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# Assessment of Effect of Propofol and Ketamine in Electroconvulsive Therapy Anesthesia

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**ABSTRACT:**
**Background:** Ketamine is in clinical use since 1970. It is a unique intravenous (IV) anesthetic that produces a wide spectrum of pharmacological effects including sedation, catalepsy, somatic analgesia, bronchodilation, and sympathetic nervous system stimulation. **Materials and methods:** The present study was conducted in the Department of Anesthesiology of MGM Medical college, Navi Mumbai. 100 patients who were scheduled for ECT treatment were enrolled. The study population was randomly assigned to receive one of three anesthetic agents (Ketamine, Propofol, or Ketofol). After premedication with intravenous atropine sulfate (0.25 mg), propofol (10 mg/ml), ketamine (10 mg/ml), or ketofol was administered slowly (20 mg/10 s) until the patient no longer responded to his/her name being called loudly and showed loss of the eyelash reflex. **Results:** We found that both ketamine and Ketofol have an increased mean seizure duration compared to propofol. **Conclusion**: We found that both Ketamine and Ketofol have an increased mean seizure duration compared to propofol.
**Keywords:** Anesthesia,Electroconvulsive Therapy, Ketamine, Propofol, Seizure.

## INTRODUCTION:

Electroconvulsive therapy (ECT), introduced by Cerlitti and Bini in 1937, is the induction of a generalised seizure by electrical stimulation of one or both cerebral hemispheres. It has become a highly sophisticated and precise procedure with passage of time. Initially, 'unmodified' technique was practised in which patients were conscious and without muscle relaxation. This resulted in musculoskeletal complications in as many as 40% patients. Beginning in the 1950s and 1960s, however, several refinements including anaesthetic medications and muscle relaxants were introduced to increase the safety and patient acceptability. [1, 2, 3] Ketamine is in clinical use since 1970. It is a unique intravenous (IV) anesthetic that produces a wide spectrum of pharmacological effects including sedation, catalepsy, somatic analgesia, bronchodilation, and sympathetic nervous system stimulation.[4] The availability of newer drugs, the disturbing emergence reactions of ketamine, its stigma as a "vet medicine" and gaining popularity as a drug with abuse potential are factors, which would discourage its use by present day anesthesiologists. [5, 6] However, ketamine because of its unique properties and newly found clinical properties has stood the test of time. Hence, this study was planned to to evaluate the effect of ketamine, Propofol, and Ketofol on hemodynamic profile, duration of seizure activity, and recovery times in patients undergoing ECT.

## MATERIALS AND METHODS:

The present study was conducted in the Department of Anesthesiology of MGM Medical college, Navi Mumbai. The ethical clearance for the study was approved from the ethical committee of the hospital. 100 patients who were scheduled for ECT treatment were enrolled. The study population was randomly assigned to receive one of three anesthetic agents (Ketamine, Propofol, or Ketofol). After premedication with intravenous atropine sulfate (0.25 mg), propofol (10 mg/ml), ketamine (10 mg/ml), or ketofol was administered slowly (20 mg/10 s) until the patient no longer responded to his/her name being called loudly and showed loss of the eyelash reflex. The required total dose of propofol, ketamine, or ketofol was recorded. Mean arterial pressure (MAP), heart rate (HR), and oxygen saturation values were recorded at baseline, at induction, and at 1, 3, 5, and 10 min after the end of seizure. The duration of the motor seizure was defined as

the time from the ECT stimulus to cessation of tonic–clonic motor activity in the 'isolated' arm. The time from the end of succinylcholine administration until spontaneous breathing, eye opening, and obeying commands was recorded.

The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistically significant.

**RESULTS:**

Table 1 shows seizure duration and recovery times of patients. We found that motor seizure duration in the propofol group was significantly decreased compared to other groups. Spontaneous breathing time in ketamine group was statistically increased compared to propofol group. Whereas eye-opening time and obeying command time were significantly increased in the ketamine group compared to other groups. Table 2 shows side effects among groups. Regarding side effects, there were no statistically significant differences between groups.

**Table 1: Seizure duration and recovery times of patients**

| Incident | Propofol group (n=30) | Ketamine group (n=30) | Ketofol group (n=30) | p-value |
|---|---|---|---|---|
| Motor seizure | 30.25 | 41.29 | 35.85 | 0.05 |
| Spontaneous breathing | 254.21 | 270.18 | 272.26 | 0.01 |
| Open eyes | 412.27 | 538.55 | 449.78 | 0.001 |
| Obey commands | 521.22 | 591.28 | 529.26 | 0.002 |

**Table 2: Side effects among groups**

| Side effect | Propofol group (n=30) | Ketamine group (n=30) | Ketofol group (n=30) | p-value |
|---|---|---|---|---|
| Nausea and vomiting | 0 | 2 | 0 | 0.5 |
| Bradycardia | 2 | 0 | 0 | 0.19 |
| Tachycardia | 1 | 3 | 2 | 0.17 |
| Hypotension | 2 | 0 | 0 | 0.2 |
| Hypertension | 0 | 3 | 1 | 0.34 |
| Arrythmia | 0 | 1 | 0 | 0.21 |

**DISCUSSION:**

When the seizure is inadequate, that is, short or unsuccessful the electrical stimulus is increased followed by potentiation of the side effects. When the therapy in itself is without effect the number of treatments is increased. Thus, there is a need to optimize each ECT treatment to lessen the energy and number of treatments. Fernie G et al [7] established if ketamine as the anaesthetic for ECT results in fewer ECT treatments, improvements in depression severity ratings and less memory impairment than the standard anaesthetic. Double-blind, parallel-design, RCT of intravenous ketamine (up to 2 mg/kg) with an active comparator, intravenous propofol (up to 2.5 mg/kg), as the anaesthetic for ECT in patients receiving ECT for major depression on an informal basis. No significant differences were found on any outcome measure during, at the end of or 1 month following the ECT course. Li XM et al [8] examined the efficacy and safety of ketamine augmentation of ECT in MDD treatment. Four RCTs (n = 239) compared ketamine alone or ketamine plus propofol (n = 149) versus propofol alone (n = 90) in patients with MDD who underwent a single ECT session. Three RCTs were considered as unclear risk with respect to random sequence generation using the Cochrane risk of bias. Compared with propofol alone, ketamine alone and the combination of ketamine and propofol had greater efficacy in the treatment of depressive symptoms at days 1, 3 and 7 after a single ECT session. Moreover, compared with propofol alone, ketamine alone and the combination of ketamine and propofol were significantly associated with increased seizure duration and seizure energy index. Compared with propofol, ketamine alone was significantly associated with increased opening-eye time. Based on the GRADE approach,

the evidence level of primary and secondary outcomes ranged from very low (26.7%, 4/15) to 'low' (73.3%, 11/15). They conluded that compared with propofol, there were very low or low evidence levels showing that ketamine alone and the combination of ketamine and propofol appeared to rapidly improve depressive symptoms of patients with MDD undergoing a single ECT session.

Brunelin J et al [9] investigated the clinical effects of the combination of ketamine and propofol as anesthetic agents during electroconvulsive therapy (ECT) in patients with uni- or bipolar major depressive episodes. In a randomized placebo-controlled trial, remission rates after 4 and 8 weeks of ECT were compared between patients who were randomly allocated to receive either the combination of ketamine (0.5 mg/kg) + propofol (n= 11) or placebo + propofol (n = 16). Depressive symptoms were assessed weekly using the Montgomery–Åsberg Depression Rating Scale (MADRS); ECT sessions were administered twice per week for a maximum of 8 weeks (16 sessions). After 4 weeks, we observed significantly fewer remitters in the ketamine + propofol group (0/11; 0%) than in the placebo + propofol group. No significant difference was observed between the two groups regarding the number of patients who achieved remission weekly throughout the study period. The mean duration of seizures was significantly shorter in the ketamine + propofol group than in the placebo + propofol group. The results did not support the use of the combination of ketamine + propofol as an anesthetic agent for ECT in patients with major depressive episodes in clinical settings. Ray-Griffith SL et al [10] examined the differences in response to electroconvulsive therapy as defined by an improvement of depressive symptoms between ketamine and methohexital as the primary anesthetic agent. Side effects and cognitive tolerability were also examined. Subjects undergoing electroconvulsive therapy for unipolar or bipolar depression were randomized to receive ketamine or methohexital as the anesthetic agent. Primary outcome measure includes the Hamilton Rating Scale for Depression (17-item). Secondary outcome measures included Mini-Mental Status Examination (MMSE) and Beck Depression Inventory. All ratings were conducted masked to anesthetic agent. Due to multiple outcome measures obtained over time, mixed models were used to account for the correlations among the measurements within the subjects. Since outcomes were either normally distributed or approximately normally distributed, general linear mixed models were fit with a random intercept specified. A total of 21 subjects were enrolled, and 16 were randomized (methohexital, n= 8; ketamine, n=8). The two treatment groups did not differ statistically in any demographic characteristic. No statistical difference was found between the ketamine and methohexital groups for an improvement in depressive symptoms; however, subjects in both groups showed significant improvement in depression overtime. MMSE results did not differ between groups, and fatigue was reported more in subjects receiving ketamine. They results of this study were inconclusive as they lack power to support an advantage of ketamine anesthesia compared to methohexital in ameliorating depressive symptoms for electroconvulsive therapy. They concluded that Ketamine as an anaesthetic does not enhance the efficacy of ECT.

**CONCLUSION:**

From the results of present study, this can be concluded that Ketofol mixture is associated with a longer mean seizure time than propofol, and shorter mean recovery times than ketamine, with better hemodynamic stability without any important side effects in ECT anesthesia.

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