

The Safety of ECT in Geriatric Psychiatry

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Electroconvulsive therapy (ECT) is often described as an effective and safe treatment of depression in the elderly. However, we have previously reported that there may be increased morbidity in this population, particularly in the very old. This paper extends this work to a second, larger sample of 136 subjects of whom 40 are over 60 years of age. We have again found that while ECT is efficacious, complications increase with age ($r = .26$; $P \leq .003$), occurring in 35% of the elderly as opposed to 18% of the younger group. This increased rate of complications appears to be accounted for by problems in the very old; six of eight subjects over 75 years of age had some untoward event. Common complications in the elderly included severe confusion, falls, and cardiorespiratory problems.

Complications in the whole sample were related to health status ($r = .22$; $P \leq .008$) which in turn correlated with age ($r = .50$; $P \leq .0001$). Those taking a greater total number of medications and a greater number of cardiovascular medications had significantly more complications during ECT. There was no relationship between either complications and outcome or complications and the number or laterality of treatments.

These findings confirm the effectiveness of ECT in the elderly but suggest there may be unappreciated risks of ECT in this population. At particular risk are the very old, those in poor general health, and those taking multiple medications, particularly cardiovascular agents. J Am Geriatr Soc 35:516-521, 1987

Depression in the elderly is commonly encountered and frequently difficult to treat. First-line treatment for depression in the elderly usually includes a trial with an antidepressant. These trials may prove unsatisfactory in the older person for many reasons, including the greater sensitivity of the elderly to the side effects of these medications, the possibly lower response rate of the elderly to these drugs, and the complicating effects of physical illness and other medications. Patients who experience unacceptable side effects from or poor response to these medications or who have physical disorders complicating or contraindicating medication use become candidates for electroconvulsive therapy (ECT). In these circumstances, ECT is often

considered a relatively hazard-free and effective alternative.¹⁻³ We have previously reported that ECT has therapeutic utility in geriatric depression but that a significant number of individuals experience complications during the course of ECT.⁴ These findings have now been extended to a second and larger sample of elderly subjects.

METHOD

Charts of subjects receiving ECT at a university-affiliated private hospital over a ten-month period were reviewed. Information was gathered concerning age, sex, diagnosis, length of hospitalization, history of prior ECT, number and laterality of ECT treatments, and treatment complications. Complications were defined as any event which caused the individual to have an unscheduled physician visit, have a change in treatment plan, or other event not considered usual during ECT. Accordingly, memory difficulty and confusion were not considered complications unless severe. Also noted were medical and psychiatric diagnoses (including current health status), consultations

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during hospitalization, laboratory testing, electrocardiogram and pertinent radiologic exams, and medications used before, during, and after ECT.

At the time of review, a nonblind, global assessment of outcome was made as described previously.⁴ Briefly stated, subjects were rated as unimproved, partially improved, or symptom free at the time of completion of their treatment (0, 1, 2, respectively). The American Society of Anesthesiologists (ASA) 5-point scale of physical status was used as a measure of general health for each subject.⁵ This rating was determined by consensus of the authors (WJB, ER, CFZ). The ASA rating is often used to describe anesthesia risk and is thus pertinent to this sample. Class I indicates a normal, healthy patient, Class II mild systemic disease, Class III severe systemic disease, Class IV severe systemic disease that is life threatening, and Class V a moribund patient with little chance of survival. In this study, psychiatric illness did not preclude a rating of Class I.

Electroconvulsive therapy was administered by an experienced treatment team consisting of a faculty psychiatrist, junior resident in psychiatry, anesthesiologist (or nurse anesthetist), and nursing staff. Laterality and number of treatments were at the discretion of the attending physician. Medications during ECT consisted of atropine 0.6 to 1.0 mg intramuscularly 30 minutes before stimulation, methohexital 0.75 mg/kg and succinylcholine 0.5 mg/kg intravenously just prior to stimulation and oxygen prior to and throughout the treatment. A sine-wave constant voltage ECT apparatus (Medcraft Corporation) was used to deliver the treatment stimulus.

RESULTS

Charts of 136 subjects were reviewed, virtually all of whom came to ECT having failed trials of psychotherapy and/or pharmacotherapy. The overall mean age was 48 years with 96 subjects <60 years of age (mean 39 ± 12.19 SD) and 40 subjects ≥60 years of age (mean 69 ± 6.43 SD). The younger sample had a higher proportion of males and received an average of almost one and one-half more treatments per patient (mean 9.48 ± 3.75 SD v mean 8.03 ± 3.02 SD). Treatments were bilateral in 85% of the older compared to 88% of the younger subjects (Table 1). In six cases, one of whom was over age 60, the laterality of treatment was changed during the course of ECT. Two of these cases were switches from unilateral to bilateral. In four cases laterality was switched from bilateral to unilateral; two of these underwent a second switch back to bilaterality.

Eighty-one percent of the sample had a diagnosis of major affective disorder (including schizoaffective disorder) without a second coexisting Axis I psychiatric diagnosis. There were 22 patients with bipolar

TABLE 1. SAMPLE CHARACTERISTICS

	Total (N = 136)	<60 Yrs (N = 96)	≥60 Yrs (N = 40)
Sex (%)			
Female	71	69	78
Male	29	31	23
Number of treatments (± SD)	9.05 (± 3.60)	9.48 (± 3.75)	(8.03 ± 3.02)
Laterality (%)			
BIL	87	88	85
UNI	13	13	15

depression, only two of whom were over age 60. The remainder of the sample had a variety of diagnoses accompanying the depressive disorder (see Table 2). Only one of the bipolar depressed patients was diagnosed as having a coexisting psychiatric illness.

Seventy percent of the total sample had a complete resolution of affective symptoms during ECT. This figure was 67% for those <60 years of age and 75% for those ≥60 years of age. Those with a diagnosis of depression uncomplicated by a coexisting psychiatric disorder had a significantly better outcome (*r* = .23; *P* ≤ .003). There was no significant correlation of age with outcome.

The ranking of patients' health status using the ASA classification is shown in Table 3. Over 90% of the sample is in Class I and II. Not surprisingly, there are increased numbers of those over 60 years of age in

TABLE 2. OUTCOME OF SUBJECTS WITH COEXISTING PSYCHIATRIC ILLNESS

	N	Outcome		
		0	1	2
≥60 years				
Schizophrenia	1			x
Psychogenic Pain Disorder	1			x
Organic Mental Disorder	2	xx		
Somatization	1	x		
Obsessive/Compulsive Disorder	1			x
<60 years				
Somatization	2	xx		
Alcohol Dependence	6		x	xxxxx
Schizophrenia	8		xxxx	xxxx
Other	4		xx	xx

TABLE 3. HEALTH STATUS BY AGE

ASA Class (%)	<60 Yrs	≥60 Yrs
I	53	18
II	44	63
III	2	18
IV	1	3
V	0	0

Classes II and III, reflecting the occurrence of health problems with age. The ASA rating correlated with age ($r = .50$; $P \leq .0001$) and with complications ($r = .22$; $P \leq .008$).

Complications were also found to increase with age ($r = .26$; $P \leq .003$), occurring in 35% of older subjects compared to 18% of the younger group (Table 4). These events clustered in the very old; six of eight subjects over 75 years of age had some untoward event. This incidence of complications differed significantly from those younger than 75 ($\chi^2 = 9.66$; $df = 1$; $P \leq .002$). Indeed, when the data were examined excluding those over 75, complications no longer correlated with age ($N = 128$; $r = .1370$; $P = NS$). It is noteworthy that in this group under age 75, complications also no longer correlated with the ASA health rating ($r = .1389$; $P = NS$).

Complications in the elderly were of varied types, but most could be categorized under one of three headings: cardiorespiratory difficulties, falls, and severe confusion. Cardiorespiratory problems included two cases of marked, sustained elevations of blood pressure after stimulation, one case of hypotension following a treatment, another with sustained tachycardia following a treatment, and two cases of pneumonia developing during the course of ECT. Falls were experienced by six patients. Four patients fell once during the course of ECT, one fell twice, and one fell three times. One patient who fell sustained a 6 cm facial laceration, and was transferred to a neurosurgical intensive care unit for observation. Unfortunately, data concerning falls occurring prior to ECT were not systematically recorded. Severe confusion was the single most common adverse effect, involving seven subjects. In addition, one of these subjects also

TABLE 4. COMPLICATIONS (%)

	<60 Yrs	≥60 Yrs
Cardiorespiratory	3	15
Falls	0	15
Confusion	13	18
Hypomania	1	3
Vomiting/Bruxism	1	0
Total	18	35

fell, and one contracted pneumonia. The six patients over 75 with complications are described in detail in Table 5.

Subjects under 60 years of age had similar types of complications with over two-thirds of these problems being confusion or agitation severe enough to delay, stop, or otherwise alter the course of ECT. Two subjects had a marked sustained pressor response to ECT. Another subject had an episode of tachycardia with a rate of 210 following ECT. All three of the subjects had spontaneous resolution of these problems without intervention.

One subject with bipolar affective disorder became hypomanic, necessitating the addition of neuroleptics; another had a slow recovery accompanied by bruxism, and later vomiting, following the first treatment. He underwent an extensive examination which was normal and then completed the course of ECT without further difficulties.

Having a complication did not relate to outcome, number of treatments, or laterality of treatments. A distinction between early and late complications was investigated by dividing the total ECT course in half for those receiving a full series of treatments. For those whose course was interrupted, early was defined as being four or less treatments. The distribution of complications was evenly divided between early and late in the course of treatment for both younger and older patients. Individual types of complications were also as likely to happen early as late in the course of treatment.

Medications were grouped under general headings of cardiovascular, psychotropic, and other medication. Older subjects more commonly received cardiovascular medications ($\chi^2 = 24.14$; $df = 1$, $P \leq .0001$) while the younger group was more likely to receive a neuroleptic ($\chi^2 = 5.03$; $df = 1$, $P \leq .05$). The elderly taking cardiovascular medications sustained complications more often than elderly not taking such drugs ($\chi^2 = 7.78$; $df = 1$, $P \leq .005$). In the entire sample, those taking cardiovascular drugs also had more complications ($\chi^2 = 15.96$; $df = 1$; $P \leq .0001$). No other class of drug was associated with complications either alone or in interaction with age or ASA rating. However, as a whole, those who experienced a complication were receiving a greater number of medications (two-tail $t = 3.25$; $P \leq .001$). This was also true of the elderly when considered separately (two-tail $t = 3.30$; $P \leq .001$). The total number of drugs also correlated with the ASA rating ($r = .3285$, $P \leq .0001$).

The patients who experienced severe confusion as a complication did not differ significantly in the type of drugs they received. Those with cardiorespiratory difficulties were, however, more likely to be receiving cardiovascular medications ($\chi^2 = 9.83$; $df = 1$, $P \leq .002$). Analysis of other types of problems was limited

TABLE 5. PATIENTS > 75 WITH COMPLICATIONS DURING ECT

Age	Sex	ASA	Outcome	Drugs During ECT		Type of Complication
				Psychotropic	Other	
81	F	II	2	Thioridazine Oxazepam	Digoxin Tolmetin	Fall
82	M	II	0	Diphenhydramine	Atenolol Carbidopa L-dopa	Fall Hypertension Confusion
80	M	IV	1	None	Digoxin Procainamide Insulin Prednisone Nitroglycerin Furosemide	Fall
81	M	III	2	Haloperidol Flurazepam	Timolol	Fall
78	F	II	0	Trifluoperazine Trazodone Diazepam	Dipyridamole Furosemide Levothyroxin Isosorbide dinitrate Nadolol Erythromycin	Confusion
81	F	II	2	Lithium carbonate Trazodone Thioridazine	Digoxin Furosemide Isosorbide dinitrate	Hypomania

by the small number of individuals having these problems.

When considered individually, age, ASA rating, and taking cardiovascular medication all correlated with sustaining a complication during ECT. In an effort to discern the relative contribution of these several correlates, a multiple regression analysis was performed. When entered first, cardiovascular medication consumption was the variable ($F = 19.45$; $P \leq .0001$) that accounted for the most variance. However, when the items were examined for any independent contribution to rate of complications, no significant difference among the variables was found, although there was a trend for a significant effect of cardiovascular medications ($F = 3.00$; $P \leq .09$). The result indicates a high degree of correlation between these variables with no one variable clearly accounting for the increased risk during ECT.

DISCUSSION

This study confirms the efficacy of ECT. Although not a treatment study, the results reflect a therapeutic benefit for the vast majority of patients, old or young. Given this efficacy, the issue of safety of the treatment becomes paramount.

For comparison with our prior report, initial analysis of these data used age 60 as a dividing line. This revealed that complications increased with age and

were related to health status. However, after finding that all but two subjects over 75 years of age experienced some problem during ECT, a reanalysis was performed using this age as a break point. Strikingly, this revealed that persons less than 75 years of age were fairly homogeneous in terms of complications, ie, complications in those under age 75 did *not* correlate significantly to age nor to health rating. In our prior investigation, we discovered that nine of the ten oldest patients in that sample of thirty patients age 60 years of age and older experienced some untoward event during ECT.⁴ Only one patient less than age 75 had any complication in that study. We have combined data on age and complications from the two studies, and they reveal a dramatic difference in the number of complications experienced by the very old ($N = 70$; $\chi^2 = 18.72$; $P \leq .00002$).

This increase in complications is probably due to a number of factors. The ASA estimate of health status strongly correlated to age and less strongly to complications overall. Thus, complications may be more common in those with more serious health problems particularly in the "old old." In addition, medication appeared to play an important role in complications in the general sample. Those with complications were taking a greater total number of medications during ECT, including a significantly higher number of cardiovascular medications. Those with cardiorespira-

tory complications were more likely taking cardiovascular medications. Among the elderly, those over 60 years of age with complications were taking more medication than their peers without complications. This held true also when those over 75 years of age with problems were compared to the remainder of those over 60 years of age.

Considering medication, age, and health status together, it is difficult to address the relative contribution of the three since they are obviously highly correlated. Those taking more total drugs and cardiovascular medication are likely to be elderly and have greater underlying health problems which could thereby potentially increase the risks of ECT. Total number of medications and health status were strongly related. A multiple regression analysis was unable to distinguish independent effects of these variables except to suggest a nonsignificant trend for complications in those taking cardiovascular medications. It should also be noted that no direct correlation between use of any psychotropic medication and complications during ECT could be established.

The type of problem sustained during ECT appears to be age-related. Seventy-two percent of ECT problems in the young were related to confusion or agitation while 35% of the complications in the elderly were of this type. Cardiorespiratory problems comprised 30% of the complications of the elderly subjects and 17% of those of the younger group. Thirty percent of the geriatric complications were falls and occurred in four of the six subjects over 75 years of age who had complications. No falls occurred in the younger group.

In a chart review of 33 elderly patients, Karlinsky and Shulman⁶ used an outcome scale similar to that used in this study. They found that patients with immediate good outcomes received significantly fewer treatments, but that only 42% of the subjects showed an immediate positive response. They also reported that only one patient had experienced a complication. On the other hand, Alexopoulos et al.⁷ noted that the elderly developed significantly more medical problems than did younger controls in a study of 199 geriatric patients. As in the present study, they described medical problems as those requiring temporary discontinuation of ECT or treatment. Further they noted that cardiovascular problems were the most important complication, occurring almost exclusively in the elderly group. Many of these patients had a history of cardiac disorders. With the exception of one patient who died following a myocardial infarction, all of the medical problems were described as reversible.

The current results are in general agreement with those of Alexopoulos et al.⁷ and our previous findings.⁴ While ECT is efficacious, there is some increase

in morbidity associated with the treatment in the elderly, particularly for the very old.

Given these findings, it is reasonable to attempt to develop strategies to minimize these adverse effects in routine practice. Confusion was a problem for both young and old in this study. The most easily modifiable variable to reduce confusion might be a change in laterality of treatment from bilateral to unilateral. The preponderance of patients who received bilateral treatments in this study presumably reflects to some degree a lack of confidence in the efficacy of unilateral treatments by the attending physicians. While the bulk of available evidence argues that there is little difference in efficacy according to laterality,^{8,9} this question remains controversial.^{10,11} In order to avoid any unnecessary cognitive impairment which may in itself lead to further morbidity, it seems appropriate to consider unilateral treatments as the initial choice, particularly for the elderly. If subjects should fail to respond to unilateral treatment, they may be switched to bilateral treatments and still show a response¹² as one elderly patient in this study did. Another possible way to avoid excess confusion would be to reduce treatment frequency to twice a week or less. This strategy could increase the length of hospitalization but conceivably might reduce it if interruptions in the course of ECT were thus avoided. Alexopoulos et al.⁷ also found that the elderly receiving antipsychotic drugs during ECT developed disorientation more often, thus suggesting attention to medication is also important. However, we found no significant difference in confusion according to any drug type. Certainly, psychotropic medication use during ECT should be minimized, particularly in the elderly.

Falls during ECT were a problem only for the elderly, but it is difficult to know what ECT contributes to the incidence of this common, complex geriatric problem.^{13,14} Efforts at minimizing confusion as outlined above may decrease any independent contribution of ECT to this problem.

Cardiorespiratory events in this study occurred in elderly subjects with a history of mild cardiovascular disease (all were ASA Class II). Such problems were associated with the use of cardiovascular medications in the elderly and in the sample as a whole. It may prove beneficial to pay meticulous attention to the physical state of such patients prior to and during ECT. At a minimum, it should be appreciated that these patients may be at higher risk during ECT.

Those subjects with complications were taking a significantly greater number of medications than those who experienced no problems during ECT. While this may reflect the health of that population, it is worthwhile to attempt to simplify the drug regimen of any patient prior to ECT. Most patients in this study re-

ceived some type of medication during ECT. The reasons patients remained on these medications during ECT is unknown but is probably due to a number of factors, including avoidance of sudden withdrawal of psychotropic medications, lack of strong evidence that use of such medications during ECT is contraindicated, and recognition that use of antidepressant medication following ECT is needed for prophylaxis against recurrent depression. However, a number of psychotropes are known to influence seizure variables,¹⁵ and lithium has been reported to cause problems if given during ECT.¹⁶ The effects of other drugs are less well known, but since ECT itself involves the use of several drugs the dangers of unwanted drug interactions are always present.

This study suffers the limitations of any retrospective study. However, we have found very similar results in a prior sample at a different institution.⁴ We believe the data support the contention that problems associated with ECT are more common in the "old old." This reflects the growing awareness that it is persons over 75 years of age who may be most likely to evidence the impaired health and functional status that are stereotypically associated with the frail elderly.¹⁷ Fortunately, most of the problems occurring in this study were not life threatening and resolved over time without need of intensive intervention. We believe ECT is a valuable tool in the treatment of affective disorders in the aged, but urge caution, particularly in those who are very old, in fragile health, and who are taking several medications, especially those with cardiovascular effects.

It is worthwhile emphasizing that pharmacotherapy may present equal or greater hazards to the depressed elderly individual. Research on the relative safety of ECT *v* pharmacotherapy is sadly lacking. Prospective randomized studies are needed to better define these problems associated with somatic therapies and to lead to safer, more effective therapeutic techniques for the depressed elderly. Also, it is essential to remember that a large number of individuals respond to ECT having failed drug therapies. These individuals should not be deprived of the opportunity to receive adequate therapy. Younger, depressed patients treated with ECT have been reported to enjoy a decrease in morbidity and mortality compared to those treated with antidepressants¹⁸—fear of complications should not deprive older persons of this potential gain.

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