J Anesth (2011) 25:435–437
DOI 10.1007/s00540-011-1127-2

CLINICAL REPORT

Anesthetic management of a patient with narcolepsy

Yasuhiro Morimoto · Yuko Nogami · Kaori Harada · Hiroko Shiramoto · Takayo Moguchi

Received: 29 December 2010 / Accepted: 7 March 2011 / Published online: 30 March 2011

Abstract We report the anesthetic management of a narcoleptic patient performed using sevoflurane–remifentanil with bispectral index (BIS) monitoring. A 22-year-old man, who was diagnosed with narcolepsy at the age of 17, requested endoscopic sinus surgery, under general anesthesia, for chronic allergic rhinitis. On the morning of the day of operation, he took his daily dose of modafinil, used to control narcolepsy. Anesthesia was induced by 5% sevoflurane and maintained with sevoflurane and continuous infusion of remifentanil and 60% oxygen in conjunction with BIS monitoring. BIS values were between 47 and 58. Duration of surgery was 150 min. After surgery, the patient emerged from anesthesia within 10 min and was extubated. His recovery was uneventful. We found the use of BIS monitoring for titrating sevoflurane concentration in a narcoleptic patient is useful for preventing not only oversedation but also intraoperative awareness caused by the preoperative medication.

Keywords BIS · Narcolepsy · Sevoflurane

Introduction

Narcolepsy is a chronic sleep disorder characterized by excessive sleepiness during the day, sleep paralysis, and cataplexy [1]. The underlying mechanism of this pathological condition is thought to be the absence of neurotransmitters that are normally present in the hypothalamus region of the brain. Hypothalamic cells produce orexin, which is essential for regulating the human sleep–wake cycle.

Little information exists regarding the perioperative management of narcoleptic patients. Postoperative hypersomnia, prolonged emergence from general anesthesia, and interaction of the anesthetics with the medications have all been suggested. However, there have been few case reports concerning the anesthetic management of narcoleptic patients [2–4].

Here, we report the anesthetic management of a patient with narcolepsy by using sevoflurane–remifentanil with bispectral index (BIS) monitoring.

Case report

A 22-year-old man, who was diagnosed with narcolepsy at the age of 17, requested endoscopic sinus surgery, under general anesthesia, for chronic allergic rhinitis. His initial symptoms of narcolepsy were excessive sleepiness during the day and cataplexy. For the past 5 years, his symptoms had been well controlled by a daily dose of 100 mg modafinil.

The patient's physical examination was unremarkable. He had no symptoms of narcolepsy. On the morning of the operation, he took his daily dose of modafinil. Otherwise, no premedication was administered. At admission to the operating theatre, his blood pressure was 115/70 mmHg, and his heart rate was 80 beats/min. In addition to the routine monitoring, a BIS sensor was applied on his left forehead. BIS values and raw electroencephalogram (EEG) waveform were continuously recorded. The BIS values

Y. Morimoto (✉) · Y. Nogami · K. Harada · H. Shiramoto
Department of Anesthesia, Ube Industries Central Hospital, 750 Nishikiwa, Ube 755-0151, Japan
e-mail: yamorimo@nifty.com

T. Moguchi
Department of Anesthesiology, Yamaguchi University Postgraduate School of Medicine, Ube, Japan

before induction were above 95. Anesthesia was induced with 0.5 μg/kg/min remifentanil and 5% sevoflurane. After loss of consciousness, 50 mg intravenous rocuronium was used to facilitate tracheal intubation. Anesthesia was maintained with sevoflurane, continuous infusion of remifentanil, and 60% oxygen. Neuromuscular blockade was maintained with intermittent administration of a bolus of rocuronium.

Before start of surgery, end-tidal sevoflurane concentration was 1.2%, whereas the BIS value was 48. During the surgery, anesthesia was maintained with 1.2% sevoflurane and continuous infusion of remifentanil. The BIS values were between 47 and 58. The raw EEG showed a high-amplitude spindle wave. The patient's blood pressure and heart rate were stable throughout the surgery.

The duration of surgery was 150 min. At the end of surgery, 50 mg flurbiprofen axetil was administered intravenously for postoperative analgesia. Postoperatively, all anesthetics were discontinued. Rocuronium was antagonized with 100 mg sugammadex. The patient emerged from anesthesia within 10 min at BIS value of 77 and was extubated. His consciousness was clear and the BIS values were above 95.

The postoperative course was uncomplicated and the patient was discharged on the fourth postoperative day. During his stay in the hospital, no symptoms of narcolepsy were observed.

Discussion

Narcolepsy is a neurological disorder characterized by derangement of the sleep–wake cycle [1]. The incidence of the syndrome is estimated to be 0.05% [5]. Men and women are equally affected, and the symptoms most commonly appear during adolescence.

The exact cause of narcolepsy remains unknown. Recent studies show evidence of a link between narcolepsy and abnormalities in the orexin system [1]. Orexin is a peptide derived from the dorsolateral hypothalamus that has been linked to multiple regulatory functions, including regulation of the sleep–wake cycle. Many studies have found orexin to be absent or reduced in the cerebrospinal fluid of patients with narcolepsy [6]. Orexin is also known to accelerate the emergence from anesthesia [7]. Therefore, prolonged emergence from general anesthesia would be expected in narcoleptic patients.

Because of the rarity of the syndrome, no guidelines have been established for these patients. Pelaez et al. [8] recommended avoiding sedative premedication, continuing habitual therapy up to the day of surgery, awareness of the increased sensitivity to anesthetic agents and the possible interactions with the patient's habitual medication, and using short-acting drugs without residual sedation. Therefore, we performed anesthesia according to these recommendations.

Central nervous system stimulants have been used to reduce sleepiness in narcoleptic patients. Preoperative discontinuation of central nervous system stimulants is under question. Burrow et al. [4] suggest that pharmacological therapy for narcolepsy should be continued perioperatively, as they found no increased risk of anesthetic complications related to the medication. In this case, the patient was treated with modafinil to control narcolepsy. Preoperative administration of modafinil could be effective in preventing prolonged recovery from general anesthesia. Modafinil is a wake-promoting drug used to treat excessive sleepiness in narcoleptic patients [9]. In contrast to traditional central nervous system stimulants that have a direct effect on dopaminergic activity, modafinil appears to selectively act in the hypothalamus and has some indirect effect on the dopaminergic pathways. Larijani et al. [10] reported that modafinil improves recovery after general anesthesia. This finding suggests that preoperative administration of modafinil may carry the risk of intraoperative awareness.

Prolonged recovery from general anesthesia, postoperative hypersomnia, and apnetic episodes caused by possible increased sensitivity to anesthetic drugs may occur in narcoleptic patients [3]. Therefore, it is important to avoid not only oversedation but also intraoperative awareness resulting from preoperative medication. Use of a BIS monitor for titrating sevoflurane concentration might be useful to prevent oversedation as well as intraoperative awareness.

In this case, we maintained BIS values between 40 and 60 with a sevoflurane concentration of 1.2% in combination with remifentanil. The relationship between BIS value and sevoflurane concentration was similar to that observed in normal anesthetized patients [11]. Titrating sevoflurane concentration enabled normal recovery from anesthesia without intraoperative awareness. Previously, the usefulness of BIS monitoring in a narcoleptic patient has been shown during sevoflurane anesthesia [12] or propofol anesthesia [13]. BIS monitoring was also useful to detect narcoleptic episodes under regional anesthesia [14].

The choice of anesthetics for narcoleptic patients is controversial. We avoided propofol, and then induced anesthesia with sevoflurane, because in vitro modafinil inhibits cytochrome P450 [15], by which propofol is partially metabolized [16]. In previous reports, however, both propofol-based intravenous anesthesia and inhaled anesthesia including sevoflurane have been successfully used. Further experience is needed to identify the optimal anesthetic.

A limitation of the case report is the patient's preoperative status. The patient was well medicated with modafinil

and showed almost no symptoms, which suggests that preoperative medication is crucial for successful anesthetic management. For surgery on an uncontrolled narcoleptic patient, more careful titration of anesthetics combined with postoperative care is necessary.

In conclusion, we performed safe anesthetic management of a patient with narcolepsy. The BIS monitor for titration of sevoflurane concentration was useful to prevent not only oversedation but also intraoperative awareness caused by preoperative medication.

References

1. Peacock J, Benca RM. Narcolepsy: clinical features, co-morbidities and treatment. Indian J Med Res. 2010;131:338–49.
2. Doyle A, Wilkinson D. Day case general anesthesia in a patient with narcolepsy. Anaesthesia. 2008;63:880–2.
3. Mesa A, Diaz AP, Frosth M. Narcolespy and anesthesia. Anesthesiology. 2000;92:1194–6.
4. Burrow B, Burkle C, Warner DO, Chini EN. Postoperative outcome of patients with narcolepsy. A retrospective analysis. J Clin Anesth. 2005;17:21–5.
5. Ohayon MM, Priest RG, Zulley J, Smirne S, Paiva T. Prevalence of narcolepsy symptomatology and diagnosis in the European general population. Neurology. 2002;58:1826–33.
6. Krahn LE, Pankratz VS, Oliver L, Boeve BF, Silber MH. Hypocretin (orexin) levels in cerebrospinal fluid of patients with narcolepsy. Sleep. 2002;25:733–6.
7. Shirasawa T, Yonaha T, Onizuka S, Tsuneyoshi I. Effects of orexin-A on propofol anesthesia in rats. J Anesth. 2011;25:65–72.
8. Pelaez R, Hortal FJ, Bastida E, Barrio JM, Riesgo MJ. Narcolepsy and cardiac surgery: can anesthesia with propofol and remifentanil be safe? J Cardiothorac Vasc Anesth. 2004; 18:201–3.
9. US Modafinil in Narcolepsy Multicenter Study Group. Randomized trial of modafinil for the treatment of pathological somnolence in narcolepsy. Ann Neurol. 1998;43:88–97.
10. Larijani GE, Goldberg ME, Hojat M, Khaleghi B, Dunn JB, Marr AT. Modafinil improves recovery after general anesthesia. Anesth Analg. 2004;98:976–81.
11. Morimoto Y, Hagihira S, Yamashita S, Iida Y, Matsumoto M, Tsuruta S, Sakabe T. Changes in electroencephalographic bicoherence during sevoflurane anesthesia combined with intravenous fentanyl. Anesth Analg. 2006;103:641–5.
12. Staikou C, Fassoulaki TA. Anaesthetic management and perioperative monitoring of a patient with narcolepsy. Eur J Anaesth. 2007;24:898–900.
13. Ozkose Z, Gunaydin B, Dogan T, Yavuzer R. Use of BIS monitor during anaesthesia of a narcoleptic patient for avoiding possible delayed emergence. Acta Anaesth Belg. 2007;58:59–61.
14. Dahaba AA, Xu GX, Liu QH, Xue JX, Metzler H. Bispectral index monitoring of a narcolepsy–cataplexy episode during regional anesthesia. Anesth Analg. 2009;108:613–5.
15. Robertson P, Decory HH, Madan A, Parkinson A. In vitro inhibition and induction of human hepatic cytochrome P450 enzymes by modafinil. Drug Metab Dispos. 2000;28:664–71.
16. Favetta P, Degoute CS, Perdrix JP, Dufrense C, Boulieu R, Guitton J. Propofol metabolites in man following propofol induction and maintenance. Br J Anaesth. 2002;88:653–8.