
CASE REPORTS

Unilateral convulsion after induction of anaesthesia with propofol

D. COCHRAN, W. PRICE AND C. L. GWINNUTT

Summary

We report a case in which a 42-yr-old man suffered a unilateral convulsion immediately after i.v. injection of propofol, and was discovered subsequently to have an old contralateral cerebral infarct. This complication and the current information on the relationship between propofol and abnormal neurological activity are discussed. (*Br. J. Anaesth.* 1996; 76: 570–572)

Key words

Anaesthetics i.v., propofol. Complications, spontaneous excitatory movement.

Since its introduction, propofol has been linked with both pro- and anticonvulsant activity. We describe a case in which a convulsion, limited to the left side of the body, occurred immediately after administration of propofol in a patient who was subsequently shown to have an undiagnosed cerebral infarct. We could not find a previous report of this type of abnormal neurological activity after propofol.

Case report

A 42-yr-old man presented for surgical correction of a Dupuytren's contracture of his right hand during general anaesthesia. The preoperative anaesthetic assessment was unremarkable and he declined any premedication. On arrival in the anaesthetic room, monitoring by pulse oximetry and ECG was commenced, and an i.v. cannula was inserted, after which his lungs were preoxygenated via a Bain coaxial system for approximately 2 min. Anaesthesia was induced with propofol 200 mg. As the injection finished the patient developed irregular jerking movements on his left arm and leg which gradually became more violent and similar to the clonic phase of a grand mal convulsion. This lasted approximately 1 min and resolved spontaneously. Ventilation was unaffected, oxygen was administered continuously and peripheral oxygen saturation remained greater than 95 % throughout. As the episode was brief and resolved spontaneously, it was decided to continue, and anaesthesia was maintained with isoflurane and 65 % nitrous oxide in oxygen. An axillary block of the left arm was performed using 0.25 % bupivacaine 40 ml without adrenaline for postoperative pain relief. During operation he received fentanyl 100 µg when a skin graft was taken from his thigh. There were no further episodes of seizure activity during anaesthesia or recovery.

Because of the unilateral nature of the seizure, a CT scan was performed after operation. This revealed a wedge-shaped, low-density area in the right posterior parietal lobe, consistent with an infarct in the vascular watershed between the territories of the middle and posterior cerebral arteries (fig. 1). On direct questioning, the patient revealed that he had suffered from meningitis at 16 yr of age which had left him with a mild bilateral hearing loss and a slight weakness in his left leg, which had recently resulted in him having to give up playing football. A more detailed neurological examination after these results showed some slight muscle wasting in the left lower leg and an up-going plantar on the left. He suffered no further seizures in hospital and was discharged home.

Discussion

Since 1987 there have been a variety of reports linking propofol with the occurrence of abnormal neurological sequelae, ranging from minor involuntary movements to opisthotonos and grand mal convulsions, both in previously healthy patients and those known to suffer from epilepsy. Excitatory events have been reported on induction of anaesthesia with propofol [1], but appear to be more common during recovery [2–7], in two patients after intervals of 21 h and 5 days between administration of propofol and the convulsions [7, 8]. Although most cases describe single convulsions, status epilepticus and repeated attacks of opisthotonos for 23 days have been reported after anaesthesia, of which propofol was a component [4, 9].

A criticism of these reports is that on many occasions combinations of drugs were administered, making the implication of propofol impossible, as many of the commonly used anaesthetic agents have been reported as being capable of causing clinically evident seizure activity [10]. Propofol has been administered uneventfully to a patient on two occasions but associated with a grand mal convulsion when given with alfentanil on a third occasion [11]. However, in the case reported by Shearer of grand mal convulsions lasting for 3 h, propofol was clearly implicated as it was the only agent administered [12].

The abnormal movements reported after propofol have been labelled as seizures, grand mal convulsions

D. COCHRAN, MB, CHB, W. PRICE, MB, BS, C. L. GWINNUTT, MB, BS, FRCA, Department of Anaesthesia, Salford Royal Hospitals NHS Trust, Hope Hospital, Stott Lane, Salford M6 8HD. Accepted for publication: December 12, 1995.

Correspondence to C. L. G.



Figure 1 Axial CT scan showing an area of low density in the right posterior parietal lobe.

and status epilepticus, all of which imply an epileptic aetiology. Electroencephalographic (EEG) evidence to support such claims is variable; in cases where the EEG has been monitored during administration of propofol, evidence of epileptiform activity has not been accompanied by motor manifestations [13, 14], while EEG recordings after the events have been reported as normal [5, 12]. By late 1992, the Committee of Safety of Medicines had received 170 reports describing convulsions after the use of propofol with only a small minority of patients (14%) receiving anticonvulsants or with a past history of epilepsy. The convulsions occurred soon after administration of propofol in 69% of all patients and after a delay ranging from 1 h to 6 days in the remainder [15].

Despite the claims that propofol may have pro-convulsant activity, there is a significant amount of evidence to the contrary. Propofol infusions have been shown to be effective controlling status epilepticus assessed neurophysiologically when standard treatments have failed [16–19] and are capable of inducing burst suppression in both adults and children during cardiopulmonary bypass [20, 21]. In patients undergoing surgery for intractable epilepsy, EEG recording from chronically implanted electrodes revealed no increase in seizure activity, but profound burst suppression after boluses of propofol [22], and similarly, propofol infusion did not cause increased seizure activity in patients with intractable partial epilepsy [23]. Recently, Borgeat and colleagues have shown that the excitatory movements are not accompanied by EEG changes suggestive of seizure activity [24]. Animal studies in mice [25] and rabbits [26] demonstrated that propofol was effective against both electrical and drug-induced seizures, and when used to induce anaesthesia for electro-

convulsive therapy there was a significant shortening of the duration of the seizure, as assessed clinically [27–30].

A true seizure is an alteration in the CNS resulting from an electrical discharge from neurones in either cortical or subcortical tissues, evidence of which is lacking in the majority of patients described as having seizures after propofol. It has been suggested that the explanation for the origin of the seizures and opisthotonos is depression of inhibitory subcortical structures in the CNS resulting in excitatory dystonic movements and opisthotonos, characteristic of midbrain and spinal excitatory activity, respectively [31]. Subcortical centres are thought to be affected by lower concentrations of propofol for longer periods than cortical ones, which are responsible for hypnosis, as demonstrated by the observation that low doses of propofol have a direct antiemetic action [32] and reduce pruritis associated with extradural and intrathecal administration of morphine [33]. This possibly explains the greater incidence of excitatory events during the recovery phase.

A similar mechanism can be invoked in patients known to suffer from epilepsy. If a cortical focus is inhibited normally by subcortical activity, administration of propofol may result in the “release” of epileptic seizure activity in susceptible patients [34]. This is possibly the explanation for the events seen in our patient. Cerebral infarcts are a well recognized cause of seizure activity [35]. If this area was inhibited normally by subcortical activity, the seizure may have occurred as a result of depression of the inhibitory neurones before the full dose of propofol had reached the central circulation. As plasma and brain concentrations of propofol increased, the seizure abated as a result of an anticonvulsant effect. Interestingly, no convulsion was seen subsequently as propofol concentrations decreased, but this may have been masked by the concurrent use of other anaesthetic agents.

It is possible that there are two groups of patients who suffer a period of “seizure” activity after administration of propofol. The majority exhibit the motor manifestations of subcortical inhibition, without abnormal electrical discharge from any group of neurones. In these patients, the terms convulsion, seizure or epileptiform activity should be avoided, as misinterpretation could lead to the patient being labelled “epileptic” with all the attendant social and economic consequences. Perhaps dystonic or myoclonic movement would be a more accurate and less worrying description of the patient. The remainder are a small group of epileptic patients in whom a true seizure may be precipitated by administration of propofol. However, it is well known that these patients are also more susceptible to drug-induced decerebrate rigidity [36] and therefore definitive identification of the cause of such an event in a known epileptic may not be clear-cut.

Therefore, it would seem sensible to avoid the use of propofol in patients who are known to be at risk of developing seizures and in those with epilepsy if their control is poor, where anticonvulsant medication has been omitted or if they are to be discharged early

after receiving propofol. However, as the present case demonstrates, the former circumstances are not always clear to either the patient or the anaesthetist, despite preoperative assessment.

Acknowledgement

We thank Dr David Hughes, consultant radiologist, for his help with arranging and reporting the CT scan.

References

- Laycock GJA. Opisthotonos and propofol; a possible association. *Anaesthesia* 1988; **43**: 257.
- Dingwall AE. Oculogyric crisis after day case anaesthesia. *Anaesthesia* 1987; **42**: 565.
- Cameron AE. Opisthotonos again. *Anaesthesia* 1987; **42**: 1124.
- Hopkins CS. Recurrent opisthotonos associated with anaesthesia. *Anaesthesia* 1988; **43**: 904.
- Saunders PRI, Harris MNE. Opisthotonos and other unusual neurological sequelae after outpatient anaesthesia. *Anaesthesia* 1990; **45**: 552–557.
- Paech MJ, Storey JM. Propofol and seizures. *Anaesthesia and Intensive Care* 1990; **18**: 585.
- Collier C, Kelly K. Propofol and convulsions—the evidence mounts. *Anaesthesia and Intensive Care* 1991; **19**: 573–575.
- Thomas JS, Boheimer NO. An isolated grand mal seizure 5 days after propofol anaesthesia. *Anaesthesia* 1991; **46**: 508.
- Jones GW, Boykett MH, Klok M. Propofol, opisthotonos and epilepsy. *Anaesthesia* 1988; **43**: 905.
- Modica PA, Tempelhoff R, White PF. Pro- and anti-convulsant effects of anesthetics (part I). *Anesthesia and Analgesia* 1990; **70**: 433–444.
- Wittenstein U, Lyle DJR. Fits after alfentanil and propofol. *Anaesthesia* 1989; **44**: 532–533.
- Shearer ES. Convulsions and propofol. *Anaesthesia* 1990; **45**: 255–256.
- Hodkinson BP, Frith RW, Mee EW. Propofol and electroencephalogram. *Lancet* 1987; **ii**: 1518.
- Nowack WJ, Jordan R. Propofol, seizures and generalized paroxysmal fast activity in the EEG. *Clinical Electroencephalography* 1994; **25**: 110–114.
- Committee of Safety of Medicines. *Current problems. Propofol and delayed convulsions*, 1992; No. 35: 2.
- Yanny, AF, Christmas D. Propofol infusions for status epilepticus. *Anaesthesia* 1988; **43**: 514.
- Wood PR, Browne GPR, Pugh S. Propofol infusion for the treatment of status epilepticus. *Lancet* 1988; **i**: 480–481.
- Mackenzie SJ, Kapadia F, Grant IS. Propofol infusion for control of status epilepticus. *Anaesthesia* 1990; **45**: 1043–1045.
- Borgeat A, Wilder-Smith OHG, Jallon P, Suter PM. Propofol in the management of refractory status epilepticus: a case report. *Intensive Care Medicine* 1994; **20**: 148–149.
- Laycock GJA, Mitchell IM, Paton RD, Donaghey SFO'B, Logan RW, Morton NS. EG burst suppression with propofol during cardiopulmonary bypass in children: a study of the haemodynamic, metabolic and endocrine effects. *British Journal of Anaesthesia* 1992; **69**: 356–362.
- Weir DL, Laycock GJA, Alston RP. EEG suppression induced by propofol during hypothermic cardiopulmonary bypass. *Journal of Cardiothoracic Anesthesia* 1990; **4** (Suppl.): 105.
- Ebrahim ZY, Schubert A, Van Ness P, Wolgamuth B, Awad I. The effect of propofol on the electroencephalogram of patients with epilepsy. *Anesthesia and Analgesia* 1994; **78**: 275–297.
- Samra SK, Sneyd JR, Ross DA, Henry TR. Effects of propofol sedation on seizures and intracranially recorded epileptiform activity in patients with partial epilepsy. *Anesthesiology* 1995; **82**: 843–851.
- Borgeat A, Wilder-Smith OHG, Despland PA, Ravussin P. Spontaneous excitatory movements during recovery from propofol anaesthesia in an infant: EEG evaluation. *British Journal of Anaesthesia* 1993; **70**: 459–461.
- Lowson S, Gent JP, Goodchild CS. Anticonvulsant properties of propofol and thiopentone: comparison using two tests in laboratory mice. *British Journal of Anaesthesia* 1990; **64**: 59–63.
- De Riu PL, Petrucci V, Testa C, Mulas M, Melis F, Caria MA, Mameli O. Propofol anticonvulsant activity in experimental epileptic status. *British Journal of Anaesthesia* 1992; **69**: 177–181.
- Simpson KH, Halsall PJ, Carr CME, Stewart KG. Seizure duration after methohexitone or propofol for induction of anaesthesia for electroconvulsive therapy (ECT). *British Journal of Anaesthesia* 1987; **59**: 1323P–1324P.
- Rampton AJ, Griffin RM, Durcan JJ, Stuart CS. Propofol and the electroconvulsive therapy. *Lancet* 1988; **i**: 296–297.
- Rampton AJ, Griffin RM, Stuart CS, Durcan JJ, Huddy NC, Abbott MA. Comparison of methohexital and propofol for electroconvulsive therapy: effects on hemodynamic responses and seizure duration. *Anesthesiology* 1989; **70**: 412–417.
- Dwyer R, McCaughey W, Lavery J, McCarthy G, Dundee JW. Comparison of propofol and methohexitone as anaesthetic agents for electroconvulsive therapy. *Anaesthesia* 1988; **43**: 459–462.
- Borgeat A, Wilder-Smith OHG, Tassonyi E, Suter PM. Propofol and epilepsy: time to clarify! *Anesthesia and Analgesia* 1994; **78**: 198–199.
- Borgeat A, Wilder-Smith OHG, Saiah M, Rifat K. Subhypnotic doses of propofol possess direct antiemetic properties. *Anesthesia and Analgesia* 1992; **74**: 539–541.
- Borgeat A, Wilder-Smith OHG, Saiah M, Rifat K. Subhypnotic doses of propofol relieve pruritus induced by epidural and intrathecal morphine. *Anesthesiology* 1992; **76**: 510–512.
- Bevan JC. Propofol-related convulsions. *Canadian Journal of Anaesthesia* 1993; **40**: 805–809.
- DeLorenzo RJ. The epilepsies. In: Bradley WG, Daroff RB, Femichel GM, Marsden CD, eds. *Neurology in Clinical Practice*. Boston, USA: Butterworth-Heinemann, 1991; 1443–1477.
- Steen PA, Michenfelder JD. Neurotoxicity and anesthetics. *Anesthesiology* 1979; **50**: 437–453.