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Case Report

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Anesthetic Management during Electroconvulsive Therapy

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Some patients with depression require electroconvulsive therapy performed under general anesthesia. This requires rapid loss of consciousness, with minimal interference from seizure activity, appropriate muscle relaxation status, prevention of hyperdynamic responses to the electrical stimulus, and proper recovery of spontaneous ventilation and consciousness. The authors report the first case of electroconvulsive therapy performed with the patient under general anesthesia at the Ewha Womans University Medical Center, Korea. **(Ewha Med J 2020;43(3):49-52)**

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Introduction

Electroconvulsive therapy (ECT) is a treatment that induces generalized epileptic seizures in the central nervous system through electrical stimulation [1]. For patients with depression who do not respond to antidepressant medication(s) and psychotherapy, ECT can be an alternative treatment option [2]. ECT is usually performed under general anesthesia to prevent psychological and physical trauma to the patient during seizure. Most anesthetics have anticonvulsant properties, and are expected to attenuate the interval of ECT-induced seizure activity in a dose-dependent manner. Therefore, ECT demands a delicate balance between an adequate anesthetic state and an optimal duration of therapeutic seizure activity.

The hyperdynamic response to electrical stimulus includes cardiovascular effects and increased intracranial pressure, which could lead to fatal consequences including myocardial infarction or intracranial hemorrhage [3,4]. Therefore, medication should be prepared using drugs that are helpful for the prevention of hyperdynamic responses. Also, because ECT needs to be performed several times in each patient, it is necessary to consider the patient's condition after each ECT session and to adjust and/or revise protocols for optimal anesthetic management [2]. Although the use of ECT has increased broadly, we report the first case of ECT at Ewha Womans University Medical Center, Korea. Because there are several types of treatments requiring ECT, we aim to share our experience for more cases of ECT in the future.

Case

A 48-year-old woman (height 159.5 cm, weight 34 kg) diagnosed with major depressive and schizoaffective disorders, and without other diseases, was offered the option to undergo

ECT under general anesthesia. Recently, the patient had lost approximately 3 kg per for 1 month due to a loss of appetite and aggravated anxiety despite of increased doses of psychiatric medication. Because there was no improvement in her mental status through established therapies, she decided to undergo ECT. Preoperative evaluations were performed as an inpatient as she was scheduled for general anesthesia. She exhibited abnormal results on electrocardiogram (ECG) and cardiac enzyme levels, which could not rule out anterior infarct; nevertheless, she had normal sinus rhythm, with a heart rate of 64 beats/min. On laboratory investigation of four major cardiac enzymes, creatine kinase and N-terminal pro-brain natriuretic peptide levels were elevated to 187 IU/L (normal range, 0-185 IU/L) and 232 (normal range, 0-172 pg/mL), respectively. Cardiovascular consultation advised that close monitoring of vital signs would be necessary due to her low body mass index (13.44 kg/m^2) and poor general condition. On arrival to the operating room, the patient was subjected to standard monitoring including ECG, non-invasive blood pressure, and pulse oximetry. Bispectral index (BIS) was used to monitor the patient's depth of sedation within the range from 40 to 60. She was equipped with a bite block, and electroencephalogram leads on her head, and a tourniquet on her left calf. As per protocol, she was fixed safely to the surgical bed to prevent falls or musculoskeletal fractures during seizure. Following preoxygenation with 100% oxygen through face mask, anesthesia was induced by intravenous administration of glycopyrrolate (0.2 mg), and pentothal sodium (125 mg) immediately after the tourniquet was placed. After gently confirming the loss of eyelash reflex, succinylcholine (35 mg) was administered and mask ventilation with oxygen was initiated. Pentothal sodium (1.5-2.5 mg/kg) was chosen as the intravenous anesthetic agent, followed by succinylcholine (0.5-1.5 mg/kg) as a short-acting muscle relaxant for rapid induction of anesthesia and recovery. In addition, we prepared for unexpected events, including difficulties with mask bagging, which is necessary for endotracheal intubation [5-7] or if acute hemodynamic changes occurred. An electric stimulus was delivered to induce the seizure for approximately 5 seconds. At that time, the individual bag-ventilating the patient withdrew to prevent electric shock. Peripheral seizure was monitored using electromyography and central seizure using electroencephalogram. The average duration of seizure was approximately 30 seconds, which satisfied with the goal of ECT. Following the therapeutic seizure, ventilation with oxygen was resumed by mask bagging and the intravenous administration of remifentanil (20 μg) to prevent acute hemodynamic changes such as tachycardia and hypertension with the sedation effect. The patient's state of awakening was confirmed through BIS monitoring, motor check with hand grip, and adequate respiratory motion. She was then monitored in a fully staffed facility, with a psychiatrist and well-equipped recovery room after the ECT, similar to patients who undergo general anesthesia.

ECT was performed twice per week for three weeks, for a total of seven ECT sessions. At the first ECT visit, ventricular bigeminy appeared after the induction of the seizure and was self-limited 1 minute later. In the fifth ECT session, there was ST depression to −1.1 during ECT in a short time. During the entire course of ECT, transthoracic echocardiography was performed to accurately evaluate heart function. Moreover, the patient had broken a tooth on the bite blocker due to her overall poor nutritional condition. Her general condition, including weight gain, was followed up to assess future doses of anesthetics and to anticipate risk factors. Remarkable changes in the patient's status were observed as ECT was repeated. The whole course of ECT progressed 7 times for 15 days. After the 4th ECT, the patient's auditory hallucinations virtually disappeared and she recovered her appetite. Her family testified that the patient's catatonic facial expression and movement became relieved. And she even got slept well without supportive medications. Eventually, she gained weight from 36.2 to 38 kg for 15 days. Also she could make decision for the plan of treatment after the 7th ECT and she did not want ECT anymore. Thereafter she was followed-up on an out-patient basis.

Discussion

ECT involves electrical stimulation of the central nervous system to provoke generalized epileptic seizure activity via placement of transcutaneous electrodes under general anesthesia to reduce psychological and physical trauma to the patient [1]. Standard monitors are used such as ECG, non-invasive blood pressure and pulse oximetry. And BIS is preferred to monitor the depth of sedation within the range from 40 to 60. Among the anesthetics, methohexital (0.75-1.0 mg/kg) is the most common drug used for ECT because of its rapid onset,

short duration of action, minor effect on seizures, and quick recovery, which are sufficient conditions for anesthetic management during ECT [5]. However, we considered other anesthetics that we are more familiar with because we have never previously used methohexital. The dose of anesthetics for ECT is less than the standard hypnotic doses because of its short duration of therapy and the effect on seizures. Propofol (0.75 mg/kg) is considered as another option that has demonstrated no impact on the results of ECT compared with methohexital in recent studies, and not relative to more hypertension and tachycardia than pentotal sodium (1.5–2.5 mg/kg) [6]. Pentotal sodium is associated with more hypertension and tachycardia than propofol [7]. In this case, it would be advantageous to change from thiopental to propofol to mitigate cardiovascular risks because our patient experienced ventricular bigeminy and ST depression during ECT.

ECT directly stimulates seizures in the brain such that physiological influences accompany acute cardiovascular responses and increases in cerebral blood flow with elevation of intracranial pressure [3,4]. An acute cardiovascular response includes initial parasympathetic-induced salivation, bradycardia lasting 10 to 15 seconds, even asystole followed immediately by a sympathetic response such as tachycardia, hypertension, premature ventricular contractions and, rarely, ventricular tachycardia [8]. Pretreatment with esmolol (1.0 mg/kg) or labetalol (0.3 mg/kg) immediately before the induction of anesthesia attenuates the hemodynamic response to ECT. We prepared esmolol and labetalol for controlling hypertension and tachycardia after ECT [9]. However, we administered remifentanil at the end of ECT to mitigate cardiovascular risks through deepening the level of analgosedation of the patient. Even though the patient did not follow the verbal command, the BIS of the patient was 80 to 90 at that time, so we made an immediate decision that was not acceptable for enduring the induced seizure, either electrical or motor. Short-acting opioids such as remifentanil are acceptable because it has both an anesthetic-sparing effects in the aspect of induced seizure and cardioprotective effects for some susceptible patients, especially unexpected prolonged seizure [10]. The patient was young with a low body mass index and poor general condition. Even though she had no history of cardiovascular or cerebral disease, a low body mass index is the risk factor susceptible for cardiovascular response during ECT. Likewise, it is important to prepare in other patients such as the elderly, patients with a history of myocardial ischemia, with a permanent cardiac pacemaker or cardioverter-defibrillator, cerebral aneurysm, subdural hemorrhage, or intracranial mass who are vulnerable for ECT's complications.

In conclusion, this was the first case of ECT performed in Ewha Womans University Medical Center; as such, we wanted to share our initial experience as the number of ECTs increases. ECT is different from other surgeries performed under general anesthesia because it requires optimal dosages of anesthetic agent, muscle relaxant(s), and medication(s) for preventing sympathetic responses, which are carefully titrated to the individuals needs of the patient. Further adjustments should be made during the course of a series of ECT treatments on the basis of the patient's earlier responses. We anticipate that this case report will serve as a reference for other patients who undergo ECT in the future.

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