Case Report

Propofol-Induced Seizure during Orthopedic Surgery: A Case Report

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Abstract
Propofol-induced seizure is a rare complication of propofol. This case study presents a case of a 26-year-old male who presented with traumatic paraplegia secondary to a Chance fracture of the second lumber vertebra (L2) with spinal cord and spinal bone involvement. Propofol 140 mg intravenous (IV) was administered along with Fentanyl 100 μg IV, and Vecuronium (VEC) 6 mg IV in preparation for surgery. The patient began to have seizure after the administration of Propofol 140 mg IV. The Electroencephalograph(EEG) patterns were consistent with those of a generalized tonic-clonic seizure. The objective of this clinical case report is to highlight the importance of vigilance during propofol infusion despite its excellent safety profile.

Keywords: *EEG patterns, propofol-induced seizure, propofol administration, traumatic paraplegia, vigilance*

Introduction
Propofol is an IV hypnotic/sedative with action on gamma-aminobutyric acid (GABA) A receptors, low dose potentiates GABA while higher doses act as GABA receptor agonist.[1] The active ingredient in propofol is 2,6-diisopropylphenol which is an oil at room temperature and is insoluble in aqueous solutions.[2] Therefore, it is formulated for IV administration as a 1% (10-mg/mL) emulsion in 10% soybean oil, 2.25% glycerol, and 1.2% purified egg phosphatide. Propofol is conjugated to sulfate and glucuronide to less-active metabolites in the liver.[3] This metabolite is then excreted through kidney. Propofol has quick onset (<1min) and rapid duration of action (5-10min). It is used for the maintenance of anesthesia as well as for induction.

Propofol has an excellent safety profile, however, it is associated with several side effects, the most common being pain on injection when administered via a peripheral vein. Other side effects include cardiovascular complications such as dose-dependent hypotension as reported in 26% of patients receiving propofol for intensive care unit (ICU) sedation[4], bradycardia, heart block[5], supra ventricular and ventricular tachycardia[6] metabolic complications such as hypertriglyceridemia and pancreatitis; allergic complications like bronchospasm; high dose propofol infusions are associated with the "propofol infusion syndrome".[7] Propofol on rare occasions have been known to cause drug-induced excitation of the central nervous system (CNS)[8] including seizures.[9]

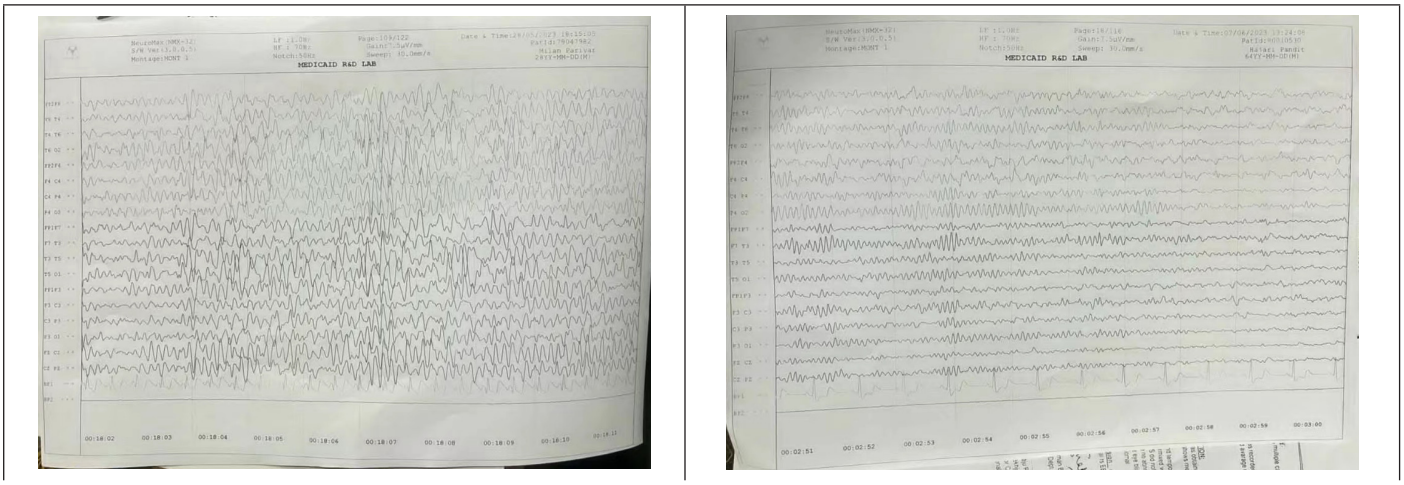
This report presents a rare case of propofol-induced seizure, highlighting the need for vigilance while using propofol despite its safety profile.

Case Report

Patient Information: A 26-year-old male presented at the emergency department of B.P. Koirala Institute of Health Sciences in Dharan, Nepal, with traumatic paraplegia secondary to a Chance fracture of the L2 vertebra with spinal cord and spinal bone involvement. The patient was prepared for surgery. Anesthetic drugs administered in preparation for the procedure included Fentanyl 100 μg IV, Propofol 140 mg IV, and VEC 6 mg IV. However, the patient began to have seizure after the administration of Propofol 140 mg IV. There was no previous history of seizures or seizure-like phenomena in the patient's medical history.

Clinical Findings: The patient had been struck by a wooden log 6 hours before the presentation, resulting in pain, swelling, and deformity over the lower back. The rest of the body exhibited no abnormalities. The patient remained alert with intact consciousness and showed no signs of vomiting or ear, nose and throat (ENT) bleeding. Vital signs were stable, with a blood pressure of 120/80 mmHg, a pulse rate of 84 per minute, and a respiration rate of 14 per minute. Upon examination, the patient displayed swelling, tenderness, and deformity in the lower back. No abnormalities were detected upon systemic evaluation of the chest, cardiovascular system, CNS, or peripheral nervous system (PNS). Reflexes were graded at 2, and the Glasgow Coma Scale (GCS) score was 15/15.

Diagnostic Assessment: Biochemical and hematological investigations conducted before the surgery indicated normal results for hematology, renal function, and liver function. Serology tests for hepatitis B surface antigen (HBSAg), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) antigens returned negative results. An EEG was performed during and after the onset of the seizure, confirming the diagnosis. The EEG patterns were consistent with those of a generalized tonic-clonic seizure.



(a) During Seizure Onset (b) After Seizure Onset

Figure 1: Diagnostic assessment of the patient

Discussion

Propofol is an intravenous anesthetic used for procedural sedation, during monitored anesthesia care, or as an induction agent for general anesthesia. Like most general anesthetic agents, the mechanism of action for propofol is poorly understood but thought to be related to the effects on GABA-mediated chloride channels in the brain. Propofol may work by decreasing the dissociation of GABA from GABA receptors in the brain and potentiating the inhibitory effects of the neurotransmitter. This, in turn, keeps the channel activated for a longer duration resulting in an increase in chloride conductance across the neuron, causing a hyper-polarization of the cell membrane, making it harder for a successful action potential to fire.[10]

Neuroexcitatory reactions secondary to propofol have been described: dystonia, myoclonus, generalized tonic-clonic seizures, exacerbation or resolution of pre-existing movement disorders.[11]

A review of reported cases spanning over 30 years revealed that these reactions primarily affect young females and tend to happen on the day of surgery. Another systematic review highlighted that Excitatory Neurological Reactions (ENR) commonly occur during the induction of anesthesia, emergence from anesthesia, or following anesthesia, with fewer instances during the maintenance phase. This pattern suggests that ENRs are more likely to happen when there are changes in propofol levels in the bloodstream or brain. The patients experiencing these reactions were further classified based on their symptoms, which included seizure-like activity (such as generalized tonic-clonic seizures or focal motor seizures), opisthotonos (a condition characterized by

muscle stiffness and arching of the back), and involuntary movements.[12]

The mechanism by which propofol induces these reactions is unknown but it is assumed that by causing an imbalance in basal ganglia transmitters that in turn produces an increase in excitatory cholinergic output resulting in abnormal motor activity that would be subcortical in origin.[9]

Interestingly, propofol has also been used to treat refractory movement disorders (i.e. seizures and dystonia). Propofol's ability to both cause and treat movement disorders suggests a complex, central-mediated effect and remains an area for future research.[13]

Abnormal involuntary movements following anesthesia may be difficult to differentiate and the differential diagnosis includes: adverse drug reaction, emergence delirium, hysterical response and post-anesthetic shivering, nevertheless as was pointed out by others the association of abnormal involuntary movements, as part of ENR, and propofol are not well known in neurology as only a few are published in neurological journals. Furthermore, there is insufficient clinical data to suggest any specific treatment but spontaneous recovery often follows. Therefore, clinicians need to be aware of this potential adverse effect so that rational treatment, reassurance and explanation can be given.[12]

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