Case Report

Total intravenous anesthesia using midazolam and dexmedetomidine as substitutes for propofol in a pediatric patient with egg allergy and a family history of malignant hyperthermia

ABSTRACT

To avoid inhalational anesthetics, total intravenous anesthesia (TIVA) is required in patients with a predisposition to malignant hyperthermia (MH). However, propofol, which is frequently used, may be avoided in patients with egg allergies because of the contraindications in the drug information. Furthermore, some patients may not consent to the use of propofol. We report a case of TIVA using midazolam and dexmedetomidine as substitutes for propofol in a pediatric patient with egg allergy and a predisposition to MH. A 10-year-old boy was scheduled to undergo perforated drainage of an epidural abscess. He had egg allergy, and his uncle had been diagnosed with MH. He also developed a generalized drug eruption caused by antibiotics. Concerned about allergic reactions, he and his parents did not consent to administrating propofol. The patient's perioperative course was uneventful. The combination of midazolam and dexmedetomidine may be a useful option as substitutes for propofol.

Key words: Dexmedetomidine, malignant hyperthermia, midazolam

Introduction

Malignant hyperthermia (MH) is a disorder that manifests as a hypermetabolic response to inhalational anesthetics.[1] Total intravenous anesthesia (TIVA) can be administered to patients who are susceptible to MH. In Japan, all propofol preparations contain egg lecithin, and a history of hypersensitivity to eggs is listed as a contraindication in the drug information. Therefore, some patients or their parents may not consent to the use of propofol. We report a case in which midazolam and dexmedetomidine were used as substitutes for propofol in a child with egg allergy and a family history of MH.

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Case Report

A 10-year-old boy (height: 140 cm; weight: 27 kg) was scheduled to undergo perforated drainage of an epidural abscess. He had egg allergy and was undergoing hyposensitization therapy. In addition, his family history was positive for MH as his uncle had been diagnosed by muscle biopsy. After admission, the patient developed a generalized drug eruption caused by antimicrobial agents, and treatment was initiated with antihistamines and steroids. We explained the need for

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TIVA and the contraindications of propofol to the patient and his parents. Although we explained that propofol was likely to be safe in most egg-allergic children, they did not consent to the use of propofol. The patient was admitted to the operating room without premedication. We began monitoring noninvasive blood pressure, electrocardiogram activity, oxygen saturation, and bispectral index (BIS). After he was administered oxygen, midazolam (0.3 mg/kg) was administered and an infusion of remifentanil (0.5 μg/kg/min) was started. After the BIS value reached <70, neuromuscular blockade with rocuronium (1 mg/kg) was used to facilitate tracheal intubation. An endotracheal tube (internal diameter: 6.0 mm) was used for intubation. Maintenance anesthesia consisted of dexmedetomidine at 0.8–1.0 μg/kg/h and remifentanil at 0.2–0.5 μg/kg/min. Additional rocuronium was administered to maintain a train-of-four count of 1 or 0. The BIS value during maintenance anesthesia varied from 40 to 70. The surgical procedure lasted for 1 h and 21 min. Upon completion of the procedure, infusion of dexmedetomidine and remifentanil was discontinued. Fentanyl (2 μg/kg) and acetaminophen (15 mg/kg) were administered as postoperative analgesics. The residual neuromuscular blockade was reversed using sugammadex (2 mg/kg). Seven minutes after the dexmedetomidine infusion was discontinued, the patient was extubated. After 10-minute follow-up, the patient was transported to the ward. His postoperative course was uneventful.

Discussion

MH is a pharmacogenetic disorder that presents as a hypermetabolic response to potent volatile anesthetic gases. Consequently, propofol is a commonly chosen alternative to volatile agents for patients susceptible to MH. In Japan, the contraindications of propofol include hypersensitivity to its components such as egg lecithin and soybean oil in the drug information. Therefore, anesthesiologists should obtain consent from patients with such food allergies to use propofol. However, no definitive literature supports the potential for allergic reactions to propofol in patients with food allergies. Some studies have shown that food allergies do not predict hypersensitivity to propofol; therefore, propofol administration is acceptable unless an anaphylactic reaction is evident.[2,3] Although our patient had no history of anaphylaxis, he was diagnosed with egg allergy and underwent hyposensitization therapy. He was also treated for systemic drug eruption. Therefore, considering that administering propofol would worsen the rash, the patient and his parents did not consent to the use of propofol.

Midazolam can be used as an alternative to propofol. However, TIVA with midazolam is less preferred than that with propofol from several perspectives. A previous study has shown that TIVA with midazolam requires higher doses of opioids and increases the incidence of delayed awakening.[4]

Dexmedetomidine is an acting α_2-adrenergic agonist with sedative, sympatholytic, and analgesic properties. Because its pharmacokinetic profile includes a rapid distribution phase and an elimination half-life, it has the advantage of smoothly regulating mild to deep sedation. There are previous studies on the use of dexmedetomidine for TIVA.[5,6] However, these studies pointed out its disadvantages. They revealed that dexmedetomidine might not be effective as the sole sedative agent for general anesthesia. Adding remifentanil to dexmedetomidine sedation did not affect the likelihood of responses to stimulation, even after reaching supraclinical concentrations.[5] Another disadvantage is its slow onset. Dexmedetomidine requires a loading dose of 10 min or longer to reach a state of adequate sedation.[6]

Therefore, we hypothesized that a combination of rapid induction with midazolam and maintenance of anesthesia with dexmedetomidine would be useful for TIVA in our case. We achieved smooth induction and awakening from general anesthesia in this case, with no perioperative complications. However, this report has several limitations. First, the operative time was not long, and surgical invasion was relatively less. For longer or more invasive surgeries, our plan may not have been sufficient to maintain adequate anesthesia. If superficial anesthetic signs, such as body movements or rapidly rising BIS value, had been noted during surgery, an additional dose of midazolam would have been administered. The second limitation is the assessment of sedation with BIS. A previous study showed that following the induction of anesthesia with midazolam, the electroencephalography is characterized by an increased beta power and average BIS value >60, even at supra-sedation levels of plasma and effect-site concentrations.[7] Another study revealed that at a comparable observational sedation scale, the BIS value is lower with dexmedetomidine sedation than with propofol.[8] Although it is widely recognized among anesthesiologists that the BIS value between 40 and 60 generally indicates adequate general anesthesia for surgery, using the BIS value to assess the depths of anesthesia for their drugs may not be appropriate. However, there is a correlation between the BIS value and the sedation level induced by midazolam or dexmedetomidine.[9,10] In fact, our patient showed no evidence of superficial anesthetic signs and intraoperative memory.

In conclusion, we safely performed TIVA with midazolam and dexmedetomidine in a pediatric patient with egg allergy and a family history of MH. The induction and awakening from general anesthesia were rapid, and no perioperative

complications occurred. Midazolam and dexmedetomidine may be a useful option as substitutes for propofol.

Patients' consent form

We obtained the patient's and his family's consent using our institutional consent form.

Ethical approval

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national guidelines on human experimentation and have been approved by the appropriate committees at our institution. Given the nature of this study, the project was exempt from institution review board/ethics committee review but informed consent from his parents was obtained for off-label use.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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