J Anesth (2008) 22:439–442
DOI 10.1007/s00540-008-0665-8

Journal of
Anesthesia

Visual hallucinations on eye closure after orthopedic surgery under general anesthesia

Sumi Otomo[1], Michiko Sugita[2], and Toshiyuki Yano[3]

[1] Department of Anesthesiology, Kumamoto Chuo Hospital, Kumamoto, Japan
[2] Department of Anesthesiology, Kumamoto University Hospital, Kumamoto, Japan
[3] Division of Anesthesia, Kumamoto Kinoh Hospital, 6-8-1 Yamamuro, Kumamoto 860-8518, Japan

Abstract
A 61-year-old woman suffering from rheumatoid arthritis without a contributory neurological, mental, or psychological history experienced visual hallucinations solely on eye closure after total hip arthroplasty under general anesthesia combined with epidural anesthesia. The visual hallucinations first appeared when she arose from sleep early on postoperative day 1, approximately 12 h after the end of surgery. Only on closing her eyes, she had a clear view of colored clothes, lace curtains, handbags, hats, and sofas, all of which were vivid, realistic, complex, of natural size, and in normal perspective without distortion and appeared independently and randomly in succession. The hallucinations disappeared when she opened her eyes even in the dark. The visual hallucinations gradually decreased as the days elapsed and they had entirely subsided on postoperative day 4. The level and content of her consciousness seemed entirely normal throughout her hospital course. Although postoperative visual hallucinations are not uncommon, they do not always show the closed-eye variation. The causes and underlying mechanisms of this type of visual hallucination remain to be elucidated.

Key words Postanesthetic complications · Hallucinations · Vision · Sleep disturbance

Introduction

Visual hallucinations are not uncommon after general anesthesia [1]. However, visual hallucinations occurring solely on eye closure after general anesthesia have been documented in only two cases, after cardiovascular surgery [2,3]. We report a new case of visual hallucinations on eye closure that developed after orthopedic surgery under general anesthesia combined with epidural anesthesia early on postoperative day 1 and lasted for 3 days.

Address correspondence to: T. Yano
Received: May 1, 2008 / Accepted: July 7, 2008

Case report

A 61-year-old woman (weight, 64 kg; height, 151 cm), suffering from rheumatoid arthritis for 37 years, was scheduled to undergo a right-sided total hip arthroplasty (THA) under general anesthesia combined with epidural anesthesia at Kumamoto University Hospital. The patient, classified as American Society of Anesthesiologists (ASA) physical status 2 because of systemic rheumatoid arthritis and mild obstructive pulmonary dysfunction (forced expiratory volume $[FEV]_{1.0}$%; 67%), had a surgical history of bilateral total knee arthroplasty, left-sided THA, and a left-ankle arthrodesis over 16 years before the current surgery, but she had no contributory neurological, mental, psychological, or family history. The preoperative laboratory data were within normal ranges. Because the patient had been medicated with steroids until she was 46 years old, surgeons scheduled intra- and postoperative steroid cover with hydrocortisone, 200 mg, on the operative day and postoperative day 1 (POD 1), 100 mg on POD 2, and 50 mg on POD 3. After premedication with 0.5 mg atropine and 3 mg midazolam intramuscularly, an epidural catheter was inserted at L2–3. Pulseoxymetric oxygen saturation (Sp_{O_2}) before the induction of anesthesia was 97%. Anesthesia was intravenously induced with 100 μg fentanyl and 375 mg thiamylal, and her trachea was intubated with 7 mg vecuronium, using a bronchofiberscope because of ankylosis of the cervical vertebrae; thereafter, anesthesia was maintained with 1.5%–2.5% sevoflurane in a 1:2 gas mixture of oxygen and air, and supplemental vecuronium. Continuous epidural infusion with 0.375% ropivacaine at 3–4 $ml \cdot h^{-1}$ was performed during surgery, followed by 0.2% (final concentration) ropivacaine and fentanyl (4 $\mu g \cdot ml^{-1}$) at 3 $ml \cdot h^{-1}$ postoperatively. Other additional medications during anesthesia were 1 g cefazolin 16 mg ephedrine as a vasopressor, 3 ml of 2% lidocaine as the test dose for epidural anesthesia, and 20 ml of 0.05% lidocaine with

5 μg·ml^{-1} epinephrine for local infiltration. Both anesthesia and surgery were uneventful, and S_{pO_2} was maintained between 98% and 100% during anesthesia. After emergence from anesthesia, she was slightly drowsy but responded to commands correctly, and epidural block height reached below T11 to pin-prick at the recovery area. Postoperatively, supplemental oxygen (3 l·min^{-1}) was provided with a nonrebreathing mask for 5 h. After she was returned to the ward at 2:00 p.m., S_{pO_2} was maintained at 100% until the termination of oxygen administration, and it was subsequently maintained at around 98%. Her course was uneventful until she went to sleep around 9:00 p.m.

On POD 1, around 2:00 a.m., approximately 12 h after the end of anesthesia, a "cannot breathe" sensation awoke her from her sleep. Immediately after arousal, she saw lined-up red clothes, light-blue lace curtains, yellow handbags, pink hats, and pink sofas, all of which appeared independently and randomly, and followed one another in succession only when she closed her eyes. The objects were floating and projected without distortion in front of her. They were vivid, realistic, complex, of natural size, and in normal perspective at appropriate distances in space. On closing her eyes she found that the images immediately appeared, and on opening her eyes they promptly vanished. The images also disappeared when her eyes were opened in the dark. She felt heavy-headed and could not fall asleep until morning because of fear of appearance of these images on eye closure. At 9:00 a.m., the orthopedic physician in charge of her suspected epidural fentanyl to have caused this symptom and terminated the continuous epidural infusion. By the time of termination of the epidural infusion, 255 μg fentanyl and 128 mg ropivacaine had been given. She looked tired and complained of insomnia, but not of vertigo or migraine. Laboratory data were within normal ranges and metabolic disorder was excluded. When an anesthesiologist visited her at 4:00 p.m., she was sitting on the bed. She was lucid and well oriented, and her consciousness level seemed entirely normal. No marked neurological deficit was found. She closed her eyes and described to the anesthesiologist, who was standing beside her, that she felt as if she were sitting on a sofa and had a clear view of many pink sofas in front of her. There were no auditory or tactile perceptions. She was loquacious but not delirious. The anesthesiologist asked her to draw some pictures of the images in the hallucinations she had on closing her eyes (Fig. 1A,B). We diagnosed her with visual hallucinations. That night, she was given 0.5 mg etizolam, but her sleep was fragmentary, and she still experienced visual hallucinations on eye closure when she arose from sleep. On POD 2, the visual hallucinations on eye closure occurred less frequently in the daytime, and she gradually adapted herself to the hallucinations, without anxiety. When the anesthesiologist interviewed her again at 3:00 p.m., she was fully alert and oriented, and explained that she saw crossed and tricolored light lines or bicolored light coils when her

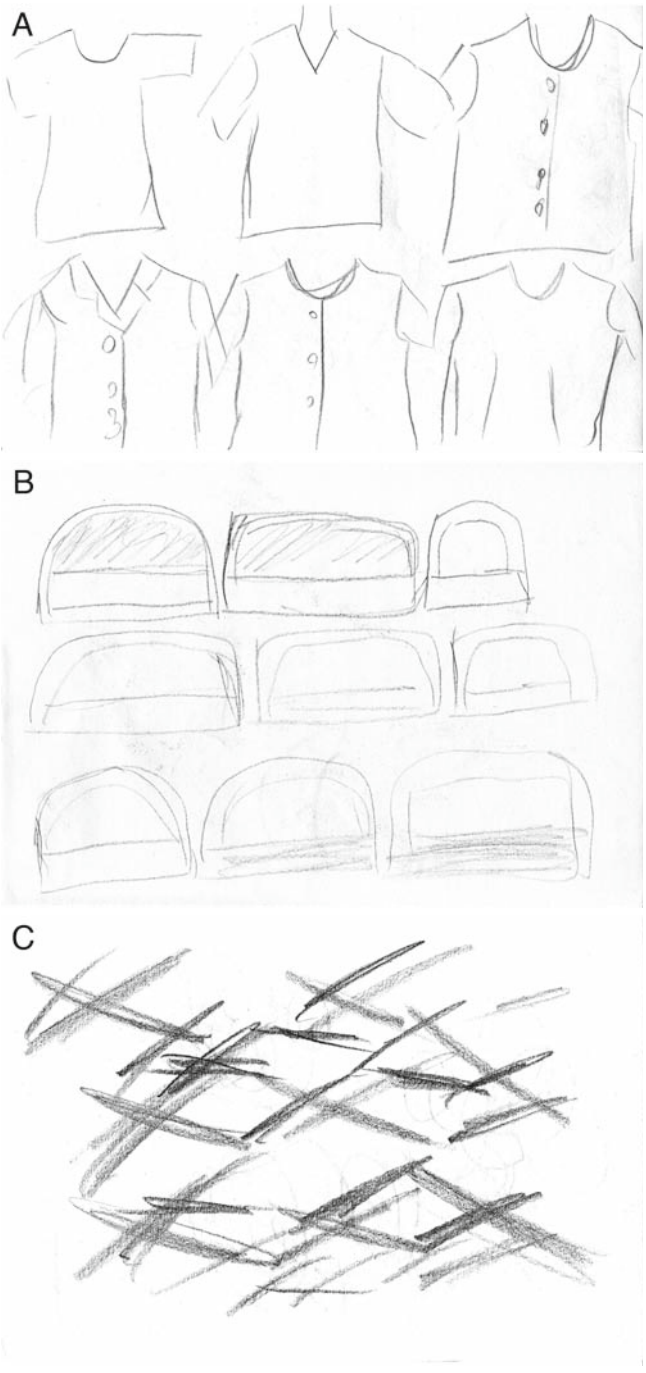

Fig. 1A–C. Pictures of the visual images in hallucinations on eye closure, drawn by the patient. **A** Lined-up red clothes seen on postoperative day 1. The original was drawn using a red-colored pencil. **B** Lined-up pink sofas seen on postoperative day 1. The original was drawn using a pink-colored pencil. **C** Crossed and tricolored light lines seen on postoperative day 2. The original was drawn using pink-, brown-, and black-colored pencils

eyes were closed, but did not see distinct images (Fig. 1C). She was administered 0.5 mg etizolam before night sleep. On POD 3, the visual hallucinations scarcely occurred, and they had entirely subsided on POD 4. Additional medication postoperatively, except for fluid therapy, included cefazolin (2 g per day) until POD 2, hydrocortisone until POD 3 as scheduled, loxoprofen (180 mg per day) for postoperative left-shoulder pain, and etizolam before night sleep. Her remaining hospital course was uneventful.

Discussion

A hallucination is defined as a false sensory perception in the absence of a sensory experience. In contrast, an illusion is defined as a misinterpretation of a real sensory experience. The series of visual disturbances observed in our patient were hallucinations. It is well known that ketamine, a dissociative anesthetic, can produce visual hallucinations at emergence from anesthesia. The visual hallucinations occur due to ketamine-induced depression of visual relay nuclei, leading to misperception of visual stimuli [4]; however, to date, there have been no reports of visual hallucinations occurring solely on eye closure after ketamine anesthesia. To our best knowledge, only two cases of visual hallucinations occurring solely on eye closure after general anesthesia have been reported [2,3]. We report here a new case of visual hallucinations occurring on eye closure, without any other mental aberrations, after orthopedic surgery under general anesthesia.

In an early study, Wilson et al. [1] reported a 2.4% incidence of hallucinations (10 visual and 2 auditory) in 490 adult patients who had undergone various types of surgery under general anesthesia. Brimacombe and Macfie [5] found no postoperative hallucinations in patients undergoing day surgery and minor surgery; however, in contrast, these authors reported a 12.5% and a 5.7% incidence of hallucinations in patients undergoing cardiac surgery and major noncardiac surgery, respectively [5]. Postoperative delirium, which is often accompanied by hallucinations, is a common complication in cardiac surgery [6]. The above-mentioned two cases of visual hallucinations on eye closure also occurred after cardiac surgery. Laloux and Osseman [2] reported a case of visual hallucinations occurring after carotid endoarterectomy and coronary artery bypass grafting. Eissa et al. [3] documented another case after coronary artery bypass grafting. Although postoperative visual hallucinations do not seem to be uncommon, the incidence of the closed-eye variation is unknown.

Various factors may contribute to visual hallucinations on eye closure. In the case reported by Laloux and Osseman [2], the authors speculated that the patient's visual hallucinations on eye closure could have been caused by temporal lobe epilepsy. Temporo-occipital seizure is one of the major causes of visual hallucinations [7]. Epilepsy could not have been a cause of the visual hallucinations in our patient, because no relevant signs other than this phenomenon were noted. Drug encephalopathy is a relevant factor in the development of visual hallucinations [7]. Fisher [7,8] described two cases of visual hallucinations on eye closure attributed to atropine toxicity and lidocaine as the local anesthetic for minor surgery. In our patient, hydrocortisone, fentanyl, ephedrine, and midazolam, along with atropine and lidocaine could be candidate hallucinogens [9–12], although the doses were not excessive. Microembolic insult to the pulmonary circulation resulting in cerebral hypoxic damage and/or direct damage to the visual association cortex may cause visual hallucinations on eye closure [3]. THA has been reported to cause both clot and fat microemboli in the lungs and brain [13]. Perioperatively, our patient did not experience systemic hypoxic events, but it cannot be denied that a cerebral microembolism without a neurological deficit or cognitive decline could have occurred, because brain imaging could not be obtained.

The main feature of our patient's hallucinations was that they appeared on the closing of her eyes and disappeared instantaneously on the opening of her eyes, even in the dark. Eissa et al. [3] considered that their case of closed-eye visual hallucinations could be explained by "release phenomena" in ophthalmopathic hallucinations (associated with visual impairment or blindness) due to the disruption of afferent visual input to the visual association cortex; this disruption causes the release of hallucinations that are normally inhibited by visual input to the visual association cortex [3]. These authors assumed that eye closure played a role corresponding to visual impairment in their patient [3]. Fisher [7] suggested that eye closure could be related to an associated activity in the brain stem involved in sleep and would not serve only to intercept light, because the hallucinations did not occur when the eyes were opened in the dark. He also speculated that visual hallucinations on eye closure could be attributed to a primary disturbance in the sleep-awake process, such as hypnagogic visual hallucinations at sleep onset, which disappear on opening the eyes [7]. Sleep disturbance is often associated with both cardiac and noncardiac major surgery [5]. Brimacombe and Macfie [5] stated that several factors, including anesthesia; the endocrine and metabolic response to surgical trauma, pain, or opioid therapy; postoperative hypoxemia; perioperative fasting; elevated body temperature; or environmental factors may contribute to sleep disturbance after surgery. These factors might be involved in the

development of visual hallucinations on eye closure after general anesthesia, by affecting the sleep center either directly or indirectly.

Quite recently, we experienced another case of visual hallucinations on eye closure (in a 54-year-old woman), which occurred the same evening after total knee arthroplasty under general anesthesia combined with epidural anesthesia performed at Kumamoto Kinoh Hospital. In this patient, the hallucinations subsided the following morning after profound night sleep induced by a hypnotic, zolpidem, implying an association with the sleep-awake process. Visual hallucinations on eye closure may not be very rare after general anesthesia and may, potentially, be unreported. The causes and underlying mechanisms of this type of visual hallucination remain to be elucidated.

References

1. Wilson SL, Vaughan RW, Stephen CR. Awareness, dreams, and hallucinations associated with general anesthesia. Anesth Analg. 1975;54:609–17.
2. Laloux P, Osseman M. Visual hallucinations on eye closure after cardiovascular surgery. J Clin Neuroophthalmol. 1992;12:242–4.
3. Eissa A, Baker RA, Knight JL. Closed-eye visual hallucinations after coronary artery bypass grafting. J Cardiothorac Vasc Anesth. 2005;19:217–9.
4. McEvoy MD. Intravenous nonopioid anesthetics. In: Miller RD, editor. Miller's anesthesia. 6th ed. Philadelphia: Elsevier Churchill Livingstone; 2005. p. 317–78.
5. Brimacombe J, Macfie AG. Peri-operative nightmares in surgical patients. Anaesthesia. 1993;48:527–9.
6. Sockalingam S, Parekh N, Bogoch II, Sun J, Mahtani R, Beach C, Bollegalla N, Turzanski S, Seto E, Kim J, Dulay P, Scarrow S, Bhalerao S. Delirium in the postoperative cardiac patient: a review. J Card Surg. 2005;20:560–7.
7. Fisher CM. Visual hallucinations on eye closure associated with atropine toxicity. A neurological analysis and comparison with other visual hallucinations. Can J Neurol Sci. 1991;18:18–27.
8. Fisher CM. Visual hallucinations and racing thoughts on eye closure after minor surgery. Arch Neurol. 1991;48:1091–2.
9. Fleming PS, Flood TR. Steroid-induced psychosis complicating orthognathic surgery: a case report. Br Dent J. 2005;199:647–8.
10. Bruera E, Pereira J. Acute neuropsychiatric findings in a patient receiving fentanyl for cancer pain. Pain. 1997;69:199–201.
11. Doyle H, Kargin M. Herbal stimulant containing ephedrine has also caused psychosis. BMJ. 1996;313:756.
12. Burnakis TG, Berman DE. Hostility and hallucinations as a consequence of midazolam administration. DICP. 1989;23:671–2.
13. Edmonds CR, Barbut D, Harger D, Sharrock NE. Intraoperative cerebral arterial embolization during total hip arthroplasty. Anesthesiology. 2000;93:315–8.