INTRODUCTION

Electroconvulsive therapy (ECT) is an important option for the treatment of depression. The efficacy of ECT in mania has also been widely documented for a long time. Although ECT is considered a very effective tool for the treatment of psychiatric diseases, memory disturbances are among the most important adverse effects.

Context: Although electroconvulsive therapy (ECT) is considered a very effective tool for the treatment of psychiatric diseases, memory disturbances are among the most important adverse effects.

Aims: This study aimed to assess prospectively early subjective memory complaints in depressive and manic patients due to bilateral, brief-pulse ECT, at different stages of the treatment, compare the associations between psychiatric diagnosis, sociodemographic characteristics, and ECT characteristics.

Settings and Design: This prospective study was done with patients undergoing ECT between November 2008 and April 2009 at a tertiary care psychiatry hospital of 2000 beds.

Materials and Methods: A total of 140 patients, scheduled for ECT with a diagnosis of bipolar disorder (depressive or manic episode) or unipolar depression according to Diagnostic and Statistical Manual of Mental Disorders IV diagnostic criteria, were included in the study and invited to complete the Squire Subjective Memory Questionnaire (SSMQ) before ECT, after the first and third sessions and end of ECT treatment.

Statistical Analysis: Mean values were compared with the Kruskal–Wallis test and comparison of the longitudinal data was performed with a nonparametric longitudinal data analysis method, F1 LD F1 design.

Results: SSMQ scores of the patients before ECT were zero. SSMQ scores showed a decrease after the first and third ECT sessions and before discharge, showing a memory disturbance after ECT and were significantly less severe in patients with mania in comparison to those with depression.

Conclusions: These findings suggest an increasing degree of subjective memory complaints with bilateral brief-pulse ECT parallel to the increasing number of ECT sessions.

Key words: Bilateral electroconvulsive therapy, depression, mania, subjective memory complaint
We opted for a validated tool that could be implemented easily to assess early subjective memory complaints due to bilateral brief-pulse ECT at different stages of the treatment series. Squire Subjective Memory Questionnaire (SSMQ) is a structured questionnaire developed by Squire, intended to question patients' own views about the extent of memory loss.\[^{7,10,15-18}\]

**MATERIALS AND METHODS**

**Patients**

All consecutive patients hospitalized between November 2008 and April 2009 at a tertiary care psychiatry hospital of 2000 beds, and scheduled for ECT were evaluated for inclusion in this study. Patients aged between 18 and 64 years, diagnosed as having treatment-resistant major depressive disorder (either bipolar or unipolar) or treatment-resistant bipolar manic episode according to Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) diagnostic criteria, who would receive ECT for the 1\(^{st}\) time or those who had not received ECT within the last 6 months were evaluated. The diagnosis and ECT indications were decided by the attending psychiatrists. Response to treatment was evaluated by the attending psychiatrist. Patients with a serious physical or neurological disorder, those with a history of head trauma and with mental retardation and those who could not self-administer SSMQ were excluded from the study. Patients who were able to complete initial cognitive assessments were enrolled in the study. A total of 140 patients (79 males and 61 females) were included in the study. The patients were informed about the procedure and the study, and their written informed consents were obtained. The study was approved by the local Ethics Committee and was conducted in accordance with the Declaration of Helsinki and Good Clinical Practice.

**Assessment**

The sociodemographic data of patients were obtained and recorded in the form developed for this purpose (ECT form). The psychiatric diagnoses were ascertained with the help of the Turkish version of Structured Clinical Interview Form for DSM-IV (SCID-I).\[^{19,20}\] Before the first ECT session, the global cognitive functioning of the patients was assessed by the Turkish version of mini-mental state examination (MMSE).\[^{21,22}\] Patients with MMSE > 25 were included in this study. SCID and MMSE were administered by a senior psychiatry resident (S.B.).

The SSMQ, developed for subjective assessment of memory, was also administered 1 day before the first ECT session and repeated 2 h after the 1\(^{st}\), 3\(^{rd}\) ECT sessions, and end of ECT treatment. We evaluated the participants after examining their consciousness and orientation. The psychiatrist enrolling the subjects ensured whether the subjects could be oriented to the test.

SSMQ is self-administered and contains 18 items. The patients’ answers are scored between -4 (worse than before), 0 (same as before), and +4 (better than before) points, the sum of which are added together to obtain a final score. A negative score shows an increase in the degree of forgetfulness. SSMQ was translated to Turkish by an English-speaking psychiatrist.

**Electroconvulsive therapy administration technique**

All patients were administered bilateral brief-pulse frontotemporal ECT (with a Thymatron IV device Somatics Inc., Lake Bluff, IL, USA) at the ECT Center, 3 times a week, every other day in the mornings. The patients were fasted for 6 h before the procedure. General anesthesia was induced by intravenous administration of appropriate anesthetic agents, with succinylcholine for muscle paralysis. Half-age method was used in determining the initial intensity of stimulus seizures shorter than 25 s were considered inadequate, and the dose was increased 50%, with a maximum of 3 times in a session.\[^{23,24}\] In the subsequent sessions, when the duration of convulsions decreased to 25–30 s, the dose was increased 10%.

**Concomitant medications**

All patients were taking combinations of psychotropic medications (antidepressants, antidepressants + antipsychotics, and antipsychotics) at maximally tolerated doses, without clinical improvement, and ECT treatment was considered necessary by their attending psychiatrists. Their usual psychopharmacological therapy continued during the course of the study. The pharmacotherapy of the patients was not restricted in any way in accordance with the protocol of this study, and a comparison on the possible effects of the drugs was not included in the design of the study.

**Statistical analysis**

The duration of seizure, mini-mental test scores, and SSMQ scores was examined with Shapiro–Wilks test. As the continuous variables did not show a normal distribution, they were presented as median (interquartile range) and minimal-maximal values, whereas categorical variables such as gender, marital status, and educational level were presented as numbers (percent). The duration of seizures and differences in total ECT sessions in diagnostic groups were examined with Kruskal–Wallis analysis, the differences in SSMQ scale scores between the measurement time points were examined with F\(_{1,LD,F1}\) design.\[^{25-27}\] The results of F\(_{1,LD,F1}\) design were presented as ANOVA-type test statistical results. In factors where significant differences were detected, relative treatment effects (RTE) for dual comparisons were evaluated. As additional information, mean ± standard deviation (mean ± SD) values were given.
in patient groups and measurement time points. IBM SPSS Statistics 21.0 (IBM Corp., Released 2012. IBM SPSS Statistics for Windows, Version 21.0, IBM Corp., Armonk, NY, USA) and MS-Excel 2013 software were used in statistical analysis, calculations, and graphic drawings. “nparLD” module was used in F1_LD_F1 design in R program.

RESULTS

Sociodemographic characteristics
A total of 140 patients were included in this study (79 [56.4%] males and 61 [43.6%] females). The mean age of male patients was 45.47 ± 8.54 years, and mean age of females was 42.1 ± 4.4 years. About 83 of the 140 patients (59.3%) had a diagnosis of bipolar mania, 23 (16.4%) had bipolar depression, and 34 (24.3%) had unipolar depression.

The sociodemographic characteristics of the patients are presented in Table 1.

Electroconvulsive therapy characteristics
The diagnostic groups were found to be homogenous according to the number of ECT sessions administered ($\chi^2 = 1.487, P = 0.476$).

The mean duration of seizure of patients with bipolar mania, bipolar depression, and unipolar depression were similar in different diagnostic groups ($\chi^2 = 2.860, P = 0.239$). ECT Characteristics according to diagnosis are presented in Table 2.

Subjective evaluation of memory
SSMQ scores of the patients before ECT were zero. SSMQ scores showed a significant decrease after the first, third, and at the end of ECT sessions. This decrease was parallel to the increasing number of ECT sessions. The scores were observed to decrease in time in all diagnostic groups and presented in Figure 1.

The group with bipolar mania had reported significantly milder subjective memory complaints in comparison to those with bipolar depression and unipolar depression.

The scale scores of patients with bipolar mania were significantly different than those of patients with bipolar depression and unipolar depression ($P < 0.001$ for all tests). The changes in scores of patients with bipolar mania in time were different than the other patients ($P < 0.001$ for group: Time test). The changes in time of SSMQ scores of patients with bipolar/unipolar depression were found to be similar ($P = 0.163$).

Results of all pair-wise comparisons are presented in Table 3.

When the groups were evaluated generally, the scores of patients in the bipolar mania group were higher than the other two groups ($RTE = 0.555, P < 0.001$), when the measurement times were evaluated, pretreatment scores were higher than other times ($RTE = 0.813$). Rank means ± SDs and relative impact of each score are presented in Table 4.
In this study, we are reporting progressive subjective memory complaints in depressive and manic patients during a bilateral brief-pulse ECT course, and it is more in depression than mania.

While early studies had reported a negative impact of ECT on subjectively rated memory, more recent studies showed a weak effect or a positive effect, implying that bilateral brief-pulse ECT may not produce the complaints that were seen with bilateral sine-wave ECT and others have reported even weaker less negative effects of unilateral placement.\textsuperscript{[8,9,15,28‑31]} Brakemeier in a recent study reported with brief-pulse unilateral versus bilateral ECT with improved SSMQ scores few days after ECT relative to baseline. Chee Ng also reported improvement in SSMQ scores at 6th ECT, the end of sessions, and 1 month with RUL ECT. Mayur comparing baseline with 24 h after 8th session and 3 months have found a significant improvement in terms of SSMQ scores at every time point and also have drawn attention to advantages of ultra-brief-pulse.\textsuperscript{[11,16,32]} In this study, contrary to a number of studies, improvement in SSMQ scores, with brief-pulse, could not be demonstrated. It is highly possible that the administration of SSMQ within 2 h of ECT was a major factor.

Another influence may also be the preference of bitemporal ECT in this study, our results were only in line with of Squire \textit{et al}.\textsuperscript{[17]} at post-ECT 1-week scores, where all patients were administered bilateral ECT and patients reporting increased memory complaints which return to pre-ECT levels at 6th months. Our results reflect the early phase findings and as the patients were not followed up to examine long-term side effects of bilateral, brief-pulse ECT on subjective memory we cannot deduce any conclusion for long-term effects on the patients.

In this study, bipolar manic patients had reported significantly less subjective memory complaints than depressive patients (either bipolar or unipolar). Most western studies using the SSMQ are done on patients with treatment-resistant depression. Although different results were reported by some studies, a significant association was found between the severity of depression and subjective memory disturbances.\textsuperscript{[33]} Studies evaluating subjective memory reported a significant relationship between the severity of depressive symptoms and SSMQ scores and marked improvement after the termination of an ECT course.\textsuperscript{[15,16]} There is few study reporting memory complaints of bipolar manic patients.\textsuperscript{[12,13,34,35]} The presence of less severe subjective memory complaints in manic patients in comparison to those in depression in this study may be considered to be an influence of the affective state at the time of the evaluations. The absence of examining if the

When the differences in SSMQ scores were examined according to diagnostic groups and time, a significant difference independent from time was found between the groups and a significant difference independent from group was found between the times ($P < 0.001$). Furthermore, a difference was detected between diagnostic groups in terms of change of scores according to time ($F = 35.699, P < 0.001$).

A decrease was detected in SSMQ scores of all patients, starting after the first session, showing a significant difference in comparison with the pretreatment evaluation, and also a significant increase in progressive sessions.

In comparison of diagnostic groups, the decrease in scores in patients with depression (bipolar or unipolar) was similar, whereas this decrease was significantly less in manic patients.

**DISCUSSION**

In this study, we are reporting progressive subjective memory complaints in depressive and manic patients during a bilateral brief-pulse ECT course, and it is more in depression than mania.

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mood status of the patients were associated with subjective memory complaints by scales may have prevented our evaluation of this effect and differences.

Limitations
As this study reflects existing treatment protocols, its findings provide information from our actual psychiatric practice and should be interpreted with caution, taking into consideration several influences that might be present. One of these influences may be continuation of the use of psychoactive medications. ECT administration in the presence of pharmacotherapy may prevent definite conclusions. Another limitation may be the lack of a control group of similar patients treated with pharmacotherapy only. Furthermore, preference of bitemporal ECT in this study (due to institutional protocols), restrict any conclusions regarding optimal electrode placement. Finally, patients were not followed up to examine long-term side effects of bilateral, brief-pulse ECT on retrograde subjective memory in this study due to financial restrictions. Future studies using more sensitive neuropsychological methods with longer-term follow-up are will be welcome.

As healthcare professionals working at a psychiatric facility treating a large number of psychiatric patients, some with ECT, we believe that ECT is very important and beneficial. We also believe that our results reflect the early phase findings. A longer-term follow-up study should be done, for which we could not provide the necessary funds, as a result of which we had to evaluate only the early phase cross-sectional findings, which we shared. We believed that a better understanding on memory disturbances associated with ECT will be beneficial for both clinicians, and the society in general. Further longer-term studies in the future will provide clearer answers to various questions that are not addressed in this study.

CONCLUSION
These findings suggest an increasing degree of subjective memory complaints with bilateral brief-pulse ECT parallel to the increasing number of ECT sessions. Although we found electroconvulsive therapy to cause some memory disturbances in the acute phase, we still believe that its benefits largely outweigh these. Long-term follow-up studies may provide more data on this issue.

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Conflicts of interest
There are no conflicts of interest.

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