A Randomised clinical trial to compare effectiveness of ketofol and ketofol-dexmedetomidine group in patients undergoing modified electroconvulsive therapy.

By

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IN ANAESTHESIOLOGY

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I declare that this dissertation entitled **"A Randomised clinical trial to compare effectiveness of ketofol and ketofol-dexmedetomidine group in patients undergoing modified electroconvulsive therapy",** is a bonafide and genuine research work carried out by me under the guidance of **DR. VIDYA PATIL (GUIDE)**, PROFESSOR, Department of Anaesthesiology, Shri B. M. Patil Medical College, Hospital and Research Centre, Vijayapura and **Dr SANTOSH RAMDURG (CO-GUIDE)**, PROFESSOR AND HEAD, Department Of Psychiatry, Shri B. M. Patil Medical College, Hospital and Research Centre, Vijayapura.

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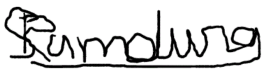

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ABBREVIATIONS

ECT	Electroconvulsive Therapy
MAP	Mean arterial pressure
NMDA	N methyl D aspartate
MgSo4	Magnesium sulphate
KFD group	Ketofol Dexmedetomidine group
KF group	Ketofol group
PACU	Post anaesthesia care unit
VAS	Visual analog score
ASA	American society of anaesthesiologist
NIBP	Noninvasive blood pressure monitoring
EtCo2	End tidal carbon dioxide
HR	Heart rate
SBP	Systolic blood pressure
DBP	Diastolic blood pressure
SPO2	Partial pressure of oxygen saturation
RSS	Ramsay sedation score
PANSS	Numerical rating score
ECG	Electrocardiogram
Mg/kg	Milligram per kilogram
Mcg/kg	Microgram per kilogram
EEG	Electroencephalogram
EMG	Electromyography
NPO	Nil per oral
HPA	Hypothalamic-Pituitary-Adrenal Axis

ABSTRACT

AIM:

1. To assess the hemodynamic fluctuations and seizure duration in patients receiving MECT using ketofol-dexmedetomedine and ketofol only.
2. To assess and compare their effects on cognitive function, severity of depression, mania and psychosis.

BACKGROUND:

- Modified Electro Convulsive Therapy (M.E.C.T.)is a well-established treatment for many psychiatric illnesses.
- Anaesthesia is provided to prevent unfavoured effects associated with M.E.C.T., which include musculoskeletal injuries and agitation, confusion aggression in the early post-M.E.C.T. period.
- Using ketofol and Dexmedetomidine aims to provide better quality by reducing the side effects mentioned above.

METHODOLOGY

❖ **Preliminaries:**

- Written informed consent was taken.
- Nil per oral status was confirmed.
- Intravenous access was secured with a 20 gauge cannula.

❖ **METHOD**:

In this prospective randomised clinical trial, 60 patients, aged 18 to 60 years of either sex, who were receiving M.E.C.T under General Anesthesia with ASA Grade I & II were randomly divided into two groups with 30 patients in group ketofol - dexmedetomidine and 30 patients in group ketofol.

The primary objective of the study was to assess and compare their effect on seizure duration ,changes in heart rate and blood pressure (systolic, diastolic). Secondary objectives of the study to assess and compare agitation, depression and effects on early post MECT complications like restlessness, and sedation of the two drugs studied.

RESULTS:

- Demographic profile regarding age, gender in both the groups were comparable and showed no significant results.
- Compared to group KF, the majority of patients in group KFD achieved their goal MAP, HR and seizure duration with a minimum acceptable hemodynamic fluctuation, a minimal infusion of the study medication, reduced induction dosages of ketofol, and a shorter induction times.
- Mean Hamilton Depression Rating score was lower in group KFD compared to KF group and it was statistically significant.
- Mean MMSE scores before and after ECT are not statistically significant between the two groups.
- Mean PANSS scores in schizophrenia patients before and after ECT are not statistically significant between the two groups.

- The KFD and KF groups showed significantly different mean induction times (P-value<0.001).The mean duration of motor seizures differed significantly between the KFD and KF groups (P-value<0.001).The mean total dose of induction differed significantly between the KFD and KF groups (P-value<0.001).The KFD group had a significantly lower and acceptable mean heart rate and mean arterial pressure than the KF group.

CONCLUSION

In comparison to ketofol, the combination of dexmedetomidine and ketofol for ECT is associated with a longer mean seizure time, effective anti-depressive effects, a lower incidence of agitation, an acceptable decrease in heart rate and blood pressure, and no significant side effects.

Dexmedetomidine premedication is helpful in avoiding acute hyperdynamic responses to electroconvulsive therapy (ECT).

KEYWORDS

ECT, ketofol , ketofol-dexmedetomedine, hemodynamic fluctuations, post ECT effects, PIA (POST ICTAL AGITATION).

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Introduction

A well-researched therapeutic option for several mental illnesses, such as severe depression, bipolar disorder, and some forms of schizophrenia, is modified electroconvulsive therapy (ECT). Even though ECT is effective, its usage is sometimes restricted because of serious side effects, including cardiovascular stress and cognitive impairment that can be upsetting for patients. To reduce such adverse effects and improve patient outcomes, appropriate anaesthetic management during ECT is essential.

Electroconvulsive therapy (ECT), is a psychiatric procedure in which patients are electrically charged in an attempt to reduce the symptoms of mental illnesses. ECT was first used in 1938. To date, it remains the exclusive form of shock therapy used in psychiatry. For the treatment of major depressive disorder, mania, bipolar disorder, and schizophrenia, it is usually used with informed consent. The method involves delivering a current of electricity to the cortex via transcutaneous electrodes, resulting in a tonic-clonic seizure lasting 10-15 seconds and 30-60 seconds.[1]

Patients with bipolar disorder account for 70 % of patients receiving ECT, and patients with schizophrenia account for 17 %. This technique has proved to be a simple and suitable replacement for pharmacologically produced seizure therapy. [2]

When electroencephalographic (EEG) seizure activity lasting more than 20 seconds was found to produce the optimal response. Patients experiencing an initial seizure duration of fewer than 15 secs are ineffective, and more than 120 s achieve a less favourable response to ECT.

Initially, inadequate muscle relaxation during ECT led to bone fractures, joint dislocation, tongue biting, and muscle fibre tears. Furthermore, negative cognitive impacts result from an insufficient understanding of the electric stimulation's dose parameters. An acute cardiovascular response and a generalized motor seizure result from applying electrical current to the brain. This leads to severe cardiac issues, most commonly a brief period of hypertension, fluctuations in heart rate (HR), and a significant increase in cerebral blood flow with intracranial pressure.

The hemodynamic response to ECT can produce myocardial ischemia and even infarction, transient neurologic ischemic deficits, intracerebral haemorrhages and cortical blindness. [3] Physical and psychological trauma caused to the patient with unmodified direct ECT in the past is now modified with anaesthesia. [3]

Anaesthesia in ECT serves multiple purposes: it reduces the anxiety and discomfort associated with the procedure, ensures patient immobility to prevent injury, and modulates the hemodynamic responses triggered by the induced seizures. Traditionally, a combination of agents has been used to achieve these goals, focusing on balancing sedation, analgesia, and hemodynamic stability. Ketamine, a dissociative anaesthetic, has gained popularity in recent years for its rapid onset and potent analgesic properties, making it a suitable candidate for ECT anaesthesia. However, ketamine alone can cause psychomimetic effects and hypertension, prompting the need for adjuncts that can counteract these drawbacks.

Propofol, known for its sedative and antiemetic properties, is frequently combined with ketamine to form a mixture known as ketofol. This

combination aims to leverage the benefits of both agents while minimizing their respective side effects in a variety of procedural circumstances, including ECT; ketofol has been demonstrated to offer efficient sedation and analgesia with a favourable hemodynamic profile. However, an ongoing search exists to optimize this regimen to enhance its efficacy and safety further.

Dexmedetomidine, an alpha-2 adrenergic agonist, has emerged as a valuable adjunct in anaesthesia and sedation protocols. Its effects include analgesia, sedation, and anxiolysis without causing a noticeable respiratory depression. Moreover, dexmedetomidine has been noted for its ability to provide stable hemodynamics and reduced stress response, making it an attractive candidate for inclusion in ECT anaesthesia protocols.

The common adverse effects of ketamine, such as hallucinations and a hyperdynamic response characterized by increased heart rate and blood pressure, are mitigated when combined with propofol.[4] Ketamine, when used with propofol, reduces the amount of propofol needed and helps maintain hemodynamic stability. Ketamine-propofol sedation results in a shorter recovery period on average than intravenous ketamine alone but a more extended recovery period than intravenous propofol alone.

As a result, the effect of dexmedetomidine paired with ketamine and propofol during ECT needs to be assessed in terms of hemodynamic parameters and seizure duration.[5] The impact of this combination on patients' post-ECT agitation and depression can also be evaluated.

Aims and Objectives

Aim

3. To assess the hemodynamic fluctuations and seizure duration in patients receiving MECT using ketofol-dexmedetomedine and ketofol only.
4. To assess and compare their effects on cognitive function, severity of depression, mania and psychosis.

Objectives

Primary Objectives

- To assess and compare their effect on seizure duration.
- To evaluate and compare changes in heart rate and blood pressure (systolic, diastolic)

Secondary Objectives

- To assess and compare agitation
- To assess and compare depression, mania and psychosis.
- To assess ketofol and ketofol-dexmedetomedine effects on early post-MECT complications like restlessness, and sedation.

Review of Literature

Verma *et al.*[2023] conducted comparative analysis of the impact of sodium Thiopentone, Propofol, and Ketofol as IV anaesthetic agents in modified electroconvulsive therapy (ECT). [58] The study's specific objectives were to evaluate these medications' effects on the length of seizures, recovery time, and hemodynamic changes brought on by ECT. Ninety patients between the ages of eighteen and sixty were assigned into three equal groups. Patients in group T received 2.5 mg/kg of thiopentone, while patients in group P received 1 mg/kg of propofol. Inject. Ketofol, a concoction of injectable propofol (0.5 mg/kg) and injectable ketamine (0.5 mg/kg), was given to patients in Group K.The results of the study showed that while the three drugs had similar seizure duration and recovery characteristics, Ketofol and Propofol had better hemodynamic stability than Thiopentone. Thus, it may be said that propofol and ketofol are both useful induction agents for electroconvulsive therapy (ECT), although propofol is less likely to cause agitation than ketofol.

Pandey et al.[2023][59] concluded that, thiopentone demonstrated inferior hemodynamic stability compared to propofol and ketofol, but similar seizure duration and recovery measures. Therefore, even though propofol induces less agitation than ketofol, both can be used as effective ECT induction agents. A study comparing the effects of three IV anaesthetic drugs used in modified ECT—propofol, ketofol, and sodium thiopentone—on hemodynamic changes brought on by the technique, duration of seizures, and recovery time has been conducted. Ninety patients between the ages of eight

and sixty were split equally into three groups and given injections of ketofol (a mixture of 0.5 mg/kg propofol and 0.5 mg/kg ketamine) in group K, 1 mg/kg propofol in group P , and 3 mg/kg thiopentone in group T.

Modir et al.[2023], studied to compare the anaesthetic efficacy of ketamine, propofol, and dexmedetomidine for electroconvulsive therapy in treatment-resistant major depressive disorder patients. [60] Treatment-resistant major depressive disorder patients (n = 85) hospitalized for ECT were included in this double-blind trial. Patients received a dose of 0.2 μg/kg ketamine, 1.5 mg/kg propofol, and 0.8 mg/kg dexmedetomidine, respectively. The study found that 10 mL of interventional medication were given intravenously for 10 minutes in each intervention group, while 10 mL of normal saline was administered to the placebo group at the same time period. The blood pressure of the dexmedetomidine group was consistently found to be much lower.

Patients treated with dexmedetomidine demonstrated an increased sense of satisfaction, whereas patients treated with propofol experienced a faster recovery period, a shorter duration of seizures, a shorter duration to reach an Aldrete score of 9–10, and a deeper level of relaxation when dexmedetomidine was administered. While dexmedetomidine was linked to greater patient satisfaction, propofol may improve relaxation, reduce recovery time and seizure length, and shorten recovery times.

According to the study by **Yeter et al.[2022]** Ketamine-dexmedetomidine induction led to longer seizures during electroconvulsive therapy compared to ketamine-propofol. [61] In comparison to propofol, the study found that dexmedetomidine has slightly improved hemodynamic stability. Despite dexmedetomidine's drawbacks, which

include a longer duration of administration, possible higher cost, and a slight initial recovery delay, the study suggested that it should be taken into consideration as a viable drug for electroconvulsive therapy anaesthesia.Research has examined into whether dexmedetomidine is a better adjuvant to ketamine during electroconvulsive therapy than propofol. In this trial, ketamine-propofol or ketamine-dexmedetomidine was randomly assigned to sixty individuals. The two groups' periprocedural hemodynamic and respiratory measures, recovery metrics, seizure duration, side effects, and treatment costs were compared.

Dilip B et al [2022] studied effect of Ketofol and Propofol on motor seizure duration, hemodynamic profile and recovery times in patients undergoing ECT. [62] 54 ECT sessions were randomly assigned to the Ketofol and Propofol groups in the study. The motor seizure duration in the Ketofol group (28.55 ± 6.54 seconds) was found to be statistically significant ($p = 0.002$) longer than that of the Propofol group (22.22 ± 7.94 seconds).Both drugs had motor seizure duration within the therapeutic range. Heart rates were statistically significantly ($p=0.017$) lower in the Propofol group (97.40 ± 18.18 bpm) than in the Ketofol group (109.37 ± 17.69 bpm) at one minute after the conclusion of the seizure. Similar to this, five minutes after the seizure ended, the heart rate in Propofol group was lower compared to Ketofol group . Between the Ketofol and Propofol groups, there was no statistically significant difference in recovery times.

Yazdi, et al [2021] aimed to find intravenous anaesthesia with profound effects but fewer side effects. 35 patients were divided into three groups for this interventional clinical trial, with each group receiving treatment for three sessions (a total of 105 cases).

Group C received ketamine + propofol (Ketofol) at a dose of 1 mg/kg, Group B received remifentanil 1 μg/kg + propofol 1 mg/kg, and Group A received distilled water + propofol 1 mg/kg. [63] and the compound ketofol had the lowest recovery time compared to remifentanil + propofol. They were least agitated when taking propofol alone, and most agitated when using ketofol.

Dr. Aditi Wanchoo et al[2021] studied the effect of ketamine, Propofol, and Ketofol on hemodynamic profile, duration of seizure activity, and recovery times in patients undergoing ECT. [64] 100 patients who were scheduled for ECT treatment were enrolled. Ketamine, Propofol, or Ketofol were the three anaesthetic drugs that were randomly given to the study population. According to the study, as compared to propofol, the mean duration of seizures is longer when using ketamine or ketofol.

Madishetti et al [2020] studied the effect of ketamine, propofol, and ketofol on hemodynamic profile, duration of seizure activity, and recovery times in patients undergoing ECT. [65] The study involved randomly assigning sixty patients who were scheduled for electroconvulsive therapy (ECT) to receive one of three anaesthetic agents: ketamine, propofol, or ketofol. The results showed that ketamine had longer recovery times, ketofol demonstrated better hemodynamic effects and both ketamine and ketofol have an longer mean seizure duration compared to propofol.

Li et al.[2020] reviewed recent clinical and preclinical ECT studies and its potential mechanism on depression to provide clinicians and patients with greater appreciation of this approach to defeat depression. [66] This review concentrated on publications from the previous five years and includes publications written in English.

Using keywords or the terms "depression," "depressive disorder," and "depressive disorder, major," together with the specifiers "therapy," "ECT," "electroconvulsive shock," and "electroconvulsive seizure," the study was able to retrieve full-length articles for every publication that was chosen. Study observed that, from overall studies in this review it was shown that, more research is required to determine how to better utilize ECT that is currently in use and to predict patients' responses.

Chavi Sethi et al [2019][67] studied 92 patients who were randomly allocated into 2 groups of 46 each. Group A received a premedication infusion of dexmedetomidine (0.5 μg/kg) along with a 1:1 mixture consisting of ketamine and propofol (10 mg/kg each); Group B had a normal saline infusion before receiving ketamine and propofol (10 mg/kg each). **[67]** Patients received ECT using ketamine-propofol in accordance with randomly assigned groups, and scores for depression and agitation were obtained and compared before and after the procedure. **[67]** According to a study, the combination of dexmedetomidine and ketofol for ECT corresponds to a longer mean seizure time, an effective antidepressant effect after the first session, a lower incidence of agitation, improved patient satisfaction, an acceptable drop in heart rate and blood pressure, and no significant side effects when compared to ketofol. **[67]**

Dr. Jose B Cherayath et al[2019] studied**,** the effects of Ketofol and Etomidate on recovery pattern, hemodynamic effects and activity of seizures in patients undergoing electroconvulsive therapy. **[68]** According to the study, 100 ECT patients between the ages of 20 and 65, regardless of gender, were chosen one at a time and split into two groups at random. Group A included 50 patients who got Ketofol (propofol 1 mg/kg with ketamine

0.5 mg/kg). Researchers observed that, in comparison to patients who got etomidate, individuals who received ketofol had quicker recovery times for spontaneous respiration, eye opening upon command, and vocal command response.

Garg K et al [2018][70] studied the, effects of dexmedetomidine in attenuation of stress response, motor seizure duration and recovery times following ECT. Two groups of thirty cases each, ranging in age from eighteen to fifty, were randomly assigned. Group B got a 20ml dilution of dexmedetomidine (1µg/kg) over 10 minutes, along with 1 mg/kg of propofol for induction and 0.75 mg/kg of succinylcholine for muscular relaxation. Group A was given normal saline (control).According to the study, dexmedetomidine at a dose of 1µg/kg mitigates the hyperdynamic response to ECT regardless of the duration of the seizure. It also has a favourable effect in terms of a smooth emergence and has no negative impacts on recovery duration.

Aksay et al[2018][71] assessed the impact of dexmedetomidine use with S-ketamine anaesthesia on Post Ictal Agitation (PIA) reduction in ECT. The prevalence of PIA in ECT sessions with dexmedetomidine administration was reported to be lower (mean per patient, 34% vs. 62%), according to this study, which involved 7 patients who underwent 178 ECT sessions with S-ketamine anaesthesia. [71]In the multivariate logistic regression analysis, A significantly significant correlation was found between the usage of dexmedetomidine and the failure to produce PIA (P=0.001, z=-3.83, odds ratio =0.011–0.303). Thus, the study came to the conclusion that a promising method for the treatment of intractable PIA syndrome appears to be the adjunctive use of dexmedetomidine to S-ketamine anaesthesia in ECT.

X. Li et al.[2017][72] assess the effect of small-dose dexmedetomidine on hyperdynamic responses to ECT. Following enrollment, 78 patients were randomized at random to receive 0.2 mg/kg dexmedetomidine (Dex group, n = 39) or saline (Control group, n = 39) before receiving electroconvulsive therapy (ECT). [72]The study concluded that, without affecting the duration of the seizure or impeding recovery, giving 0.2 mg/kg dexmedetomidine to individuals undergoing ECT significantly lowers their HR, MAP, and peak HR responses to therapy. Moreover, dexmedetomidine efficiently decreased the incidence rates of undesirable effects following electroconvulsive therapy, including headache and agitation.

Begec et al.[2008] studied the effect of dexmedetomidine on the acute hyperdynamic response, duration of seizure activity and recovery times in patients undergoing electroconvulsive therapy (ECT). [74] They found that, without affecting the duration of seizure activity or recovery time, a dexmedetomidine dose of 1 mg/kg IV given over 10 min prior to the induction of anaesthesia with propofol may be helpful in preventing the acute hyperdynamic responses to ECT.

ELECTRO CONVULSIVE THERAPY

AND

MODIFIED ELECTRO CONVULSIVE THERAPY.

Electroconvulsive therapy (ECT)

- **History**

Electroconvulsive therapy (ECT) is one of the oldest treatment methods in the field of psychiatry. [6] It was first introduced 80 years ago in Rome when Ugo Cerletti and Lucio Bini used an electric current to elicit an epileptic seizure for therapeutic purposes [6]. This was not, however, the first instance of treating mental illness with an epileptic fit. The idea of inducing epileptic seizures to treat patients was first proposed by Meduna, a Hungarian neuropathologist and psychiatrist. [7]

With an electric current, electroconvulsive treatment (ECT) induces a widespread cerebral seizure in a patient receiving intravenous sedation or general anaesthesia. Patients with schizophrenia, schizoaffective disease, catatonia, neuroleptic malignant syndrome, and bipolar disorder may potentially benefit, despite its main use is in the treatment of severe depression. However, false information about procedural conduct has stigmatized the therapy.

- **Anatomy and Physiology**

Patients with severe depression display a number of pathophysiologic abnormalities in several brain locations, including reduced activity and volumetric changes in the frontal lobes' dorsal regions.[8] The ventral and orbital frontal cortical areas interpret emotional stimuli differently.[8]

In addition to the frontal lobe, functional alterations and volumetric reductions are apparent in the hippocampus, parahippocampal gyri, and amygdala.[9] The hypothalamic-pituitary-adrenal (HPA) axis becomes hypersensitive to stressors and

exhibits chronically elevated levels of stress hormones and impaired feedback regulation.[10] Patients experiencing stress activate both the HPA axis and the mesocorticolimbic dopamine system. Dopamine function is thought to be impaired in patients with depression, causing impairment in essential functions, including concentration, motivation, and pleasure.[11] The ECT's antidepressant effects are a reflection of the above system alterations.

- **Indication**

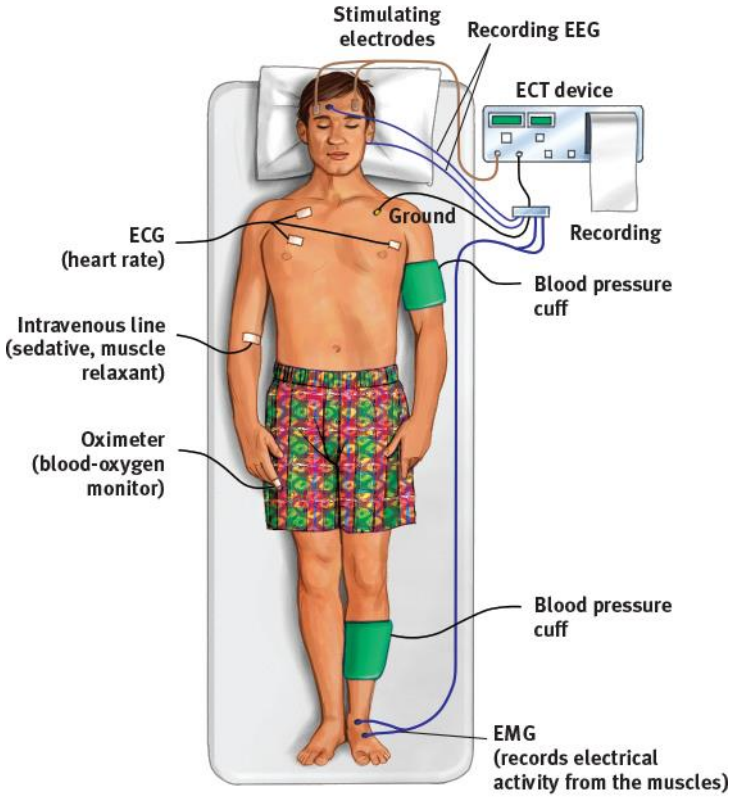
When a patient's major depression is severe enough to interfere with everyday activities or when they are unresponsive to multiple antidepressant medication trials, ECT is often considered.[12] Also used for catatonia , suicidality and psychosis,.[13, 14] Bipolar patients , patients with depression , mania patients can also receive treatment with ECT.[15]

In patients who are debilitated, elderly, pregnant, and breastfeeding, ECT may be a safer option than antidepressants or antipsychotics.

- **Contraindication**

ECT-induced seizures can result in brief elevations in blood pressure, heart rate, myocardial oxygen demand, and intracranial pressure. Patients with compromised central nerve systems, lung systems, or cardiovascular systems require care. Absolute contraindicating conditions are pheochromocytoma and or raised intracranial tension due to mass effect. While without mass effect ,cardiovascular conduction defects, high-risk pregnancy conditions, and aortic and cerebral aneurysms are relatively contraindicated.[16]

Figure 1: Electroconvulsive therapy (ECT)



- **Preparation**

Significant risk factors, such as heart failure, cerebral pathology, or cardiac ischemia or arrhythmia, may be revealed by a thorough history and physical examination. The usage of herbal remedies such ginseng, valerian, kava, Ginkgo biloba, St. John's wort, and ginseng should also be included in the history because they might all conflict with ECT.

There is a risk of status epilepticus in patients on theophylline.[17] In addition to potentially reducing ECT-related hypertension and tachycardia,short-acting intravenous beta-blockers may also shorten seizure duration and decrease the

effectiveness of ECT. On the day of the procedure, it is advisable to continue taking cardiac drugs, such as clopidogrel, aspirin, statins, antihypertensive agents, and antianginal medications.

Since ECT treatments have the potential to elevate blood glucose levels, serum glucose levels should be monitored both before surgery and in the recovery area. Even though ECT seems safe when administered to a patient who is using a defibrillator, the patient should have access to external defibrillation equipment at their bedside, and the detecting mode should be turned off during the operation. It is advised that pregnant patients undergo nonstress testing with a tocometer after 24 weeks and non-invasive fetal monitoring after 14 to 16 weeks.

In ECT, general anaesthesia is used. Barbiturates like thiopental and methohexital as well as nonbarbiturate drugs like etomidate and propofol are utilized in anaesthesia induction therapy. An ECT-induced seizure ought to endure longer than thirty seconds. Methohexital is the most often utilized induction agent because of its short half-life, efficiency, affordability, and little impact on the length of seizures. It has been demonstrated that thiopental and propofol shorten seizure duration. Etomidate has been linked to longer seizure duration and myoclonus.

- **Technique**

ECT is often administered as an outpatient procedure, usually in a specialized suite, ambulatory surgery site, or post-anaesthesia care facility. Patients who are extremely disabled, such as those who have significant physical or mental health

conditions, may begin treatment as inpatients and switch to outpatient status as needed. For the procedure, patients should be adequately nil per oral (NPO) prior to anaesthesia.

Vital indicators are regularly monitored and include blood oxygen saturation, ECG, and EEG activity. The right foot is used to capture an EMG in order to quantify the motor component of seizure activity. During the process, succinylcholine, a depolarizing muscle relaxant that lessens tonic-clonic contractions, is monitored by a nerve stimulator. A BP measuring cuff is placed on the ankle to stop succinylcholine from getting into the lower limb of the patient. This allows for the measurement of tonic-clonic contractions and a visual monitor of seizure activity. After the intravenous induction, the patient's teeth and tongue are shielded with a bite block. EEG records are made from the right and left frontal and mastoid positions, allowing for the monitoring of the onset and termination of a cerebral seizure.

Seizure induction is via 2 electrodes placed temporally or a right unilateral electrode, allowing electricity to pass.[18] Preferential use of right unilateral ECT reduces retrograde amnesia. Less than half milliseconds or upto 2 milliseconds is used as the ECT stimulus based on requirement and tolerability of patient. [20] During the first treatment session, the seizure threshold is gradually increased by trial and error [21,22] and it typically rises with ECT treatment.

A pain-free, safe experience for the patient is the anaesthesiologist's goal during ECT.[23] which is by preoxygenating using a face mask or nasal cannula, paralysis and anaesthetic induction. Before receiving ECT, an anticholinergic drug may be used to avoid arrhythmias like bradycardia or asystole as well as profuse oral secretions.

To increase seizure intensity ,cerebral vasoconstriction is induced .Patient is hyperventilated via a bag mask before delivery of the electrical stimulus to cause cerebral vasoconstriction.[24] The gold standard for induction of anaesthesia is methohexital, given at 0.75 to 1 mg/kg.[23] Methohexital (gold standard for induction in ECT) is preferred to propofol as 2 randomized trials' meta-analysis revealed comparatively longer seizure duration than propofol.[25] A key component of ECT is skeletal muscle relaxation, which helps to reduce motor seizures and prevent musculoskeletal damage.

The depolarizing neuromuscular relaxant- succinylcholine is used[26, 27] ,administered as 0.75 to 1 mg/kg.[26,27] In cases where succinylcholine is contraindicated nondepolarizing neuromuscular relaxants are preferred.[12]

Once unresponsive , 100% oxygen is given to the patient through a bag valve mask and a muscle relaxant is administered. The effectiveness of muscular relaxation and the clinical evaluation of plantar reflexes and fasciculations in the left foot and calves are assessed using a nerve stimulator. The right foot is shielded from muscle relaxants by an inflated blood pressure cuff. Because muscle relaxants do not stop the electrical pulse from contracting the masseter muscle, lingual and tooth protection requires the installation of a biting block.

Most therapeutic ECT seizures last 15 to 70 seconds.[28] EEG recording lasts one-fourth per cent longer than motor seizures.[28] Clinically seizures not lasting more than 15 seconds, cannot not be beneficial, but longer seizures could damage cognition. A brief period of hyperventilation and restimulation with a stronger electrical current should be used as a follow-up to a missed or brief seizure.

To prevent neurologic damage and decrease seizure activity, a benzodiazepine or an induction drug, such as propofol or methohexital, is administered at half dose if a patient is having seizures that last longer than two minutes. Since anaesthetic induction medicines like etomidate or ketamine have less anticonvulsant effects than methohexital, they can be helpful in a patient who has missed a lot of seizures.

Caffeine is no longer recommended to prolong seizure due to its uncertain safety profile. [29, 17] Hyperventilation during ECT should be avoided in pregnant women since it can lower placental blood flow and result in fetal hypoxia. To prevent dehydration and early uterine contractions, minimal NPO time and sufficient IV fluid hydration are crucial.

Left lateral uterine displacement is essential in a female with a gestational age greater than 20 weeks to optimize maternal venous return and maintain optimal uterine blood flow. Fetal heart rate and uterine activity in pregnancies deemed viable at more than 24 weeks gestation should be continuously monitored by an obstetrician qualified to handle obstetric and neonatal emergencies 30 minutes prior to and following each treatment.

Anticholinergic drugs avoided in pregnant patients due to their risk for aspiration pneumonitis.[30-33] For aspiration prevention in this situation, a nonparticulate antacid such sodium citrate is safer.

- **Clinical Significance**

In order to treat depression, suicidality, severe psychosis, food refusal resulting from depression, and catatonia, electroconvulsive therapy (ECT) is a reasonably

safe and low-risk method. Interprofessional care coordination between nurses, psychiatrists, and anaesthesiologists is necessary. For most patients to experience a long-lasting result, multiple sessions are needed. The main cause of the stigma around ECT is that early treatments did not provide anaesthesia, which led to serious harm and profound memory loss.

The antidepressant effect manifests itself really soon and might persist for several years. When ECT is given under strict supervision, the overall death rate is quite low, but over time, minor memory loss is still a side effect. Because of the avoidance of risk, ECT is frequently used in elderly and pregnant patients.

- **Complication**

Although this effect is temporary, bitemporal or bilateral ECT impairs cognition more than unilateral ECT as revealed by a meta-analysis of 1415 depressed patients.[34]

A 15–20 second parasympathetic discharge happens physiologically during the tonic phase of the seizure. This can result in bradyarrhythmias, such as asystole, atrioventricular block, and premature atrial and ventricular contractions. Patients with subconvulsive seizures are at higher risk for asystole.[35] Paradoxically, asystole is less common in patients with underlying arrhythmias or heart blocks.

A temporary catecholamine surge causes tachycardia and hypertension, with seizure duration.[36] After the seizure, tachycardia and hypertension usually go away in 10 to 20 minutes, while some individuals continue to have persistent hypertension that needs medical intervention.

Modified Electroconvulsive therapy (MECT)

Modified Electroconvulsive Therapy (ECT) is a medical procedure used to treat certain psychiatric disorders by inducing controlled seizures through electrical stimulation of the brain. It differs from unmodified ECT in that it is performed under general anaesthesia and with the use of muscle relaxants, making it safer and reducing the physical risks associated with the procedure.

❖ Indication

- Major depressive disorder (Particularly treatment-resistant depression)
- Bipolar disorder (Both Manic and Depressive episodes)
- Schizophrenia (Especially catatonic and treatment-resistant types)
- Severe suicidal ideation
- Some cases of severe obsessive-compulsive disorder (OCD)
- Parkinson's disease (For severe, treatment-resistant cases)

❖ Effectiveness

Modified ECT is highly effective for many patients with severe or treatment-resistant psychiatric conditions. It can result in rapid and significant improvement in symptoms, particularly in major depressive disorder and bipolar disorder.

❖ Preparation

Preparation for Modified Electroconvulsive Therapy (Modified ECT) is a meticulous process designed to ensure patient safety and procedural efficacy. Initially, the patient undergoes a comprehensive psychiatric evaluation to confirm the necessity of ECT, followed by a thorough medical clearance by an anaesthesiologist or

general physician to assess overall health and fitness for anaesthesia. This includes physical examinations, blood tests, ECG, and any additional relevant tests. Once cleared, the patient or their legal guardian is fully informed about the procedure, including its benefits, risks, and alternatives, and written consent is obtained.

On the day of the procedure, the patient is required to fast for 6-8 hours to minimize the risk of aspiration during anaesthesia. An intravenous (IV) line is then inserted to administer medications. These preparatory steps ensure that the patient is optimally prepared for the procedure, minimizing risks and enhancing the overall safety and effectiveness of the ECT treatment.

❖ **Technique**

- Once the patient is prepared and an IV line is in place, general anaesthesia is administered by an anaesthesiologist, typically using short-acting agents such as methohexital or propofol, ensuring the patient remains unconscious and pain-free during the procedure.
- A muscle relaxant, commonly succinylcholine, is then administered to prevent physical convulsions and reduce the risk of injury.
- Electrodes are strategically placed on the patient's head, either bilaterally on both temples or unilaterally on one side, to deliver the electrical stimulus. The electrical current is precisely controlled and adjusted to induce a brief, controlled seizure, typically lasting between 20 and 60 seconds.

- The patient's vital signs, such as blood pressure, oxygen saturation, and heart rate, are continuously recorded during the procedure. Additionally, an EEG is used to track brain activity.
- This meticulous technique ensures the seizure is effectively induced while minimizing potential complications and ensuring patient safety.

❖ **Side Effects**

➢ Short Time

- Headache
- Muscle Soreness
- Nausea
- Confusion
- Short Term memory loss

➢ Long Time

- Cognitive effects such as memory loss, which can vary in duration and severity
- Rarely, there may be more significant long-term memory issues.

General Anaesthesia for Modified-ECT

General anaesthesia is essential for Modified Electroconvulsive Therapy (Modified ECT) as it significantly enhances the procedure's safety, efficacy, and patient experience. By inducing unconsciousness, general anaesthesia ensures that patients do not experience pain or discomfort during the electrical stimulation and seizure induction, thereby reducing anxiety and stress. The combination of anaesthesia with muscle relaxants prevents violent muscle contractions, minimizing the risk of physical injuries such as fractures or dislocations. This controlled environment allows healthcare providers to closely monitor and adjust the procedure, ensuring optimal seizure quality and duration. Additionally, anaesthesia helps reduce cognitive side effects, such as memory loss and confusion, facilitating quicker recovery and better overall treatment outcomes. The consistency and reproducibility provided by general anaesthesia contribute to the efficacy of ECT, making it a safer and more humane treatment option for severe psychiatric conditions.

Patients should fast from solids for more than eight hours prior to receiving ECT. Up to two hours before to the surgery, clear liquids are acceptable, allowing for the taking of oral medications like hypertension meds. Patients can receive intravenous ketorolac, acetaminophen, or enteric-coated aspirin as a premedication to avoid post-ECT myalgia. During electrocardiography (ECT), a face mask equipped with a standard simple bag-valve-mask system helps with ventilation.

With the exception of very specific circumstances (such as late pregnancy or emergency treatments while the patient has a full stomach), tracheal intubation is not

advised because ECT is usually performed frequently (two or three times a week for three to four weeks), and each procedure only takes a few minutes. An oral airway can help obese patients with sleep apnea syndrome maintain their ventilation during the procedure.

During an ECT procedure, non-invasive blood pressure monitoring, pulse oximetry, electrocardiography, and capnography are recommended. The duration of the motor seizure activity should be measured using a tourniquet technique or electromyographic monitoring. Before applying the muscle relaxant, the distal circulation is isolated using the tourniquet technique at a pressure of 160–200 mmHg. While adequate muscle relaxation is required during electroconvulsive therapy (ECT), the electrical current's direct activation of the masticatory muscles—specifically, the masseter and temporalis muscles—means that severe jaw clenching will still occur.

Therefore, to safeguard the patient's teeth and reduce the possibility of lacerating the tongue, a bite block should be carefully inserted prior to the application of the electric shock.

Standard non-invasive hemodynamic variables and oxygen saturation should be monitored post half an hour of ECT [37]. A small dose of midazolam or dexmedetomidine proves beneficial for emergence agitation after ECT .[38,39].

❖ **General Anaesthesia during Modified-ECT for specific patient groups**

- **Children and adolescents**

ECT is not frequently used in children and adolescents due to the possibility of early nervous system damage, even though it is known to be safe in adults.

Past 20 years , indications for ECT in the pediatric population have increased steadily,like refractory depression, bipolar disorder and preoperative anxiolytic containing dexmedetomidine probably is the best drug. [40] and methohexital remains the gold standard anaesthetic for pediatric ECT [40,41, 42].

- **Pregnant Cases**

ECT,an effective and safe treatment for pregnancy-induced depression and other psychiatric illnesses [43, 44]. On the other hand, ECT can result in fetal challenges like spontaneous abortion and fetal mortality, as well as maternal concerns like aspiration and early labour.

For a challenging airway, or insufficient fasting, laryngeal mask airway or cricoid compression and endotracheal intubation can be helpful [46]. Tocolytics can also be used as prophylaxis if there is a history of premature labour or uterine contractions after ECT.

The use of inhaled anaesthetics (e.g., sevoflurane) may reduce the risks of uterine contraction in late pregnancy post ECT [47]. In rare circumstances, an emergency cesarean section may be necessary.

- **Drugs for ECT**

A fast onset, attenuation of ECT-induced physiological changes, limited anticonvulsant effects, and a quick recovery are the ideal qualities of an anaesthetic to be used with ECT. While most anaesthesia drugs now on the market can be used for ECT, choosing the right medication requires taking into account factors including seizure

duration, hemodynamic stability, recovery time, antidepressant impact, and cognitive side effects and to dose-dependent anticonvulsant effects of most anaesthetics ,minimum effective dose should be used [48].

Table 1: Comparison between Electroconvulsive Therapy and Modified Electroconvulsive Therapy

Points	**Electroconvulsive Therapy**	**M-Electroconvulsive Therapy**
Anaesthesia	Performed without general anaesthesia.	Performed under general anaesthesia.
Muscle Relaxants	No muscle relaxants are used. Patients experience full-body convulsions, increasing the risk of physical injuries such as fractures or dislocations.	Muscle relaxants such as succinylcholine are administered. The use of muscle relaxants prevents full-body convulsions, significantly reducing the risk of physical injuries.
Procedure	An electrical current is applied to the patient's head via electrodes. To cause a seizure, an electrical current passes through the brain,	Electrodes are similarly placed on the patient's head. A controlled electrical current is used to induce a brief seizure, typically

	which frequently results in observable, uncontrollable muscular movements.	lasting 20-60 seconds, with continuous monitoring of brain activity (EEG) and vital signs.
Risk Factor and Side Effects	Due to the lack of muscle relaxation, there is a higher risk of physical injuries. Post-procedure confusion and memory loss are common, with potentially more severe cognitive side effects.	Muscle relaxation minimizes the risk of physical injuries. While post-procedure confusion and memory loss can still occur, the cognitive side effects are generally less severe compared to traditional ECT.
Patients Recovery	Recovery may take longer due to the absence of anaesthesia, with patients experiencing more immediate distress.	Patients recover more quickly from the anaesthesia and muscle relaxants, with fewer immediate side effects and less distress.

KETAMINE

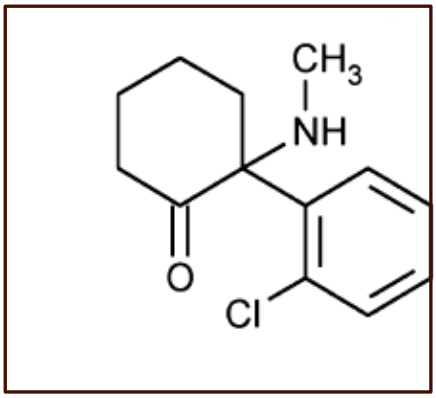
An intravenous anaesthetic having hypnotic and analgesic properties is ketamine. Although a small dosage of ketamine (0.4–0.8 mg/kg) results in a shorter seizure duration on an EEG compared to methohexital, the recommended dosage of this drug can help achieve the desired ECT effects.

Ketamine can cause raise in blood pressure,tachychardia , and raised intracranial pressure hence generally not preferred in ECT . [48,49] and also can induce psychiatric side effects [50,51]. However, because of its antidepressant properties, it is preferred in patients with depression [49].

Structural formula : $C_{13}H_{16}C_lNO$

IUPAC Name : (*RS*)-2-(2-Chlorophenyl)-2-(methylamino)cyclohexanone

Structural formula :



Molecular wt : 238 g/mol

pKa = 7.5,

Ketamine is a hydrosoluble aryl-cyclo-alkylamine. Preservatives such as chlorobutanol or benzethonium chloride are occasionally added to ketamine when it is

used as a chlorhydrate in an aqueous solution with a slightly acidic pH of 3.5–5.5. The cyclohexanone radical has an asymmetric second carbon.. Two times stronger than the racemic form and four times stronger than the R(_)-ketamine isomer, the active enantiomer is S(+)-ketamine ("S" spatial structure, light diverging to the right).

❖ **Pharmacokinetics of Ketamine :**

Ketamine is a dissociative anaesthetic commonly used for anaesthesia, pain management, and treatment-resistant depression. Understanding its pharmacokinetics is crucial for its effective and safe use.

- **Absorption**
  - ✓ **Routes of Administration :** Ketamine can be administered intravenously (IV), intramuscularly (IM), orally, intranasally, and subcutaneously.
- **Bioavailability :**
  - ✓ **Intravenous :** Nearly 100% availability.
  - ✓ **Intramuscular :** Approximately 93% bioavailability
  - ✓ **Oral :** Approximately 17-20% due to extensive first-pass metabolism.
  - ✓ **Intranasal:** Approximately 25-50%, depending on the formulation and administration technique.
- **Distribution : Onset of Action**
  - ✓ **Intravenous :** Rapid onset within 30 seconds.
  - ✓ **Intramuscular :** Onset within 3-5 minutes.
  - ✓ **Oral and intranasal :** Onset within 20-30 minutes.

- **Distribution: Volume of distribution :** Approximately 2.5-3.5L/Kg, indicating extensive tissue distribution.
- **Distribution : Protein Binding :** About 12-50% bound to plasma proteins, which is relatively low**.**
- **Metabolism :**
  - ✓ **Primary Metabolism :** Ketamine is extensively metabolized in the liver by cytochrome P450 enzymes, primarily CYP2B6 and CYP3A4.
  - ✓ **Major Metabolism : Norketamine** The primary active metabolite, which has about 1/3 the potency of ketamine and contributes to its analgesic effects.
  - ✓ **Major Metabolism Dehyronorketamine :** An inactive metabolite.
  - **First-pass Effect :** Significant first-pass metabolism reduces the bioavailability of orally administered ketamine.

❖ **Pharmacodynamics of Ketamine :**

- **Mechanism of action** : Ketamine is an NMDA receptor antagonist, which leads to its dissociative anaesthetic and analgesic effects. It also interacts with opioid receptors, monoaminergic systems, and other neurotransmitter systems contributing to its broad pharmacological profile.
- **Effects**: Produces analgesia, amnesia, and anaesthesia with minimal respiratory depression. It can cause dissociative experiences, hallucinations, and, at higher doses, cardiovascular stimulation (increased heart rate and blood pressure).

❖ **Clinical Consideration :**

- **Indication**: Used for induction and maintenance of anaesthesia, pain management, sedation in intensive care, and treatment-resistant depression.
- **Adverse Effects**: Include emergence delirium, hallucinations, elevated intracranial and intraocular pressure, hypertension, and tachycardia.
- **Drug Interaction**: Ketamine can interact with other central nervous system depressants, potentiate opioids, and influence the metabolism of drugs processed by CYP450 enzymes.

PROPOFOL

Due to its quick recovery and antiemetic effect, propofol is the most widely used intravenous anaesthetic. It has stronger anticonvulsant effects hence the seizure duration after ECT is shorter [52–54]. Thus preferred in adolescents and young adults receiving ECT than adults [50]. The usual propofol dosage ranges from 1.0 to 1.5 mg/kg.

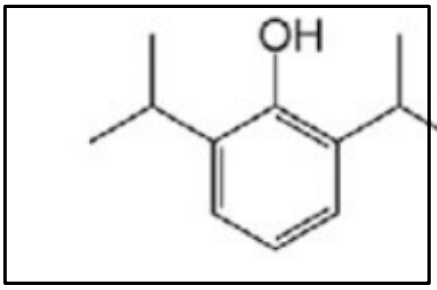
Propofol produces similar antidepressant effects and similar seizure duration as with methohexital when given at minimum hypnotic dose (0.75 mg/kg) [53,55]

Propofol can decrease acute hemodynamic alterations immediately after ECT because of its cardiovascular inhibitory effects and hence preferred in tachycardia, hypertensive patients . [50].

Chemical Formula : $C_{12}H_{18}O$

IUPAC Name : 2,6-diisopropylphenol

Structural Formula :



Propofol is a widely used intravenous anaesthetic agent known for its rapid onset and short duration of action. It is commonly used for induction and maintenance of anaesthesia, sedation for medical procedures, and in intensive care settings.

❖ **Pharmacokinetics of Propofol :**

- **Absorption :**
  - **Route of Administration :** Intravenous (IV) administration, providing 100% bioavailability.
- **Distribution :**
  - **Onset of Action :** Rapid onset within 30-40 seconds due to high lipophilicity and rapid distribution to the brain.
  - **Volume of Distribution :** Large volume of distribution (approximately 4-8 L/kg), indicating extensive tissue distribution.
  - **Protein Binding** : Highly protein-bound (97-99%), primarily to albumin.
- **Metabolism :**
  - **Primary Metabolism :** Metabolized primarily in the liver through conjugation with glucuronic acid via the cytochrome P450 enzyme system (mainly CYP2B6 and CYP3A4).

- **Metabolites :** Inactive metabolites, which are excreted in the urine.

❖ **Pharmacodynamics of Propofol :**

- **Mechanism of Action** :
  - **GABA – A Receptor Modulation** : At the GABA-A receptor, propofol increases the neurotransmitter gamma-aminobutyric acid's (GABA) inhibitory effects.This action increases chloride ion conductance, leading to hyperpolarization of neuronal membranes and resulting in sedative, hypnotic, and anxiolytic effects.
  - **NMDA Receptor Inhibition :** Propofol has been shown to inhibit NMDA receptors, contributing to its anaesthetic properties.
  - **Other Mechanism :** It may also interact with glycine receptors and inhibit voltage-gated sodium channels, contributing to its overall CNS depressant effects.

❖ **Clinical Application of Propofol :**

- **Indication** :
  - **Induction of Anaesthesia** : Commonly used for the rapid induction of general anaesthesia.
  - **Maintenance of Anaesthesia** : Used in continuous infusions for the maintenance of general anaesthesia
  - **Procedural Sedation** : Employed for sedation during procedures such as endoscopies and minor surgeries

- **Sedation in ICU :** Used for sedation of mechanically ventilated patients in intensive care units.

- **Dosing** :
  - **Induction** : Typically, 1.5-2.5 mg/kg IV for adults.
  - **Maintenance** : Continuous infusion rates of 4-12mg/kg/h for adults.
  - **Sedation** : Doses vary depending on the level of sedation required, usually lower than doses for induction and maintenance of anaesthesia.

- **Adverse Effects :**
  - **Cardiovascular Depression** : Hypotension and bradycardia, requiring careful monitoring and management.
  - **Respiratory Depression** : Requires monitoring of respiratory function and support as needed..
  - **Pain on Injection** : Often mitigated by prior administration of lidocaine or using larger veins.
  - **Propofol Infusion Syndrome** : Rare but serious condition characterized by metabolic acidosis, rhabdomyolysis, hyperlipidemia, and cardiac failure, typically associated with prolonged high-dose infusions.

KETOFOL

Ketofol is as an enhanced anaesthetic agent for short painful procedures. It minimizes the adverse effects of both propofol and ketamine drugs individually.

❖ **Pharmacology**

The risk of adverse events rises with serum levels of ketofol since it is presumed that the single drugs' side effects are dose-dependent.When used alone, propofol has a rapid CNS penetration, rapid sedation, and a brief recovery time; nevertheless, it also has a higher risk of respiratory depression and hypotension. Hemodynamic abnormalities and respiratory depression are less likely when ketamine is added.

In addition to its anaesthetic effects, ketamine also has analgesic effects. Lower dosages of both drugs are possible when they are administered together, maintaining the anaesthetic or analgesic effects of each agent while promoting respiratory and hemodynamic stability.

❖ **Dosing**

- **Induction Dose**
  - **Bolus Administration :**
    - ✓ For a 1:1 ratio: Administer 0.5-1 mg/kg of the combined ketofol solution IV as a bolus over 1-2 minutes.
    - ✓ For a 1:2 ratio: Administer 0.5-1 mg/kg of the combined ketofol solution IV as a bolus over 1-2 minutes.
  - **Maintenance Dose : (Continuous Infusion)**

- ✓ For ongoing sedation, a continuous infusion can be used.
- ✓ Infusion rates typically range from 5-50 mcg/kg/min of the combined Ketofol solution, adjusted based on clinical response and depth of sedation.

- **Maintenance Dose : (Intermittent Boluses)**

  Additional boluses of 0.25-0.5 mg/kg of the combined ketofol solution can be administered as needed to maintain the desired level of sedation

- **Procedural Sedation : (For short Procedure)**

  Initial bolus of 0.5-1 mg/kg IV

  additional boluses of 0.25 to 0.5 mg/kg IV as needed.

- **Procedural Sedation : (For Longer Procedure)**

  Initial bolus of 0.5-1 mg/kg IV.

  Continuous infusion at 5-20 mcg/kg/min, with intermittent boluses as needed.

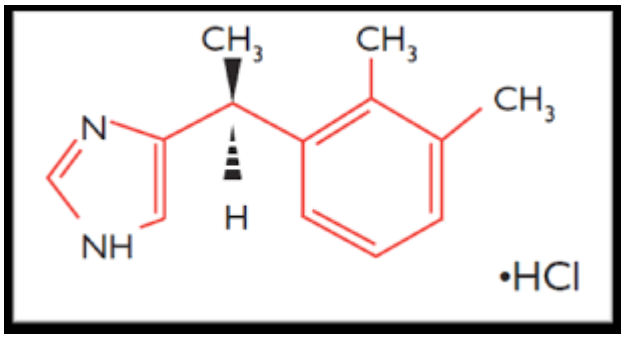
❖ **Adverse Effects Management**

- **Respiratory Depression :** Be prepared to support ventilation if necessary. Lower doses of ketofol can help minimize respiratory depression.
- **Hypotension :** Monitor blood pressure closely, particularly in patients with cardiovascular instability. Adjust doses as needed to maintain hemodynamic stability.
- **Emergence Reaction :** Lower doses of ketamine in the ketofol mix can help minimize the risk of emergence reactions.

DEXMEDITOMIDINE

Rarely is dexmedetomidine used alone, but when combined with other intravenous anaesthetics, it can lessen the likelihood of abrupt hemodynamic variations following ECT. [56, 57].

- **Structural Formula**



- **Mechanism of Action**

The alpha2 adrenoceptors have been employed as an adjuvant because of their sedative, analgesic, sympatholytic, anaesthetic sparing, and hemodynamic stabilizing qualities.

Action on the pons nucleus and locus ceruleus regulates the effects of arousal, analgesia, memory, and vigilance. By inhibiting substance P in the nociceptive pathway at the dorsal root neuron and activating the alpha$_2$ receptor in the locus ceruleus, central dexmedetomidine produces sedation and analgesia. Analgesia is produced by inhibiting the propagation of pain signals by suppressing activity in the descending noradrenergic pathway, which modulates nociceptive neural transmission. Anti-inflammatory cytokines rise and immune cells release less proinflammatory products at the site of injury. This

reduces perineural inflammation and contributes to the neuroprotective effects of dexmedetomidine.

Its sedative and anxiety alleviating properties are mediated by the pons's locus cereleus' alpha 2 adrenoreceptor. Adenyl cyclase is inhibited upon binding to these G protein receptors, resulting in a decrease in CAMP synthesis, alteration of ion channel conductance, and restriction of norepinephrine release. By stimulating the alpha2 adrenoceptor in the spinal cord's dorsal horn, dexmedetomidine's analgesic effects prevent substance P release.

- **Pharmacokinetics**

  Dexmedetomidine's pharmacokinetics are linear. The oral route has a bioavailability of 16%, intranasal route of 65%, buccal route of 82%, 93% in intravenous route and intramuscular route is 99 % . 94% protein bound, half life of two to three hours, and distribution volume of 1.31 L/kg in adults and 1.5–2.2 L/kg in children, it undergoes hepatic cytochrome p450 metabolism and direct glucuronidation to undergo complete hydroxylation. Excreted metabolites: 4% in feces, 95% in urine. Adult clearance is 39 l/hour; for children, it is 0.56 - 1 l/kg/hour.

- **Properties**

Dexmedetomidine is clear, isotonic and preservative free ,with approximate molecular weight of 236. Its partition coefficient is 2.89 and its pka is 7.1. Compatible with 0.3% potassium chloride solution, 5% dextrose in water, 20% mannitol magnesium sulphate solution, and 0.9 normal saline in water. Given intravenously, the onset of action occurs in 25 minutes, whereas when taken orally, it takes 30 to 45 minutes.

- **Physiological Effects**

✓ **Cardiovascular System**

Decreased heart rate [direct effect on sinus and AV node]

Biphasic blood pressure response.

Hypertension is followed by dose dependent hypotension .

Reduced plasma catecholamines.

Transient increase in pulmonary vascular resistance.

✓ **Respiratory System**

Even with increasing sedation , dexmedetomidine has ability to maintain respiratory drive and airway patency is preserved.

✓ **Central Nervous System**

Both somatosensory and motor evoked potentials are preserved.

Arousable sedation .

No effects on cerebral perfusion pressures or intracranial pressures.

✓ **GIT**

Dose dependent gastrointestinal transit delay.

✓ **Thermal Regulation**

It is effective in controlling postoperative shivering in children. Dexmedetomidine interferes with non-shivering thermogenesis by lowering centrally mediated metabolic heat production and inhibiting lipolysis.

✓ **Overdose**

An overdose of dexmedetomidine has been associated to temporary hypertension, prolonged drowsiness sedation without respiratory

depression. It is easy to mitigate the effects of dexmedetomidine by using the alpha 2 adrenoreceptor antagonist atimomezole.

❖ **Clinical Application**

✓ **Premedication**

A novel premedication that produces anxiolysis, sedation, analgesia, and hemodynamic stability is dexmedetomidine. It offers further antisialogogue advantages and reduces gastric secretions .

✓ **Sedation for Non-Invasive Procedures**

Effective sedation is provided by dexmedetomidine for non-invasive procedures like EEG recording, CT and MRIs. Administered alone or in conjunction with other agents, 1 mcg/kg of loading dose given over 10 minutes, then 0.5 mcg/kg of infusion given every hour.

✓ **Sedation for Invasive Procedures**

Dexmedetomidine has been used as a sedative for invasive procedures such as lithotripsy, bronchoscopy ,endoscopic procedures.

✓ **Prevention and Treatment of Emergence Delirium**

Children who have received anaesthesia with sevoflurane have a lower incidence of emerging delirium post-surgery when they receive prophylactic dexmedetomidine at a dose of 1 mcg/kg IV at the end of the surgery.

✓ **Analgesia**

Adults with dexmedetomidine have demonstrated opioid sparing effects. In children, 1mcg/kg of it has an analgesic effect equivalent to 100mcg/kg of morphine.

- ✓ **Intensive Care Unit**

Dextmedetomidine serves as a primary sedative in both adult and pediatric ICUs, a second-line sedative subsequent to benzodiazepines or opioids

- ✓ **Scoliosis Surgery**

As an adjunct for total IV anaesthesia.

- ✓ **Cardiac Surgery**

Intraoperative IV dexmedetomidine attenuates the neuroendocrine and hemodynamic responses during sternotomy, incision, and post-bypass in both adults and children.

- ✓ **In Challenging Patients**

Used to provide sedation without causing significant respiratory depression in patients with mediastinal masses, difficult airways, or obstructive sleep apnea. Use to treat shivering, tachyarrhythmias, and cyclical vomiting in children.

Materials and Method

Study Design :

This study is Randomized Clinical Study.

Source of data:

This study was done in the Department of Anaesthesiology, B.L.D.E.U.'s Shri. B. M. Patil Medical College, Hospital and Research centre, Vijayapura

Study Duration and Place of Study :

The study was conducted period of one and half year from august 2022 to march 2024 in our hospital.

Study Groups

- **Group KFD (ketofol-dexmedetomidine):** Group 0.5 mcg/kg dexmedetomidine (diluted to 10 ml with 0.9% saline) was infused intravenously over a period of 10 minutes and 10 minutes prior to the procedure.
- **Group KF (Ketofol)** : 10 ml of 0.9% saline was infused intravenously over a period of 10 minutes and 10 minutes before the procedure.

Sample Size :

The anticipated Mean±SD of M.A.P. of E.C.T. patients in the Ketofol-Dex group compared to Ketofol group 71.9±5.1 versus 75.8±6.3 resp. (ref) the required minimum sample size is 30 per group (a total sample size of 60, assuming equal group sizes) to achieve a power of 80% and a significance level of 5% (two-sided) for detecting a true difference in means between two groups.

Level of significance=95%, The power of the study=90%, d=clinically significant difference between two parameters, SD= Common standard deviation

Inclusion and Exclusion Criteria

Inclusion Criteria

- Patients aged between Age 18-60 years
- Patients of either sex.
- Patients with A.S.A. Grade I & II.

Exclusion Criteria

- Cardiovascular disease,
- Cerebrovascular disorder,
- Intracranial hypertension,
- Respiratory tract disease,
- Glaucoma,
- Presence of a pacemaker,
- History of seizures,
- ASA III –V physical status,
- History of allergy to the study drugs,
- Pregnancy

Ethical Committee Approval:

The present study was approved by institutional ethics committee of our tertiary care centre (B.L.D.E.U.'s) committee.

Method

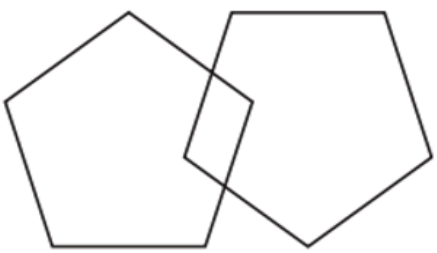
- History of underlying medical illness, previous history of surgery, anaesthetic exposure, and hospitalization were elicited.
- General examination including weight and height, baseline heart rate, blood pressure, respiratory rate were recorded.
- Examination of the respiratory system, cardiovascular system, central nervous system was done.
- Airway assessment by Mallampati grading.
- The procedure was explained to the patient and patient attenders.
- Initial socio-demographic data were obtained.
- Pre-ECT cognitive assessment was done by (mini-mental state examination) MMSE, psychiatry illness severity was assessed by HAM-D, YMRS and PANSS scale, pre MECT agitation score was also assessed.
- Baseline hemodynamics like PR, BP, RR and other parameters were noted.
- Pre-anaesthetic evaluation was done in the ward.
- Patients were kept nil by mouth for 6 hrs overnight fasting.
- Patients were selected for the study based on the inclusion and exclusion criteria.
- The procedure were explained to the patient attenders, and informed consent were taken.
- Patients were encouraged to empty their bladder before E.C.T.
- Randomly patients were divided into two equal groups, the ketofol (KF group) and the ketofol-dexmedetomidine (KFD) group, each with thirty patients.

- Patients were connected to the baseline monitor as soon as they entered the operation room in order to continuously monitor their heart rates, electrocardiograms, non-invasive blood pressure, and oxygen saturation (Spo_2).
- An IV connection was made.
- 0.5 mg of intravenous atropine sulphate were given to each patient as a premedication
- For three minutes, patients were pre-oxygenated with 100% oxygen.
- Ketofol was produced by mixing 10 mg/ml ketamine and 10 mg/ml propofol in a 20 ml syringe in a 1:1 ratio. It was then administered gradually (20 mg/10 s) until the patient lost their ability to respond to to their name being called loudly and the loss of the eyelash reflex.
- If, within 60 seconds of the drug's administration, the recipient's responsiveness to verbal command has not been lost, additional ketofol was administered in increments of 10 mg. Both the total induction time and the necessary total dose of ketofol were noted.
- Following the induction of anaesthesia with ketofol, 0.5 mg/kg of succinylcholine was given. With a face mask and 100% oxygen at a flow rate of 8 L/min, manual ventilation will be performed.
- In order to protect the patient's teeth, lips, and tongue, a bite-block will be placed.
- Bifrontotemporal electrodes were used to administer a suprathreshold electrical stimulation. All of the patients were then ventilated using a face mask containing

100% oxygen at a rate of 14–18 breaths per minute until the patient's spontaneous breathing returned and they were clinically recovered from the state of anaesthesia.

- Mean arterial pressure (M.A.P.), heart rate (H.R.), and oxygen saturation were recorded at baseline, after induction, during ECT and after 5, 10, 30 after the end of the seizure.
- The time interval between the start of E.C.T. and the end of tonic-clonic motor activity in the "isolated" arm was used to determine the motor seizure duration.
- Using Aldrete's score of ≥9, the duration of recovery was recorded starting from the administration of anaesthetic agent and ending when the patient was able to sit without assistance, obey vocal commands, and meet discharge criteria.
- Pre-procedure agitation and post-procedure agitation was measured by Richmond Agitation-Sedation scale (R.A.S.S.) patients with R.A.S.S. >=1 are considered as having agitation.

❖ Mini-Mental State Examination (MMSE):

Maximum Score	Patient's score	Questions
5		What is the (year) (season) (date) (day) (month)?
5		Where are we (state) (country) (town) (hospital) (floor)?
3		**Registration** Name 3 objects: 1 second to say each. Then ask the patient all 3 after you have said them. Give 1 point for each correct answer. Then repeat them until he/she learns all 3. Count trials and record. Trials _____
5		**Attention and Calculation** Serial 7's. 1 point for each correct answer. Stop after 5 answers. Alternatively spell "world" backward.
3		**Recall** Ask for the 3 objects repeated above. Give 1 point for each correct answer.
2		**Language** Name a pencil and watch.
1		Repeat the following "No ifs, ands, or buts"
3		Follow a 3-stage command: "Take a paper in your hand, fold it in half, and put it on the floor."
1		Read and obey the following: CLOSE YOUR EYES
1		Write a sentence.
1		Copy the design shown. 

Total score of 30		ASSESS level of consciousness along a continuum _____ Alert Drowsy Stupor Com□

❖ Table 2: Richmond Agitation Sedation Scale

Richmond Agitation-Sedation Scale	Term	Description
4	Combative	Overtly combative or violent; immediate danger to staff
3	Very agitated	Pulls on or removes tube(s) or catheter(s) or has aggressive behavior toward staff
2	Agitated	Frequent non purposeful movement or patient-ventilator dyssynchrony
1	Restless	Anxious or apprehensive but movements not aggressive or vigorous
0	Alert and calm	
−1	Drowsy	Not fully alert, but has sustained (>10 s) awakening with eye contact to voice
−2	Light sedation	Briefly (<10 s) awakens with eye contact to voice
−3	Moderate sedation	Any movement (but no eye contact) to voice
−4	Deep sedation	No response to voice, but any movement to physical stimulation
−5	Unarousable	No response to voice or physical stimulation

❖ HAMILTON DEPRESSION RATING SCALE (H.D.R.S.) SCORES:

A psychiatrist who was not aware of the anaesthetic study groups used the Hamilton depression rating scale (HDRS) to grade the patients for depression before and after each ECT session. The patients' scores were taken one day prior to ECT as a baseline and on days 1, 2, 3, 4, and 5 following ECT therapy.

HAMILTON DEPRESSION RATING SCALE

The total Hamilton Depression (HAM-D) Rating Scale provides an indication of depression and, over time, provides a valuable guide to progress.

• Classification of symptoms which may be difficult to obtain can be scored as:

0 - absent: 1 - doubtful or trivial: 2 - present.

• Classification of symptoms where more detail can be obtained can be expanded to:

0 - absent; 1 - mild; 2 - moderate; 3 - severe; 4 - incapacitating.

• In general the higher the total score the more severe the depression.

• HAM-D score level of depression:

10 - 13 mild; 14-17 mild to moderate; >17 moderate to severe.

Assessment is recommended at two weekly intervals.

		Pre-treatment	1st Follow-up	2nd Follow-up
HAM-D Rating Scale Symptoms		Date	Date	Date
	Depressed mood			
	Guilt feelings			

	Suicide			
	Insomnia - early			
	Insomnia - middle			
	Insomnia - late			
	Work and activities			
	Retardation - psychomotor			
	Agitation			
	Anxiety - psychological			
	Anxiety - somatic			
	Somatic symptoms GI			
	Somatic symptoms - General			
	Sexual dysfunction - menstrual disturbance			
	Hypochondrias			
	Weight loss by history			
	- by scales			
	Insight			

❖ YOUNG MANIA RATING SCALE :

YMRS has 11 items,

- 7 scored 0–4 and 4 scored 0–8.
- Total score ranges from 0 to 60.
- Higher item scores indicate greater severity.

1.Elevated Mood

0 – Absent;

1 - Mildly or possibly increased on questioning;

2 - Definite subjective elevation; optimistic, self-confident; cheerful; appropriate to content;

3 - Elevated, inappropriate to content; humorous;

4 - Euphoric; inappropriate laughter; singing.

2 .Increased Motor Activity Energy

0 – Absent;

1 - Subjectively increased;

2 - Animated; gestures increased;

3 - Excessive energy; hyperactive at times; restless (can be calmed);

4 - Motor excitement; continuous hyperactivity (cannot be calmed).

3.Sexual Interest

0 - Normal; not increased;

1 - Mildly or possibly increased;

2 - Definite subjective increase on questioning;

3 - Spontaneous sexual content; elaborates on sexual matters; hypersexual by self-report;

4 - Overt sexual acts (toward patients, staff, or interviewer).

4.Sleep

0 - Reports no decrease in sleep;

1 - Sleeping less than normal amount by up to one hour;

2 - Sleeping less than normal by more than one hour;

3 - Reports decreased need for sleep;

4 - Denies need for sleep.

5.Irritability

0 – Absent;

2 - Subjectively increased;

4 - Irritable at times during interview; recent episodes of anger or annoyance on ward;

6 - Frequently irritable during interview; short, curt throughout;

8 - Hostile, uncooperative; interview impossible.

6.Speech

0 - No increase;

2 - Feels talkative;

4 - Increased rate or amount at times, verbose at times;

6 - Push; consistently increased rate and amount; difficult to interrupt;

8 - Pressured; uninterruptible, continuous speech.

7.Language-Thought Disorder

0 – Absent;

1 - Circumstantial; mild distractibility; quick thoughts;

2 - Distractible; loses goal of thought; change topics frequently; racing thoughts;

3 - Flight of ideas; tangentiality; difficult to follow; rhyming, echolalia;

4 - Incoherent; communication impossible.

8.Content

0 – Normal;

2 - Questionable plans, new interests;

4 - Special project(s); hyperreligious;

6 - Grandiose or paranoid ideas; ideas of reference;

8 - Delusions; hallucinations.

0 - Absent, cooperative;

2 - Sarcastic; loud at times, guarded;

4 - Demanding; threats on ward;

6 - Threatens interviewer; shouting; interview difficult;

8 - Assaultive; destructive; interview impossible.

10.Appearance

0 - Appropriate dress and grooming;

1 - Minimally unkempt;

2 - Poorly groomed; moderately disheveled; overdressed;

3 - Disheveled; partly clothed; garish make-up;

4 - Completely unkempt; decorated; bizarre garb.

11.(Impaired) Insight

0 - Present; admits illness; agrees with need for treatment;

1 - Possibly ill;

2 - Admits behavior change, but denies illness;

3 - Admits possible change in behavior, but denies illness;

4 - Denies any behavior change.

TOTAL SCORE :

PANSS RATING FORM:

PANSS RATING FORM

		absent	minimal	mild	moderate	moderate severe	severe	extreme
P1	Delusions	1	2	3	4	5	6	7
P2	Conceptual disorganisation	1	2	3	4	5	6	7
P3	Hallucinatory behaviour	1	2	3	4	5	6	7
P4	Excitement	1	2	3	4	5	6	7
P5	Grandiosity	1	2	3	4	5	6	7
P6	Suspiciousness/persecution	1	2	3	4	5	6	7
P7	Hostility	1	2	3	4	5	6	7
N1	Blunted affect	1	2	3	4	5	6	7
N2	Emotional withdrawal	1	2	3	4	5	6	7
N3	Poor rapport	1	2	3	4	5	6	7
N4	Passive/apathetic social withdrawal	1	2	3	4	5	6	7
N5	Difficulty in abstract thinking	1	2	3	4	5	6	7
N6	Lack of spontaneity & flow of conversation	1	2	3	4	5	6	7
N7	Stereotyped thinking	1	2	3	4	5	6	7
G1	Somatic concern	1	2	3	4	5	6	7
G2	Anxiety	1	2	3	4	5	6	7
G3	Guilt feelings	1	2	3	4	5	6	7
G4	Tension	1	2	3	4	5	6	7
G5	Mannerisms & posturing	1	2	3	4	5	6	7
G6	Depression	1	2	3	4	5	6	7
G7	Motor retardation	1	2	3	4	5	6	7
G8	Uncooperativeness	1	2	3	4	5	6	7
G9	Unusual thought content	1	2	3	4	5	6	7
G10	Disorientation	1	2	3	4	5	6	7
G11	Poor attention	1	2	3	4	5	6	7
G12	Lack of judgement & insight	1	2	3	4	5	6	7
G13	Disturbance of volition	1	2	3	4	5	6	7
G14	Poor impulse control	1	2	3	4	5	6	7
G15	Preoccupation	1	2	3	4	5	6	7
G16	Active social avoidance	1	2	3	4	5	6	7

p	**Positive symptoms**
N	**Negative symptoms**
G	**General symptoms**

❖ **MODIFIED ALDRETE SCORE:**

Criteria	Characteristics	Points
Activity	Able to move 4 extremities	2
	Able to move 2 extremities	1
	Unable to move extremities	0
Respiration	Able to breathe deeply and cough freely	2
	Dyspnea or limited breathing	1
	Apneic	0
Circulation	BP +/- 20% of pre-anesthetic level	2
	BP +/- 20-49% of pre-anesthetic level	1
	BP +/- 50% of pre-anesthetic level	0
Consciousness	Fully awake	2
	Arousable on calling	1
	Not responding	0
Oxygen saturation	Able to maintain O_2 saturation >92% on room air	2
	Needs oxygen to maintain O_2 saturation >90%	1
	O_2 saturation <90% even with supplemental oxygen	0

❖ **Statistical Analysis**

- The data obtained were entered in a Microsoft Excel sheet, and statistical analysis were performed using a statistical package for the social sciences (SPSS Version 25).
- Categorical data were presented with frequency and proportion while quantitative data were presented with mean and standard deviation.
- Normality of the data were tested with the help of Shapiro-Wilk test
- For a normally distributed continuous variables between two groups were compared using an independent t-test for not normally distributed variables Mann Whitney U test was used.

- Association between two groups were assessed by using the Chi-square test.
- .$p<0.05$ will be considered statistically significant. All statistical tests will be performed two-tailed.

Observation and Results

Table 3: Age distribution between the groups.

Age	Mean	SD	t-test	P - value
KFD(n=30) Group	41.23	3.64	1.4	0.166
KF(n=30) Group	39.8	4.24		

Mean age distribution between the groups were statistically not significant, it was comparable between the groups as shown in above table.

Graph 1: Age distribution between the groups.

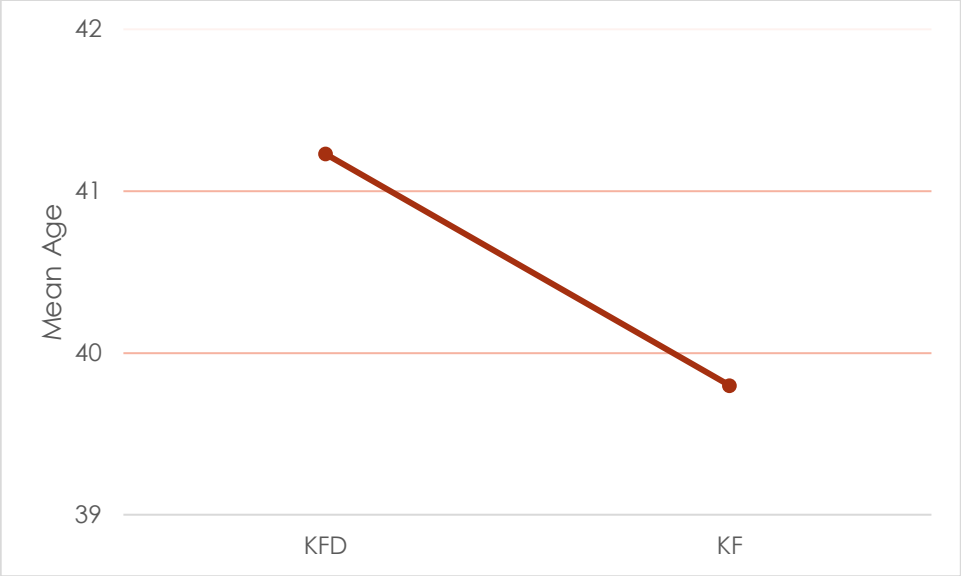


Table 4: Gender distribution between the groups.

Gender	Group		Chi-square	P - value
	KFD(n=30)	KF(n=30)		
Male	23	25	0.41	0.518
Female	7	5		

There was no significant difference in gender between the groups, gender were comparable between the groups and there were majorly males present in the study.

Graph 2: Gender distribution between the groups.

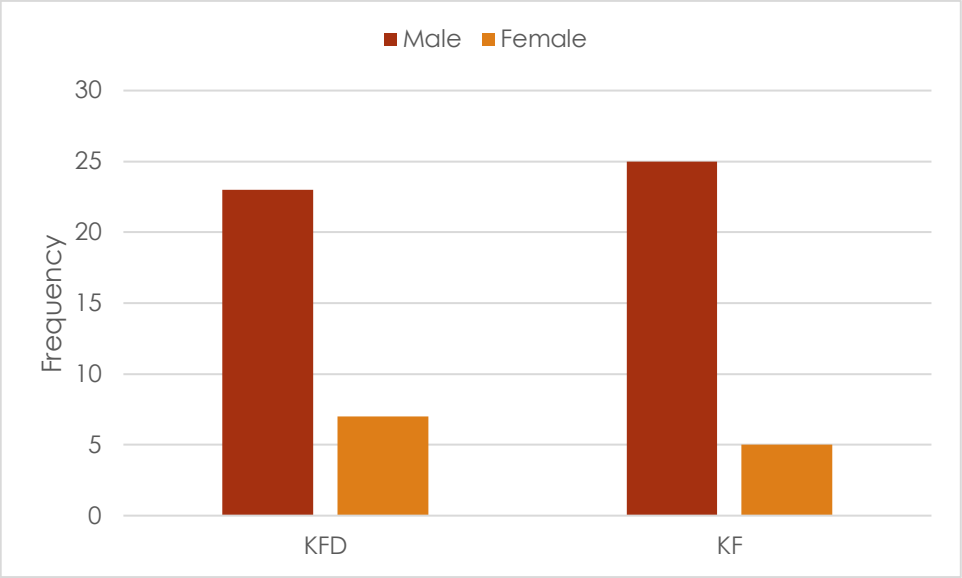


Table 5: Mean induction time between the groups.

Induction Time (Sec)	Mean	SD	t-test	P - value
KFD Group (n=30)	40.21	4.62	12.77	0.0001
KF Group (n=30)	52.32	6.24		

**p-value<0.01, statistically highly significant at 5% level of significance.

Mean induction time in KFD group was earlier than group KF (40.21sec Vs 52.32) and this difference between the groups was statistically significant. As shown in above table.

Graph 3: Mean induction time between the groups.

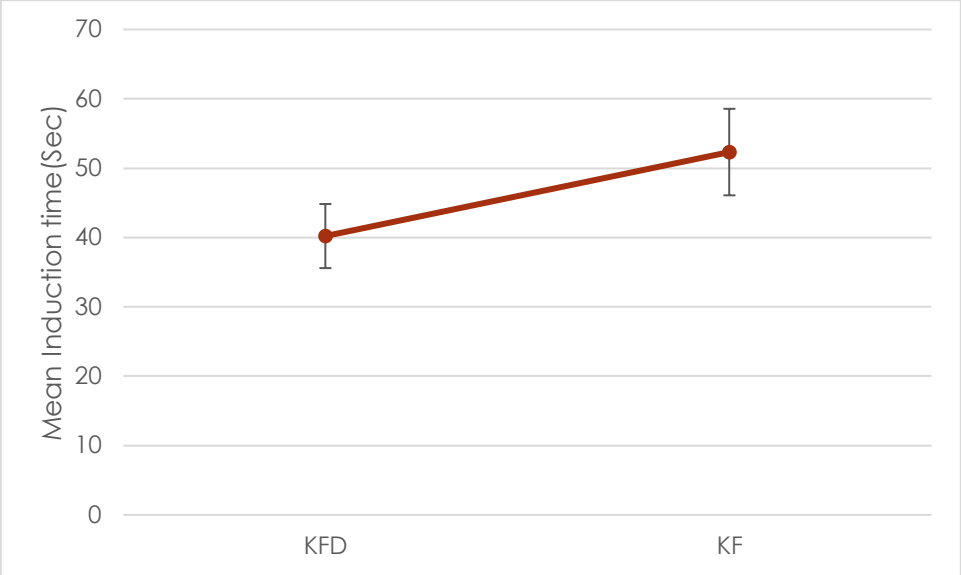


Table 6: Mean duration of motor seizure (Sec) time between the groups.

Duration of Motor Seizure(Sec)	Mean	SD	t-test	P - value
KFD Group (n=30)	28.57	2.329	13.23*	< 0.001
KF Group (n=30)	22.43	1.006		

*p-value<0.01, highly statistically significant at 5% level of significance

Mean duration of motor seizure (Sec) were was longer in KFD compared to KF and this mean duration of motor seizure (Sec) was statistically significant as shown in above.

Graph 4: Mean duration of motor seizure (Sec) time between the groups.

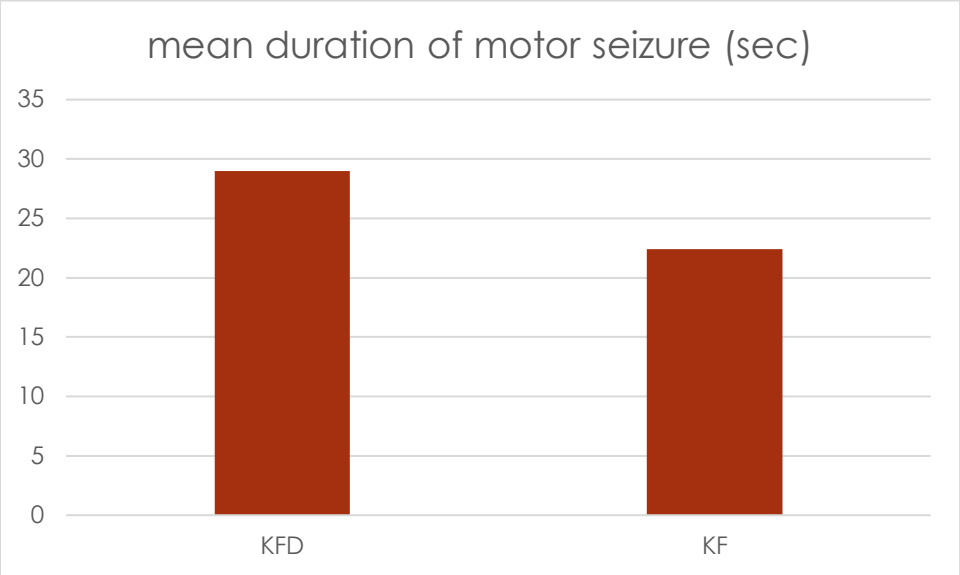


Table 7 : Mean induction dose (Ketofol in gm) used between the groups.

Induction Dose (Ketofol in gm)	Mean	SD	t-test	P - value
KFD Group (n=30)	54.07	3.11	38.11**	<0.0001
KF Group (n=30)	81.30	2.36		

**p-value<0.01, statistically highly significant at 5% level of significance

Mean induction dose of Ketofol in gm, was statistically highly significant and it was lower in group KFD compared to KF.

Graph 5 : Mean induction dose (Ketofol in gm) used between the groups.

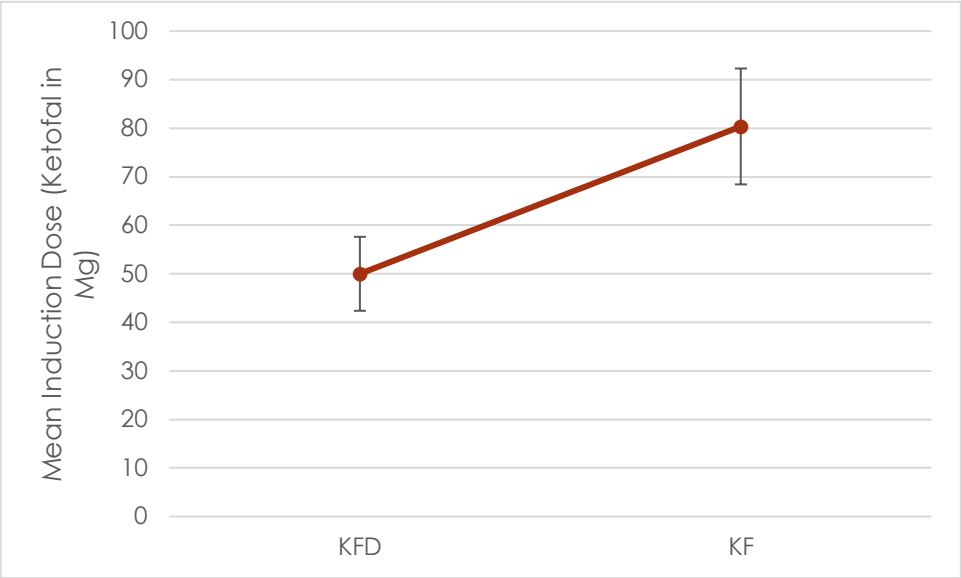


Table 8: Mean heart rate between the groups.

Heart Rate	Group		t-test	P - value
	KFD(n=30)	KF(n=30)		
Baseline	76.5±5.62	77.24 ± 6.24	0.58	0.559
After Induction	75.62±5.12	103.8 ± 9.14	15.21**	<0.001
During ECT	89.66±3.40	104.8 ± 7.02	10.98**	<0.001
5 Min	73.42 ± 5.91	105.8 ± 3.92	25.82**	<0.001
10 Min	72.61 ± 6.81	76.91 ± 6.24	2.54*	0.0134
30 Min	73.62 ± 4.5	77.26 ±6.21	2.59*	0.0118

*p-value<0.05, statistically significant at 5% level of significance

**p-value<0.01, statistically significant at 5% level of significance

Mean heart rate after 5 minutes, induction and ECT till 30 minutes were statistically significant. Mean heart rate in KFD group was lower than group KF.

Graph 6 : Mean heart rate between the groups.

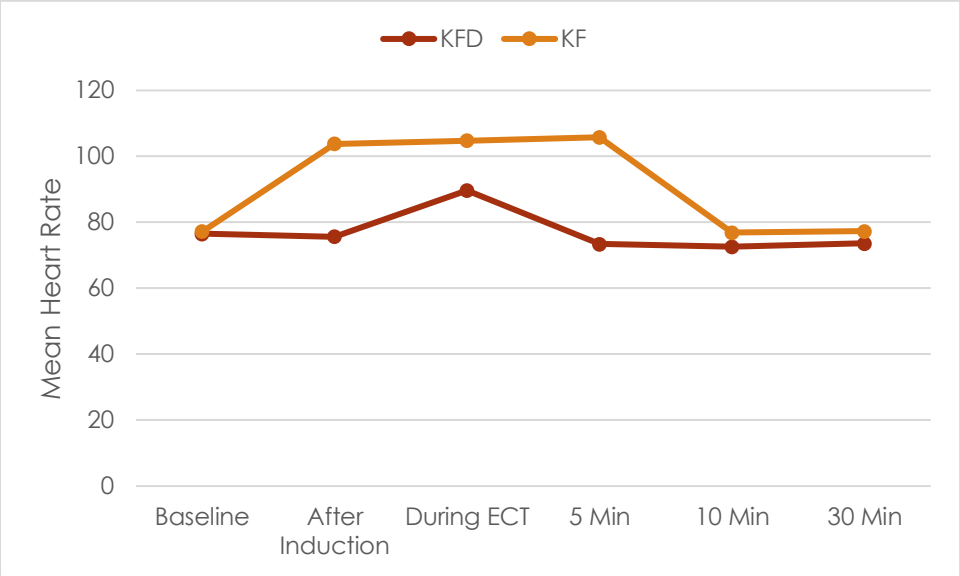


Table 9 : Mean arterial pressure between the groups.

Mean Arterial Pressure	Group		t-test	P - value
	KFD(n=30)	KF(n=30)		
Baseline	91.23 ± 1.04	91.73 ±1.46	1.52	0.13
After Induction	88.77 ± 1.47	91.80 ±1.06	9.12**	<0.0001
During ECT	93.20 ± 1.91	107.93± 1.53	32.88**	<0.0001
5 Min	90.80 ± 2.56	98.07 ±1.11	14.23**	<0.0001
10 Min	86.30 ± 1.70	98.33± 1.06	32.81**	<0.0001
30 Min	85.63 ± 0.92	95.97 ± 1.21	36.97**	<0.0001

**p-value<0.01, statistically highly significant at 5% level of significance

Mean arterial pressure after induction till 30 minutes were statistically highly significant. Mean arterial pressure in KFD group was lower than group KF.

Graph 7: Mean arterial pressure between the groups.

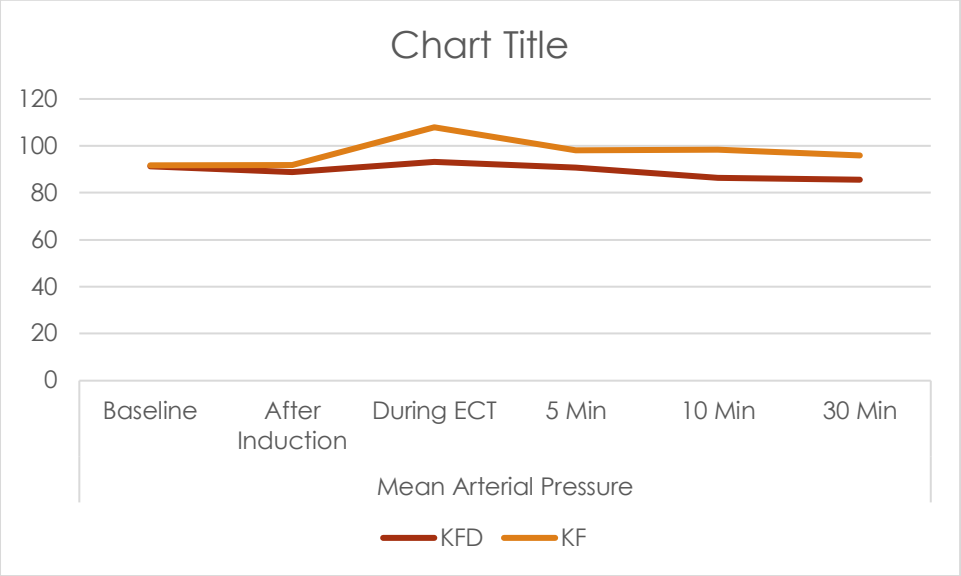


Table 10 : Mean oxygen saturation (SPO2) between the groups.

Oxygen Saturation (SPO2)	Group		t-test	P - value
	KFD(n=30)	KF(n=30)		
Baseline	99.23 ± 0.94	99.36 ± 1.24	0.457	0.6489
After Induction	98.29 ± 1.36	99.62 ± 1.42	3.7**	0.005
During ECT	99.62 ± 0.92	99.37 ± 0.99	0.91	0.3618
5 Min	99.22 ± 1.12	99.67 ± 0.83	1.768	0.0823
10 Min	98.61 ± 0.87	99.07 ± 0.76	2.18*	0.033
30 Min	99.84 ± 0.91	99.31 ± 0.95	2.206**	0.0313

**p-value<0.01, statistically highly significant at 5% level of significance

Mean oxygen saturation between the groups during induction, and after 10 minutes and 30 minutes were statistically significant, but during ECT and at baseline it was comparable.

Graph 8 : Mean oxygen saturation (SPO2) between the groups.

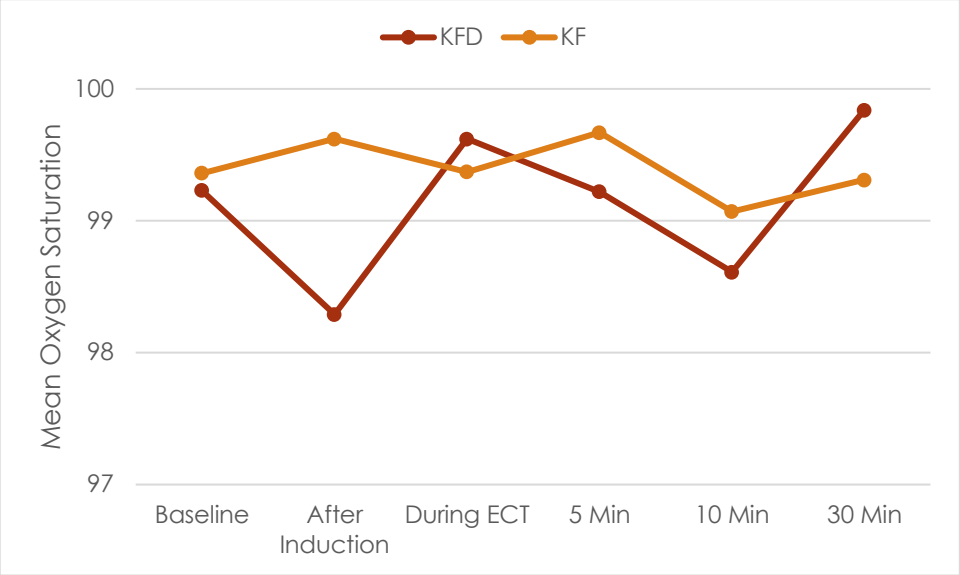


Table 11 : Comparison between the recovery times in the two groups:

Recovery Time (Min)	Group		t-test	P - value
	KFD(n=30)	KF(n=30)		
Consciousness	7.26 ± 2.63	6.32 ± 1.26	1.765	0.0827
Obey command	12.62 ± 4.91	10.94 ± 2.93	2.03*	0.046
Orientation	22.34 ± 5.97	18.63 ± 6.42	2.31*	0.024
Ability to sit unaided	23.94 ± 3.94	20.71± 4.29	3.035**	0.0036
Time taken to meet discharge criteria	105.23 ± 6.97	62.31± 8.46	21.44**	0.0001

**p-value<0.01, statistically highly significant at 5% level of significance

Above table showed that, in groups KF time for consciousness was earlier compared to KFD group but it was comparable between groups, but time to obey command, orientation, ability to sit unaided, and time taken to meet discharge criteria was earlier in group KF and difference of this time between groups were statistically significant.

Graph 9 : Comparison between the recovery times in the Two groups

Table 12 : Richmond Agitation sedation scale between the groups

TERM	Score	KFD	KF
Combative	4	0	0
Very Agitated	3	0	0
Agitated	2	0	8
Restless	1	4	7
Alert and Calm	0	22	14
Drowsy	-1	2	1
Light Sedation	-2	2	0
Moderate Sedation	-3	0	0
Deep Sedation	-4	0	0
Unrousable	-5	0	0

Richmond agitation sedation scale, showed that 22 patients were found alert and calm in group KFD while there were 14 patient found alert and clam. In group KF, there were 8 patients were found agitated while in the same group 7 patients were found with restlessness and only 4 patients were found with restlessness. Each of 2 patients were

found with drowsiness and had light sedation and only 1 patient was with drowsiness in group KF.

Graph 10: Richmond Agitation sedation scale between the groups.

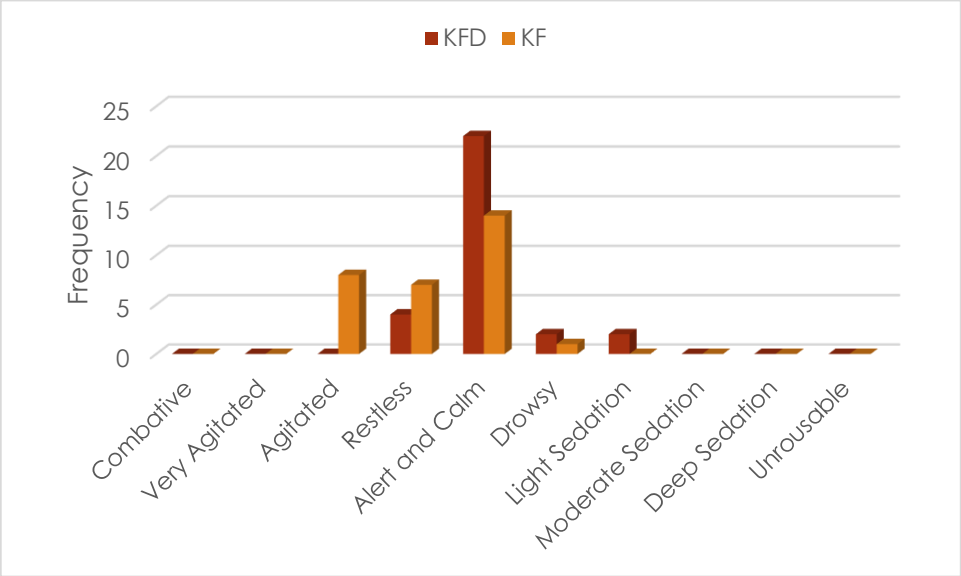


Table 13: Hamilton Depression Rating score between the groups.

HDR Score	KF		KF	
	Mean	SD	Mean	SD
Baseline (Pre ECT)	25.04	1.02	25.2	1
1 day After ECT	19.77	9.081	19.97	9.163
2 day After ECT	19.77	9.081	19.97	9.163
3 day After ECT	17.73	8.489	18.13	8.637
4 day After ECT	17.53	8.492	17.7	8.478
5 day After ECT	17.33	8.474	17.3	8.429
F-value	3.147		3.389	
p-value	0.006		0.006	

**p-value<0.01, statistically highly significant at 5% level of significance

Mean Hamilton depression rating score between the groups after 1 day till 5 days it was showed lower in group KFD and higher in group KF and this difference was found statistically highly significant between the groups.

Graph 11: Hamilton Depression Rating score between the groups.

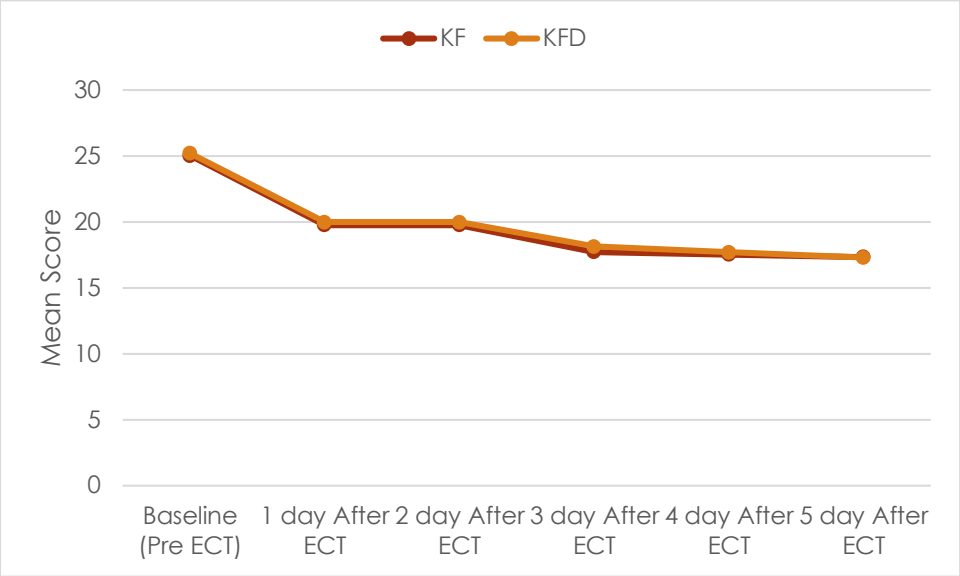


Table 14 : Mini Mental State Examination(MMSE)

MMSE		N	Mean	SD	t-test	P-value
PRE-ECT	KFD	30	28.20	0.88	0.30	0.76
	KF	30	28.27	0.82		
POST ECT	KFD	30	27.07	0.86	0.13	0.89
	KF	30	23.10	0.99		

Mean MMSE scores before and after ECT are not statistically significant between the two groups.

Graph 12: Mini Mental State Examination (MMSE)

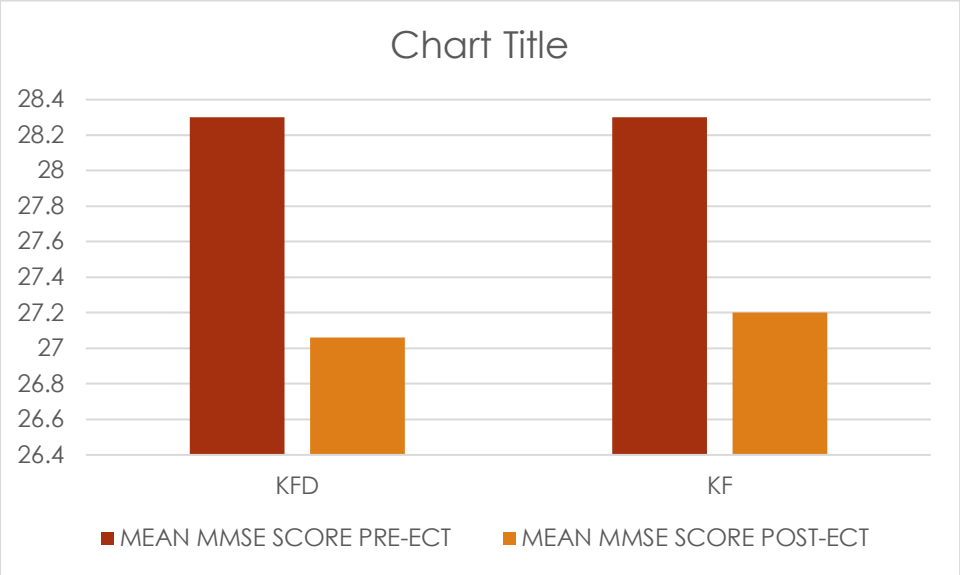


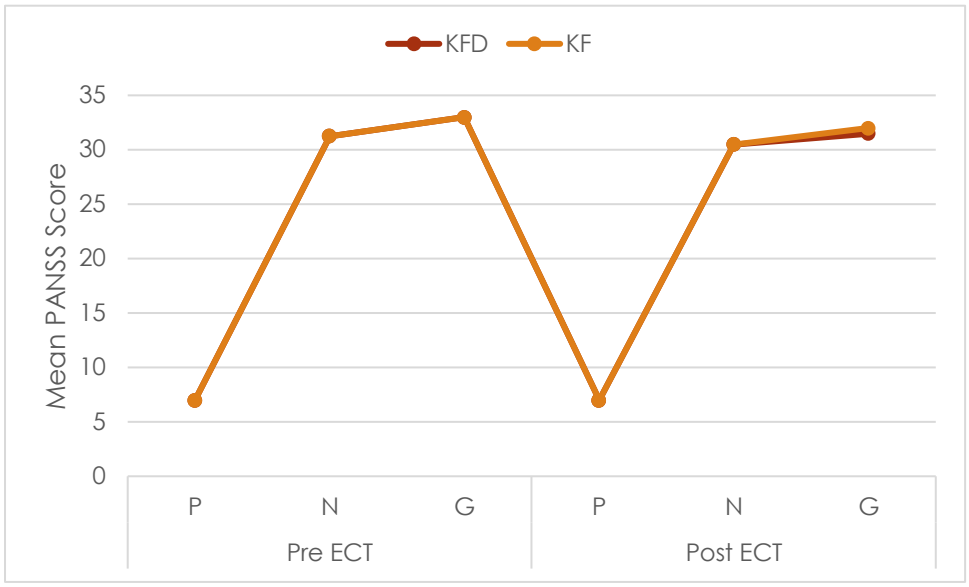
Table 15 : The Positive and Negative Syndrome Scale (PANSS)

PANSS Score	GROUPS	N	Mean	SD	t-test	P-value
P Pre ECT	KFD	4	7	0	0	1
	KF	4	7	0		
N Pre ECT	KFD	4	31.25	1.5	0	1
	KF	4	31.25	1.5		
G Pre ECT	KFD	4	33	2	0	1
	KF	4	33	2		
P Post ECT	KFD	4	7	0	0	1
	KF	4	7	0		
N Post ECT	KFD	4	30.5	1	0	1
	KF	4	30.5	1		
G post ECT	KFD	4	31.5	2.38	-0.322	0.759
	KF	4	32	2		

p	**Positive symptoms**
N	**Negative symptoms**
G	**General symptoms**

Mean PANSS scores in schizophrenia patients before and after ECT are not statistically significant between the two groups.

Graph 13: The Positive and Negative Syndrome Scale (PANSS)



Discussion

ECT is a highly recognized, well-accepted, and efficacious therapy technique for a variety of psychiatric conditions. In 1951, Wanderdel created modified ECT by the use of succinylcholine. It reduces incidence of physical and psychological trauma.[75] For best results during electroconvulsive therapy (ECT), general anaesthesia combined with muscle relaxation is crucial, and it should be carefully administered. An ideal drug or combination of drugs should be fast-acting, complete neuromuscular blockade, cause amnesia, and have no adverse effects. It should also not affect the quality of seizures.

Given that it preserves cognitive function and has an antidepressant effect, ketamine appears to be a suitable anaesthetic for ECT.[76] Ketamine is helpful when an early antidepressant effect is required in severe cases, as demonstrated by Okamato et al. The suppression of excitotoxicity and neuroprotective effects resulting from NMDA antagonism could be a potential mechanism of the antidepressant effect.

Ketamine side effects include cardiotoxicity, brief psychotic episodes, and delayed recovery as well.[78] Ketamine inhibits norepinephrine re-uptake at peripheral nerves and heart tissue and releases catecholamines into the bloodstream.[77]Because of its quick recovery, minimal effect on hemodynamic responsiveness, and antiemetic properties, propofol is regarded as one of the most widely used anaesthetic drugs in ECT. For analgesia and hemodynamic stability, ketofol may be beneficial. When ketofol is used instead of ketamine alone, the overall amount of ketamine needed for ECT is reduced and

the recovery period is shortened without experiencing any remarkable side effects. Furthermore, it's thought that the sedative and antiemetic properties of propofol could balance out the effects of ketamine on nausea and psychomimetic behavior.[79] A number of antihypertensive medications have not been able to totally stop the acute hypertension response to the ECT stimulation without producing persistent hypotension, according to earlier research. [80].

Dexmedetomidine reduces the need for anaesthesia and post-operative analgesics, blunts the hemodynamic response to intubation and operation, and provides intraoperative hemodynamic stability, as multiple studies have shown. [81,82].Dexmedetomidine inhibits adenylyl cyclase, which in turn stimulates parasympathetic outflow and inhibits sympathetic outflow overall, resulting in a decrease in CNS and CVS excitement. It operates on adrenergic receptors in the locus coeruleus in brain.

With its unique properties of sympatholysis, sedation, and analgesia, dexmedetomidine is a potent α2-adrenergic agonist that is well-suited for ECT. Its sedative effect helps to reduce agitation and improve satisfaction in patients who may otherwise complain about an unpleasant experience with ECT.[83]After the first ECT session, the use of dexmedetomidine premedication in addition to ketamine propofol combination (Ketofol-dex) has an additional anti-depressive impact due to improved seizure duration in a calm patient.

The ketofol-dex combination has also been shown to provide advantages in the form of a lower incidence of agitation, increased patient satisfaction,

and an acceptable decrease in heart rate and blood pressure, all without causing any serious adverse effects.[84]. The outcomes were similar to the study published in Anaesthesiologica Scandinavia 2008; 90:422–4, which analyzed the advantages of adding an alpha-2 agonist as a premedication and found that dexmedetomidine blunts acute hyperdynamic outcomes to electroconvulsive therapy without changing seizure duration.

- **Demographic Profile**

In the present study, we tried to compare effectiveness of ketofol and ketofol-dexmedetomidine group in patients undergoing modified electroconvulsive therapy. We have observed that, age(p-value=0.166) and gender(p-value=0.518) difference between the groups were statistically not significant, they were comparable between the groups.

- **Mean Induction time (Sec)**

In the present study we have observed that, Mean induction time in KFD group was earlier than group KF (40.21sec Vs 52.32) and this difference between the groups was statistically significant. According to the study conducted by Shah, *et al*.[85] Propofol had a smoother induction than thiopentone or midazolam. In the current study, thiopentone and midazolam groups showed a higher incidence of gag reflex coughing, tearing, and limb movement than the propofol group. Also our finding was well correlated with observation of previous studies.[86-88]

- **Mean Duration of Induction (Sec)**

Our study found that mean duration of motor seizure (Sec) were was longer in KFD compared to KF and this mean duration of motor seizure (Sec) was statistically significant. Seizure duration is thought to be a good measure of ECT effectiveness, even though the precise mechanism underlying its therapeutic effect is still unclear.

In the past, it was advised that a seizure last longer than 25 seconds to guarantee the clinical suitability of ECT. [89]. he majority of short-acting anaesthetics used in ECT reduce the length of the seizure in a dose-dependent manner. The significance of seizure duration has been questioned, though. According to reports, the only seizures that can lead to a reduced therapeutic benefit are those that are abortive or very brief (15 s). [90]

Another study by Roopesh Kumar et al[93] total Seizure duration improved significantly in group A(KFD) (35.13 ± 1.48) as compared to group B(KF) (31.04 ± 3.46) but without affecting recovery in group A than B which was similar to our study.

- **Mean total Induction Dose (Ketofol)**

In the present study due to shorter motor duration of seizures, total mean induction doses were more in KF group compared to KFD, it required low doses of ketofol induction. In the study by Shams & El-Masry et al., the use of dexmedetomidine resulted in lower total doses of ketofol in the ketofol-dex group compared to the ketofol group.

- **Haemodynamic Parameters (Heart Rate and Mean arterial pressure):**

In the present study, Mean heart rate after 5 minutes, induction, during ECT and after ECT till 30 minutes were statistically significant, but during induction it was comparable between the groups. Mean heart rate in KFD group was lower than group KF. Also mean arterial pressure after induction till 30 minutes were statistically highly significant,. Mean arterial pressure in KFD group was lower than group KF. These results, which were found to be similar to by Z.Begec et al. study and it implies that premedication with dexmedetomidine may be helpful in preventing acute hyperdynamic responses to ECT.

One of the alleged advantages of using α2 agonists, such as dexmedetomidine, as premedication before ECT, according to Roopesh Kumar et al.'s study, was to prevent the abrupt hyperdynamic response associated with seizures. Improved hemodynamic measures, such as mean arterial pressure (mean 88.86 ± 1.577) and pulse rate (mean 82.25 ±4.606), were clearly observed in group A. The mean arterial pressure (108.31±1.305) and mean pulse rate (105.81+4.881) in group B immediately following the seizure were markedly different from this. As a result, using dexmedetomidine as a premedication lowers the abrupt rise in hemodynamic parameters, lowering the risk of myocardial ischemia and infarction immediately following an ECT seizure.

Similar to our study, Shams & El-Masry et al.'s study reported that the ketofol-dex group had a significant reduction in MAP and HR till 40 minutes post administration when compared to the ketofol group. This decrease was found to be within a clinically acceptable range.

Another study by Garg K et al. found that the dexmedetomidine group significantly reduced post-ECT hyperdynamic responses at 0, 2, 4, 6, and 8 min compared to the control group.

❖ **Recovery Time (Min):**

In the study group KF time for consciousness was earlier compared to KFD group but it was comparable between groups, but time to obey command, orientation, ability to sit unaided, and time taken to meet discharge criteria was earlier in group KF and difference of this time between groups were statistically significant. According to the study Z Begec et al, since ECTs are usually performed as outpatient procedures, the anaesthetics utilized should have quick recovery times.

According to the another study by X. Li et al. as ECT procedures are outpatient procedures, which need anaesthetic agents with rapid recovery profiles.[96] Additionally, a delayed recovery raises the possibility of airway blockage and difficult mask ventilation, both of which have been linked to the anaesthesia-related death and morbidity in ECT.[97] According to the current study, infusing a lower dose of dexmedetomidine during ECT may lessen its sedative effects and limit its duration of action.This could eventually help patients recover faster and lower their chance of experiencing a delayed recovery. The study conducted by Dr. Jose B. Cherayath et al. found that in comparison to group B (Etomidate), group A (Ketofol) had shorter times for spontaneous respiration to return, eye opening upon command, and vocal command response.

❖ **Richmond agitation Sedation scale and Hamilton Depression Rating score**

In the present study, Richmond agitation sedation scale, showed that 22 patients were found alert and calm in group KFD while there were 14 patient found alert and clam. In the KFD group we didn't find any patients with agitation, while in group KF, there were 8 patients were found agitated while in the same group 7 patients were found with restlessness and only 4 patients were found with restlessness. Each of 2 patients were found with drowsiness and had light sedation and only 1 patient was with drowsiness in group KF, also Mean Hamilton depression rating score between the groups after 1 day till 5 days it was showed lower in group KFD and higher in group KF and this difference was found statistically highly significant between the groups.

Roopesh Kumar et al. found that premedication with dexmedetomidine and ketamine propofol (ketofol-dex) reduced the occurrence of agitation in patients following electroconvulsive therapy (ECT). In comparison to group B, where scores 1, 2, and 3 were 78.46%, 15.21%, and 6.5%, respectively, 95.65% and 4.34% of participants in group A had agitation scores 1 and 2. Our results also in accordance to study of Mizrak A, Koruk S et al. After electroconvulsive therapy, agitation is lessened by premedication with dexmedetomidine and midazolam.

The Hamilton depression rating score was determined in patients with depression one day before ECT and 24 hours after ECT in the same study by Roopesh Kumar et al. Both groups' HDR scores decreased when ketamine and

propofol were used as ECT inducing drugs for patients with serious depression, although group A's improvement in HDR scoring was much greater—by 8–10 points—than group B's (5–6 points). This may be attributed to improved seizure duration in group A and thus better outcome.

Another research effort by Shams et al. investigated the effects of the ketofol-DEX combination on depression and agitation during electroconvulsive therapy (ECT). The results showed that the mixture increased patient satisfaction, decreased depression and agitation, and reduced blood pressure and heart rate in an appropriate amount of time. Their results agreed with what we noticed.

- **Mini Mental State Examination (MMSE) And The Positive and Negative Syndrome Scale (PANSS)**:

In the current investigation, eight patients from the KFD group and three from the KF group, out of the eleven patients with low baseline MMSE scores (<24), saw a substantial improvement in their MMSE score following ECT, while 49 In patients whose initial MMSE score was normal (≥24), there was no discernible change in score during ECT. Mean MMSE scores before and 2 hours after ECT are not statistically significant between KFD and KF groups.

This finding is in accordance with the study done by **Jasmein obbels** et al where they observed that in the patients with a low baseline MMSE score (<24), the MMSE score improved significantly with ECT, while the score did not change significantly during ECT in the patients with a normal baseline

MMSE score (≥24).[98] Similarly mean PANSS scores in schizophrenia patients before and after ECT are not statistically significant between the two groups wherein 3 out of 8 patients with schizophrenia has shown slight drecrease in their negative symptoms.

Conclusion

- Based on our observations and results, as well as references to other studies, we can conclude that the ketofol-dexmedetomidine combination for ECT is associated with a longer mean seizure time and an acceptable decrease in heart rate and blood pressure when compared to ketofol, without any significant side effects.
- Also linked to a slightly effective anti-depressant effect and a lower incidence of agitation.
- These data suggest that premedication with dexmedetomidine may be useful in preventing the acute hyperdynamic responses to ECT.

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RESULTS

- Mean age distribution between the groups were statistically not significant (p-value = 0.166)
- There were no significant difference in gender between the groups(p-value =0.518)
- There was statistically significant difference in mean induction time between the KFD and KF group (P-value<0.001)
- There was statistically significant difference in mean duration of motor seizure between the KFD and KF group (P-value<0.001)
- There was statistically significant difference in mean total dose of induction seizure between the KFD and KF group (P-value<0.001)
- The KFD group had a significantly lower and acceptable mean heart rate and mean arterial pressure than the KF group.
- Recovery time were earlier in KF group compared to KF group and its was statistically significant.
- Mean Hamilton Depression Rating score was lower in group KFD compared to KF group and it was statistically significant.
- Mean MMSE scores before and after ECT are not statistically significant between the two groups.
- Mean PANSS scores in schizophrenia patients before and after ECT are not statistically significant between the two groups.

SUMMARY:

We performed this randomized clinical trial titled **"A Randomised clinical trial to compare effectiveness of ketofol and ketofol-dexmedetomidine group in patients undergoing modified electroconvulsive therapy."** in B.L.D.E. (DEEMED TO BE) UNIVERSITY SHRI B. M. PATIL MEDICAL COLLEGE, HOSPITAL AND RESEARCH CENTRE,VIJAYAPURA, KARNATAKA ,to assess the effectiveness of ketofol dexmedetomidine and ketofol on hemodynamics and seizure duration in patients receiving MECT and compare their effectiveness on cognitive function, on severity of depression, mania and psychosis

We also studied their effect on seizure duration , acceptable decrease in heart rate and blood pressure , their effects on agitation and depression and also early post modified ECT complications like restlessness and sedation .

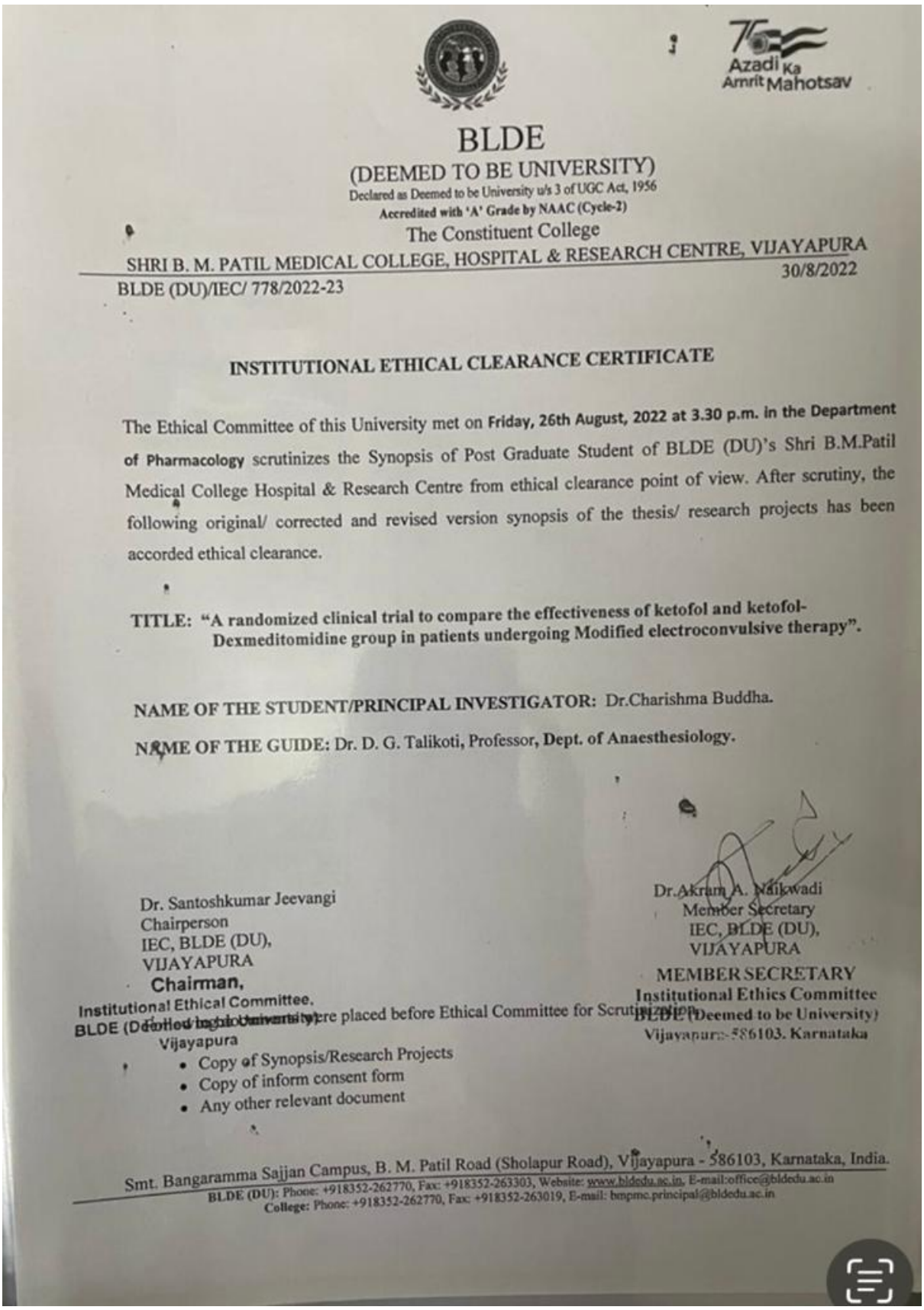
Sixty patients in the age group of 18 to 60 of either sex who belonged to ASA category 1 and 2 who were electively posted for "ECT" procedures were enrolled in the study and randomly assigned into two groups.

- "**Group ketofol**" : 30 patients were enrolled in this group and injection ketofol was used as the anaesthetic agent.
- "**Group ketofol-dexmedetomedine**": 30 randomly selected patients were included in this group

Demographic profile: either group shared characteristics such as age, sex, weight, height and ASA grade and were scheduled for similar procedure.

- ✓ This randomised clinical trial was conducted in a study period of one and half year from December 2022 to August 2024 in "**B.L.D.E. (DEEMED TO BE UNIVERSITY)SHRI B. M. PATIL MEDICAL COLLEGE**".
- ✓ Results were recorded using a present Proforma.
- ✓ Pre-anaesthetic evaluation was done, patients were kept fasting for 8 hours prior to surgery.
- ✓ Written informed consent was taken and the procedure was explained to the patients' attenders in their own understandable language.
- ✓ Any adverse effects that occurred were noted and treated promptly.
- ✓ It was come to the observation that "Group ketofol -dexmedetomidine" was superior to "group ketofol" in providing better hemodynamic stability in subjects and provided fairly better outcomes on post-Modified ECT agitation and depression which lead to better phsyciatrist satisfaction in the same group.
- ✓ The study proves the superiority of ketofol -dexmedetomidine over ketofol in providing better hemodynamic stability and therefore recommends its use.

ANNEXURE – I: ETHICAL COMMITTEE CLEARANCE CERTIFICATE:



BLDE
(DEEMED TO BE UNIVERSITY)
Declared as Deemed to be University u/s 3 of UGC Act, 1956
Accredited with 'A' Grade by NAAC (Cycle-2)
The Constituent College
SHRI B. M. PATIL MEDICAL COLLEGE, HOSPITAL & RESEARCH CENTRE, VIJAYAPURA

BLDE (DU)/IEC/ 778/2022-23 30/8/2022

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Ethical Committee of this University met on **Friday, 26th August, 2022 at 3.30 p.m. in the Department of Pharmacology** scrutinizes the Synopsis of Post Graduate Student of BLDE (DU)'s Shri B.M.Patil Medical College Hospital & Research Centre from ethical clearance point of view. After scrutiny, the following original/ corrected and revised version synopsis of the thesis/ research projects has been accorded ethical clearance.

TITLE: "A randomized clinical trial to compare the effectiveness of ketofol and ketofol-Dexmeditomidine group in patients undergoing Modified electroconvulsive therapy".

NAME OF THE STUDENT/PRINCIPAL INVESTIGATOR: Dr.Charishma Buddha.

NAME OF THE GUIDE: Dr. D. G. Talikoti, Professor, **Dept. of Anaesthesiology.**

Dr. Santoshkumar Jeevangi
Chairperson
IEC, BLDE (DU),
VIJAYAPURA
Chairman,
Institutional Ethical Committee,
BLDE (Deemed to be University),
Vijayapura

Dr.Akram A. Naikwadi
Member Secretary
IEC, BLDE (DU),
VIJAYAPURA
MEMBER SECRETARY
Institutional Ethics Committee
BLDE (Deemed to be University)
Vijayapura-586103. Karnataka

...ere placed before Ethical Committee for Scrutinization.

- Copy of Synopsis/Research Projects
- Copy of inform consent form
- Any other relevant document

Smt. Bangaramma Sajjan Campus, B. M. Patil Road (Sholapur Road), Vijayapura - 586103, Karnataka, India.
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College: Phone: +918352-262770, Fax: +918352-263019, E-mail: bmpmc.principal@bldedu.ac.in

ANNEXURE – II:

SAMPLE INFORMED CONSENT FORM:

B.L.D.E.U.'s Shri B.M.PATIL MEDICAL COLLEGE HOSPITAL

AND RESEARCH CENTER, VIJAYAPURA - 586103,

KARNATAKA

TITLE OF THE PROJECT: A Randomised clinical trial to compare effectiveness of ketofol and ketofol-dexmedetomidine group in patients undergoing modified electroconvulsive therapy.

PRINCIPAL INVESTIGATOR: **Dr. CHARISHMA BUDDHA**

Department of Anesthesiology
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PG GUIDE: **Dr. VIDYA PATIL**

PROFESSOR,
Department of Anesthesiology.
B.L.D.E. (Deemed to be University)
Shri B.M Patil Medical College
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PG CO-GUIDE: **Dr SANTOSH RAMDURG**

PROFESSOR AND HEAD

Department of Psychiatry.

B.L.D.E. (Deemed to be University)

Shri B.M Patil Medical College

Hospital & Research Centre,

Vijayapura–586103.

.

PURPOSE OF RESEARCH:

I have been informed that this study is to compare effectiveness of ketofol and ketofol-dexmedetomidine in patients undergoing modified electroconvulsive therapy.

I have been explained the reason for doing this study and selecting me/my ward as a subject for this study. I have also been given the free choice of either being included or not in the study.

PROCEDURE:

I understand that I will be participating in the study: to compare effectiveness of ketofol and ketofol-dexmedetomidine in patients undergoing modified electroconvulsive therapy.

RISKS AND DISCOMFORTS:

I understand that my ward may experience some discomfort during the procedure and that necessary measures will be taken to reduce them.

BENEFITS:

I understand that my ward participating in this study will help in the comparison of depression, agitation, and seizure duration between ketofol and ketofol-dexmedetomidine groups in patients undergoing modified electroconvulsive therapy.

CONFIDENTIALITY:

I understand that medical information produced by this study will become a part of this hospital record and will be subjected to the confidentiality and privacy regulation of this hospital. If the data are used for publication in the medical literature or teaching purposes, no names will be used, and other identities such as photographs and audio and videotapes will be used only with my special written permission. I understand that I may see the photograph and videotapes and hear audiotapes before giving permission.

REQUEST FOR MORE INFORMATION:

I understand that I may ask more questions about the study at any time. **Dr CHARISHMA BUDDHA** is available to answer my questions or concerns. I understand that I will be informed of any significant new findings discovered during the course of this study, which might influence my continued participation.

If during this study or later I wish to discuss my participation in or concerns regarding this studywith a person not directly involved, I am aware that the social worker of the hospital is available to talk with me. And that a copy of this consent form will be given to me to keep for careful reading.

REFUSAL OR WITHDRAWAL OF PARTICIPATION:

I understand that my participation is voluntary, and I may refuse to participate or may withdraw consent and discontinue participation in the study at any time without prejudice to my present or future care at this hospital.

I also understand **Dr.CHARISHMA BUDDHA** will terminate my participation in this study at any time after he has explained the reason for doing so and has helped arrange for my continued care by my own physician or therapist if this is appropriate.

INJURY STATEMENT:

I understand that in the unlikely event of injury to me/my ward, resulting directly due to my participation in this study, such injury will be reported promptly, then medical treatment would beavailable to me, but no further compensation will be provided.

I understand that by my agreement to participate in this study, I am not waiving my legal rights. I have explained the purpose of this research, the procedure required, and the possible risk and benefits to the best of my ability in patients, own language.

Date:

(Investigator) Dr.CHARISHMA BUDDHA

Patient's signature Witness to above signature

STUDY SUBJECT CONSENT STATEMENT:

I confirm that **Dr.CHARISHMA BUDDHA** has explained to me the purpose of this research, the study procedure that I will undergo, and the possible discomforts and benefits that I may experience in my own language.

I have been explained all the above in detail in my own language, and I understand the same. Therefore, I agree to give my consent to participate as a subject in this research project.

_____ _____

(Participant attender) (Date)

_____ _____

(Witness to above signature) (Date)

ANNEXURE – III:

CASE TAKING PROFORMA:

STUDY : A Randomised clinical trial to compare effectiveness of ketofol and ketofol-dexmedetomidine group in patients undergoing modified electroconvulsive therapy.

PROFORMA :

1. PATIENT DETAILS :

- Name :
- Age /sex :
- IpNo: Group allocated by randomization: group A / group B

2. Type of procedure :

3. Significant history :

4. General physical examination :

- Pallor
- Koilonychia
- Icterus
- lymphadenopathy
- Cyanosis
- Edema
- Clubbing
- Teeth
- Dentures:

5. Vital parameters :

- Pulse:
- Blood pressure:
- Respiratory Rate :

- Temperature:

6. Systemic examination :

- CVS
- RS
- CNS
- PERABDOMEN

7.Airway assessment :

- Mallampati grade:
- Cervical spine :
- Mouth opening :
- Neck movement :

8 . A.S.A. Grade :

9. Investigation

- Hemoglobin
- T.L.C.
- S.Urea
- S. CREATININE
- RBS
- Platelet count:
- Urine routine :
- Chest X-ray

TABLE 1 : Baseline Hemodynamic Parameters During The Procedure:

TIME	HEART RATE (B.P.M.)	SBP	DBP	MAP	SPO_{2} %
0 MINS					
5 MINS					
10 MINS					
30 MINS					

TABLE 2 :Variables During The Procedure (M.E.C.T) :

	KF GROUP (A)	KF-DEX GROUP (B)
INDUCTION TIME		
DURATION OF MOTOR SEIZURE		
INDUCTION DOSE (KETOFOL)		

Table 3: Comparison between the recovery times in the two groups:

		Time range (in min)	Mean±SD	P
Consciousness	KF			
	KF-D			
Obey command	KF			
	KF-D			
Orientation	KF			
	KF-D			
Ability to sit unaided	KF			
	KF-D			
Time taken to meet discharge criteria	KF			
	KF-D			

TABLE 4: Richmond Agitation Sedation Scale :

SCORE	TERM	KF	KF-D
4	COMBATIVE		

3	VERY AGITATED		
2	AGITATED		
1	RESTLESS		
0	ALERT AND CLAM		
-1	DROWSY		
-2	LIGHT SEDATION		
-3	MODERATE SEDATION		
-4	DEEP SEDATION		
-5	UNROUSABLE		

Hamilton depression rating scale (H.D.R.S.) Scores:

The patients were assessed for depression before and after every ECT session by a psychiatrist unaware of the anaesthetic study groups using THE HAMILTON DEPRESSION RATING SCALE (H.D.R.S.) scores (1 day before ECT as a baseline and days 1,2,3,4, and 5 after ECT treatment).

YOUNG MANIA RATING SCALE (YMRS) –

PRE-ECT=

POST-ECT=

PANSS RATING FORM

PRE-ECT=

POST-ECT=

BIODATA OF GUIDE

GUIDE NAME : **DR.VIDYA PATIL M.D**.

DATE OF BIRTH : 23/09/1965

EDUCATION : M.B.B.S.-1991
J.N.MC,
BELGAUM KARNATAKA UNIVERSITRY,
DHARWAD
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J.N.M.C. BELGAUM, KARNATAKA UNIVERSITRY,
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DEPARTMENT OF ANAESTHESIOLOGY

TEACHING : UG TEACHER-21 YEARS
PG TEACHER-21 YEARS

ADDRERSS : PROFESSOR
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CO-GUIDE BIO-DATA

Name : Dr. SANTOSH RAMDURG

Date of birth : 25/6/1980

Educational Qualification:

Degree	Name of the College	Name of the University	Year of Passing
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MD PSYCHIATRY	AIIMS DELHI	AIIMS DELHI	2009

Present position : PROFESSOR AND HOD

K.M.C Registration No : 69081

Teaching Experience : UG TEACHER-7 YEARS
PG TEACHER-7 YEARS

Publications: 22 published articles in international, national and state journals

Research projects: 6 projects are ongoing

BIODATA OF INVESTIGATOR

NAME	:	DR. CHARISHMA BUDDHA
QUALIFICATION	:	M.B.B.S.
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CONTACT NUMBER	:	8919259121
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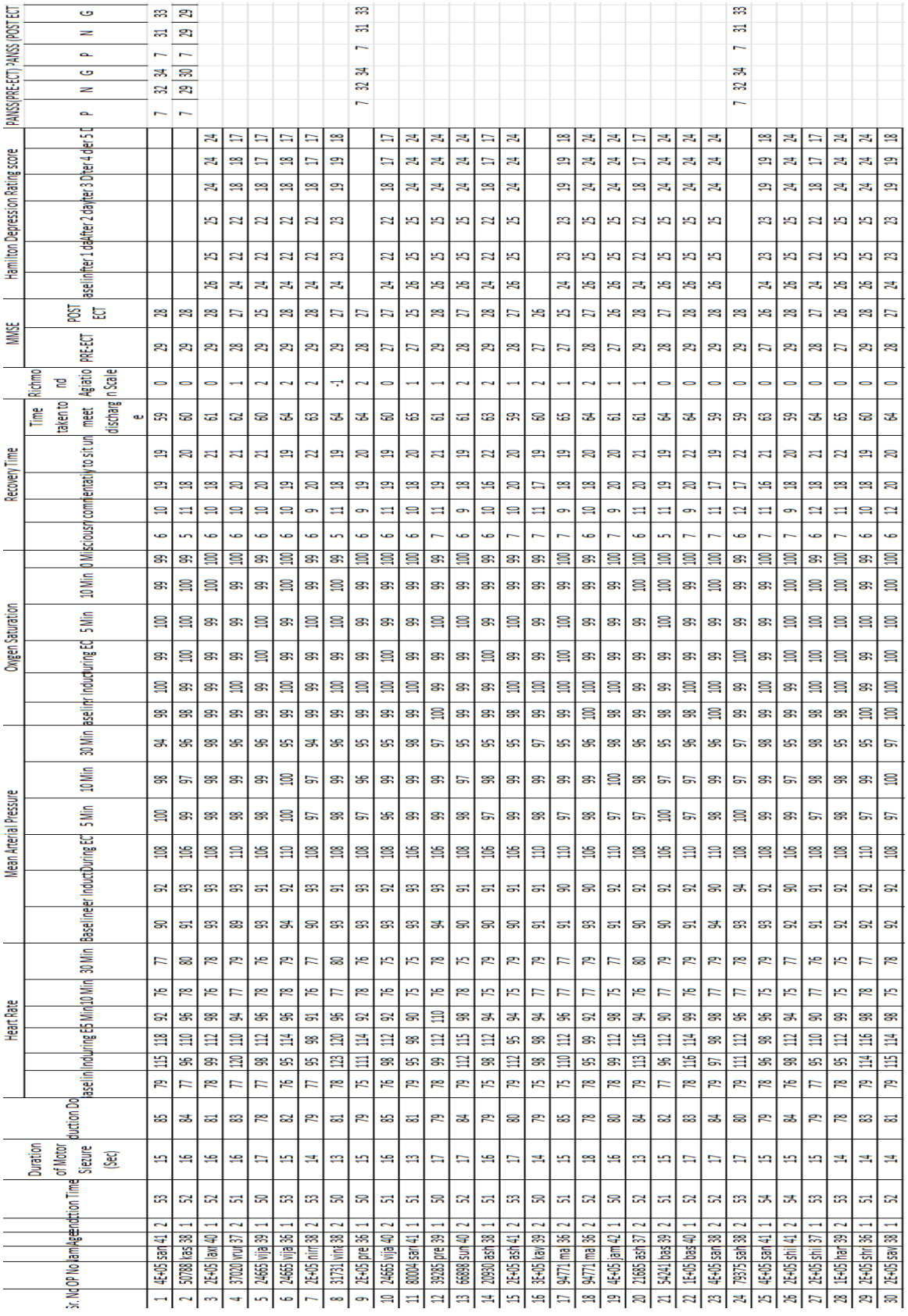
ANNEXURE – IV:MASTER CHART:



Sr. No	OP No	Name	Age	Gender	Duration of Illness	Duration of Motor Seizure (Sec)	Induction Dose	Heart Rate							Mean Arterial Pressure							Oxygen Saturation							Recovery Time					Mimse		Hamilton Depression Rating score					PANSS(PRE-ECT)		PANSS(POST ECT		
								Baseline	Induction	During ECT	5 Min	10 Min	30 Min	Baseline	Induction	During ECT	5 Min	10 Min	30 Min	Baseline	Induction	During ECT	5 Min	10 Min	O Min	Miscellaneous	comfortably	to sit unaided	Time taken to meet discharge	Agitation Scale	Richmond	PRE-ECT	POST ECT	baseline	After 1 day	After 2 days	After 3 Days	After 4 days	After 5 Days	P	N	G	P	N	G
1	4E+05	sanj	41	2	53	15	85	79	115	118	92	76	77	90	92	108	100	98	94	98	100	99	100	99	99	6	10	19	19	59	0	29	28							7	32	34	7	31	33
2	50788	ilas	38	1	52	16	84	77	96	110	96	78	80	91	93	106	99	98	96	99	100	99	100	99	100	5	11	18	20	60	0	29	28							7	29	30	7	29	29
3	2E+05	lavi	40	1	52	16	81	78	99	112	98	76	78	93	93	108	98	98	98	99	100	99	100	99	100	6	10	18	21	61	0	29	28	26	25	25	24	24	24						
4	37020	vrut	37	2	51	16	83	77	120	110	94	77	79	89	93	110	98	99	96	99	100	99	100	99	100	6	10	20	21	62	1	28	27	24	22	22	18	18	17						
5	24665	vija	36	1	53	15	82	76	95	114	96	78	79	94	92	110	100	99	96	99	100	99	100	99	100	6	10	20	21	60	2	29	25	24	22	22	18	18	17						
6	24665	vija	36	1	53	15	82	76	95	114	96	78	79	94	92	110	100	99	96	99	100	99	100	99	100	6	10	19	19	64	2	29	28	24	22	22	18	18	17						
7	2E+05	nirr	38	2	53	14	79	77	95	98	91	76	77	90	93	108	97	97	94	99	100	99	100	99	100	6	9	20	22	63	2	29	28	24	22	22	18	17	17						
8	31731	vinn	38	2	50	13	81	78	123	120	96	77	80	93	91	108	98	99	96	99	100	99	100	99	100	5	11	18	19	64	-1	29	27	24	23	23	19	19	18						
9	2E+05	pre	36	1	50	15	79	75	111	114	92	78	76	93	93	108	97	96	95	99	100	99	100	99	100	6	9	19	20	64	2	28	27							7	32	34	7	31	33
10	24665	vija	40	2	51	16	85	76	98	112	92	76	75	93	92	108	96	99	95	99	100	99	100	99	100	6	11	19	19	60	0	27	27	24	22	22	18	17	17						
11	80004	sanj	41	1	51	13	81	79	95	98	90	75	75	93	93	106	99	98	95	99	100	99	100	99	100	6	10	18	20	65	1	27	25	26	25	25	24	24	24						
12	39285	pre	39	1	50	17	79	78	99	112	110	76	78	94	93	106	99	99	97	100	99	99	100	99	100	7	11	19	21	61	1	29	28	26	25	25	24	24	24						
13	66898	sun	40	2	52	17	84	79	112	115	98	78	75	90	91	108	98	97	95	99	100	99	100	99	100	6	9	18	19	61	2	28	27	26	25	25	24	24	24						
14	20890	ash	38	1	51	16	79	75	98	112	94	75	79	90	91	106	99	98	95	99	100	99	100	99	100	6	10	16	22	63	2	29	28	24	22	22	18	17	17						
15	2E+05	ashi	41	2	53	17	80	79	112	95	94	75	79	90	91	106	99	98	95	98	100	99	100	99	100	7	10	20	20	59	1	28	27	26	25	25	24	24	24						
16	3E+05	kavi	39	2	50	14	79	75	98	98	94	77	79	91	91	110	98	99	97	99	100	99	100	99	100	7	11	17	19	60	2	27	26												
17	94771	mal	36	2	51	15	85	75	110	112	96	77	77	91	90	110	97	99	95	99	100	99	100	99	100	7	9	18	19	65	1	27	25	24	23	23	19	19	18						
18	94771	mal	36	2	52	18	78	78	95	99	92	77	79	93	90	106	98	100	96	100	100	99	100	99	100	6	10	18	20	64	2	28	27	26	25	25	24	24	24						
19	4E+05	jam	42	1	50	16	80	78	99	112	98	75	77	91	92	110	97	100	98	98	100	99	100	99	100	7	9	20	20	61	1	27	26	25	25	25	24	24	24						
20	21685	ash	37	2	52	13	84	79	113	116	94	76	80	90	92	108	97	98	96	99	100	99	100	99	100	6	11	20	21	61	1	29	28	24	22	22	18	17	17						
21	54241	ibad	39	2	51	15	82	77	96	112	90	77	79	90	92	106	100	97	95	98	100	99	100	99	100	5	11	19	19	64	0	28	27	26	25	25	24	24	24						
22	1E+05	ibad	40	1	52	17	83	78	116	114	99	76	79	91	92	110	97	97	96	98	100	99	100	99	100	7	9	20	22	64	0	29	28	26	25	25	24	24	24						
23	4E+05	sanj	38	2	52	17	84	79	97	98	98	77	79	94	90	110	98	99	96	100	100	99	100	99	100	7	11	17	19	59	0	29	28	26	25	25	24	24	24						
24	79375	sanj	38	2	53	17	80	79	111	112	96	77	78	93	94	108	100	97	97	99	100	99	100	99	100	6	12	17	22	59	0	29	28							7	32	34	7	31	33
25	4E+05	sanj	41	1	54	15	79	78	96	98	96	75	79	93	92	108	99	99	98	99	100	99	100	99	100	7	11	16	21	63	0	27	26	24	23	23	19	19	18						
26	2E+05	shri	41	2	54	15	84	76	98	112	94	75	77	92	90	106	99	97	95	99	100	100	100	100	100	7	9	18	20	59	0	29	28	26	25	25	24	24	24						
27	2E+05	shri	37	1	53	15	79	77	95	110	90	77	76	91	91	108	97	98	97	98	100	100	100	99	100	6	12	18	21	64	0	28	27	24	22	22	18	17	17						
28	1E+05	hari	39	2	53	14	78	78	95	112	99	75	75	92	92	108	98	98	95	98	100	100	100	100	100	7	11	18	22	65	0	27	26	26	25	25	24	24	24						
29	2E+05	shri	36	1	51	14	83	79	114	116	98	78	77	92	92	110	97	99	95	100	99	99	100	99	100	6	10	18	19	60	0	29	28	26	25	25	24	24	24						
30	2E+05	sanj	38	1	52	14	81	79	115	114	98	75	78	92	92	108	97	100	97	100	100	100	100	100	100	6	12	20	20	64	0	28	27	24	23	23	19	19	18						

Sr. No	OP No	Name	Age	Gender	Marital Status	Number of Children	Heart Rate				Mean Arterial Pressure				Oxygen Saturation				Recovery Time				Richmond Agitation Scale	MMSE		Hamilton Depression Rating scale							PANSS PRE-ECT		PANSS POST ECT		YMRS	
							Baseline before inducing ECT	Inducing ECT	5 Min	10 Min	Baseline before inducing ECT	Inducing ECT	5 Min	10 Min	Baseline before inducing ECT	Inducing ECT	5 Min	10 Min	30 Min	Baseline before inducing ECT	Inducing ECT	5 Min	10 Min	30 Min	Time taken to meet various consciousness criteria	Time taken to meet various consciousness criteria	PRE-ECT	POST ECT	Baseline before inducing ECT	Inducing ECT	1 day after 5 Day	2 days after 5 Day	3 Days after 5 Day	4 days after 5 Day	P	N	G	P	N	G	
1	360075	sam	43	1	39	28	53	79	78	85	74	74	74	74	91	88	91	87	99	98	99	99	7	13	21	22	105										7	32	34	7	31	33	
2	510788	kas	41	2	41	30	49	79	75	84	74	75	75	75	90	90	93	89	100	98	99	99	8	12	22	24	105										7	29	30	7	29	28	
3	2490692	ank	40	2	40	32	52	76	76	92	75	75	74	75	93	90	97	92	100	99	100	99	7	12	22	23	103	0	29	28	26	25	25	24	24	24	24						
4	2490692	lam	45	2	41	32	59	77	74	90	74	75	75	75	92	90	94	92	99	98	99	99	8	12	23	24	105	0	27	26	24	22	22	18	18	17	17						
5	370200	vis	40	2	38	29	53	74	75	93	74	74	74	74	93	90	96	93	99	98	99	99	7	11	22	22	104	0	28	27	24	22	22	18	17	17	17						
6	246655	vis	41	2	37	26	59	80	78	85	75	75	74	75	92	90	94	92	99	98	99	99	6	12	24	24	104	0	29	27	24	22	22	18	18	17	17						
7	246655	vis	41	1	42	31	57	80	78	96	74	74	74	75	93	90	97	92	99	98	99	99	6	12	21	24	105	0	29	28	24	22	22	18	17	17	17						
8	1802388	mir	41	2	38	26	55	78	75	88	74	75	75	75	91	88	91	87	99	97	99	99	8	11	21	24	105	1	29	28	24	23	23	19	18	16	16						
9	37131	vin	43	2	37	29	57	76	74	94	74	74	74	75	91	88	91	87	99	98	99	99	7	13	22	23	103	0	27	26	26	25	25	24	22	17	17						
10	34425	pre	42	2	38	30	53	78	75	88	74	75	74	75	91	88	91	87	99	97	98	99	6	12	20	23	103	-2	27	26								7	32	34	7	31	33	
11	246655	vis	39	1	37	32	59	77	74	88	74	75	75	75	90	88	93	89	99	98	99	99	7	13	21	24	105	0	28	27	26	25	25	24	24	24	24						
12	800094	sai	42	1	40	25	57	79	78	93	75	75	74	75	90	88	93	89	99	98	99	99	6	12	21	24	104	0	29	28	26	25	25	24	22	22	22						
13	693888	sur	41	1	40	25	52	80	76	88	75	75	74	75	91	87	93	89	100	98	99	99	7	12	24	22	105	0	27	26	26	25	25	24	24	24	24						
14	209300	adi	42	2	40	26	50	77	74	85	75	75	74	74	90	88	93	89	100	98	99	99	6	13	22	23	104	0	29	28	24	22	22	18	17	17	17						
15	2227047	Vea	43	1	39	31	55	78	78	84	74	74	74	75	90	88	93	89	100	98	99	99	7	11	23	23	105	0	27	26													
16	94771	ma	45	1	37	31	52	79	76	94	74	75	75	75	92	87	94	92	99	97	100	99	7	12	23	24	105	1	28	26	26	25	25	24	24	24	24						
17	3884552	dar	43	2	38	31	56	77	75	88	74	74	74	74	92	90	94	92	99	99	100	99	8	11	24	22	104	0	29	27	24	23	23	19	19	18	18						
18	4873393	sai	40	2	38	31	49	76	75	88	75	75	75	75	90	87	93	89	99	98	99	99	7	11	21	24	104	0	27	26	26	25	25	24	24	24	24						
19	1010100	bas	39	1	38	29	56	74	76	92	75	74	75	75	92	90	94	92	99	98	100	99	7	12	20	23	103	1	28	27	26	25	25	24	24	24	24						
20	1010100	bas	42	1	39	26	52	76	76	93	74	75	74	75	91	88	91	87	99	98	99	99	7	12	21	22	105	0	29	28	24	22	22	18	17	17	17						
21	330006	sai	44	1	42	26	54	75	76	88	74	75	74	75	90	87	93	89	99	98	99	99	8	11	23	24	103	0	27	26	26	25	25	24	24	24	24						
22	793375	adi	40	1	41	30	49	75	77	90	75	74	74	75	92	90	94	92	99	98	100	99	7	13	22	23	103	-2	29	28	26	25	25	24	24	24	22						
23	175001	vis	43	1	39	26	58	79	74	85	74	74	74	74	91	88	93	89	99	98	99	99	8	12	24	23	103	0	29	27	26	25	25	24	22	24	24						
24	186800	mal	43	2	41	28	55	79	77	90	75	75	74	74	91	88	91	87	100	98	99	99	7	11	21	23	105	0	29	28	26	25	25	24	22	22	22						
25	17846	sai	44	1	41	29	54	76	78	88	74	75	74	74	93	90	97	92	99	98	100	99	7	12	22	22	104	0	28	27	24	23	23	19	19	18	18						
26	186653	sai	44	2	39	27	54	75	75	94	74	75	75	75	93	87	93	89	99	98	99	99	7	12	21	23	105	1	29	28	26	25	25	24	24	24	24						
27	793375	sai	44	2	40	27	60	79	77	85	75	75	74	74	93	90	97	92	99	98	99	99	7	13	23	22	104	0	27	26								7	32	34	7	31	32	
28	793375	shr	43	1	39	26	60	78	76	92	75	74	75	75	91	89	91	87	99	98	99	99	8	12	23	22	104	0	28	27	26	25	25	24	24	24	24						
29	1801399	sai	41	2	37	27	54	79	74	88	75	75	74	75	92	90	94	92	99	97	99	99	8	12	23	23	104	-1	29	28	26	25	25	24	24	24	24						
30	793375	adi	45	1	42	31	51	79	77	92	74	75	75	75	89	88	91	87	99	98	99	99	8	12	22	23	103	0	27	26	24	23	23	19	19	18	18						

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