the six possible groups no one group of patients was significantly more depressed than any other group. The older patients who previously had received ECT were not more depressed on admission than older patients who had no history of ECT or than any of the younger groups of patients.

We performed a regression analysis assessing performance on the Trail Making test by age and the number of months since the last ECT for those patients who reported prior ECT. The number of months since the last ECT series did not account for the results over and above age; therefore there was no relationship between time since the last ECT and the performance on the test. Data were available for 16 of the 18 younger patients and for all 15 of the older patients with a history of ECT. Younger patients had a mean ($\pm$SD) of 65.06 ± 92.26 months since last series of ECT and older patients had a mean of 52.20 ± 77.41 months. Thus, both groups averaged at least 4 years

since last ECT and there was no statistical difference between the two groups. Six (40%) of these 15 older patients and seven (44%) of these 16 younger patients had had ECT within a year of our study.

The mean (±SD) number of series of prior ECT reported in the patients' history was not significantly different for younger patients (2.28±1.49) than for older patients (2.87±2.42).

There was a nonsignificant trend reflecting a relationship between the number of prior series of ECT and more deficient performance on the test among the older patients ($r=.37$, $df=13$, n.s.) which was directly opposite to and significantly greater than ($p<.05$) that found in younger patients ($r=-.22$, $df=16$, n.s.).

DISCUSSION

In this study, elderly depressed patients with a history of ECT were found to be more likely than similar patients with no history of ECT or younger depressed patients regardless of their history for ECT to show some cognitive dysfunction. The difference cannot be laid to a more serious depression, a more extensive history of ECT, or more recent ECT treatments.

Although this retrospective small-group study must be interpreted cautiously, it suggests that the depressed older patient with a history of ECT may be functioning less efficiently than older depressed patients who have never received ECT. The results, if replicated, suggest longer lasting effects of ECT in elderly patients. There is, however, at least one other possible interpretation of this finding. We were unable to assess electrode placement in prior treatments accurately. Since bilateral ECT is more extensively used, it is possible that the cognitive effects noted in those patients with a history of ECT can be attributed to previous bilateral electrode placement. Although this hypothesis might be dismissed, since younger depressed patients with a similar history did not show this effect (and their chances of having had unilateral placement are probably only slightly greater), it is possible that bilateral ECT has potentially more side effects for the older patient. That possibility would support Fraser's (1) recommendation to use nondominant unilateral ECT to minimize the cognitive side effects of ECT in the elderly.

When one is evaluating treatment alternatives for the older patient, focusing on the patient's history of ECT along with other significant ECT treatment variables such as monitoring seizure length, deciding on unilateral versus bilateral electrode placement and so forth (17) is not unlike the strict monitoring of psychopharmacologic treatments due to such factors as differences in drug half-life and absorption rates for patients of all ages. Thus, the "proper dosage" of ECT may need to be more carefully evaluated for older patients just as special monitoring of psychotropic medications is required with these patients. A history of ECT, therefore, may be an important consideration in evaluating the level of functioning of a depressed older patient and a significant factor in shaping expectations for the course of recovery.

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