

LETTER TO THE EDITOR

Open Access



General anesthesia with remimazolam in a patient with clinically suspected malignant hyperthermia

Keita Uchiyama, Hiroshi Sunaga^{*} , Nobuyuki Katori and Shoichi Uezono

To the Editor,

Malignant hyperthermia (MH) is a life-threatening complication of general anesthesia. Avoidance of the trigger drugs is mandatory for known or suspected MH-susceptible patients, and total intravenous anesthesia (TIVA) should be chosen if general anesthesia is necessary [1]. Whereas an in vitro study suggested that a new ultra-short-acting benzodiazepine, remimazolam, might be safely used without causing MH [2], our literature search failed to identify any reports of remimazolam use for MH in clinical practice. We present a case of a patient with a medical history of suspected MH safely managed under general anesthesia with remimazolam. Informed consent was obtained from the patient for this publication.

The patient was a 26-year-old man (177 cm, 64 kg) who was scheduled to undergo endoscopic sinus surgery for allergic rhinitis and a septoplasty for a deflected nasal septum. He underwent open reduction and internal fixation for a right forearm fracture under general anesthesia at another hospital at the age of 11 years. He developed a high temperature, reddish-brown urine, and hyperkalemia during that surgery, and a clinical diagnosis of MH was made. The operation was finished quickly, and he was treated in the intensive care unit. Although a specialized test for definitive diagnosis of MH susceptibility was not performed, the high level of the creatine

kinase (approximately 40,000 IU/L) and myoglobinuria (approximately 3000 ng/mL) after surgery supported a clinical diagnosis of MH. He did not undergo general anesthesia since that time and underwent removal of the internal fixation with several rounds of local anesthesia. His past medical history also included an allergic reaction to soy.

For the procedure, an anesthesia machine was flushed and prepared according to the manufacturer's recommendations [3]. Anesthesia was induced with an infusion of remimazolam at a rate of 12 mg/kg/h along with rocuronium, fentanyl, and remifentanyl, and the trachea was intubated. The patient was mechanically ventilated, and anesthesia was maintained with an infusion of remimazolam at 1.5 mg/kg/h along with rocuronium, fentanyl, and remifentanyl. Body temperature remained at 36.3°C to 36.9°C, and there were no clinical signs of MH during anesthesia. The infusions of remimazolam and remifentanyl were discontinued at the end of surgery. Sugammadex and flumazenil were administered, and the trachea was extubated. The surgery took 2 h and 13 min, and the anesthesia time was 2 h and 59 min. Monitoring and observation were continued in the postanesthesia care unit, and the patient was then transferred to the general ward. No signs of MH were noted until discharge from the hospital on the second postoperative day.

Propofol can be administered without any concerns for patients with MH susceptibility and patients allergic to

*Correspondence: hs-031@jikei.ac.jp

Department of Anesthesiology, The Jikei University School of Medicine, 3-25-8 Nishishimbashi, Minatoku, Tokyo 105-8461, Japan

soy [4, 5]. That said, remimazolam should not be inferior to propofol with respect to efficacy as a sedative agent for general anesthesia and might have fewer hemodynamic side effects [6]. We considered that remimazolam might be beneficial for TIVA owing to reversibility with flumazenil or avoidance of propofol infusion syndrome. This case suggests that patients with clinically suspected MH can be safely managed under general anesthesia with remimazolam.

Abbreviations

MH: Malignant hyperthermia; TIVA: Total intravenous anesthesia.

Acknowledgements

Not applicable.

Authors' contributions

KU wrote an original draft. HS, NK, and SU revised the manuscript. All authors read and approved the final manuscript.

Funding

This work was funded by the Department of Anesthesiology, The Jikei University School of Medicine.

Availability of data and materials

Not applicable.

Declarations

Ethics approval and consent to participate

The publication of case reports is exempted from ethics committee approval in our institution.

Consent for publication

Written informed consent was obtained from the patient for publication.

Competing interests

The authors declare that they have no competing interests.

Received: 6 September 2021 Revised: 4 October 2021 Accepted: 9 October 2021

Published online: 18 October 2021

References

1. Gupta PK, Bilmen JG, Hopkins PM. Anaesthetic management of a known or suspected malignant hyperthermia susceptible patient. *BJA Educ.* 2021;21:218–24. <https://doi.org/10.1016/j.bjae.2021.01.003>.
2. Watanabe T, Miyoshi H, Noda Y, Narasaki S, Morio A, Toyota Y, et al. Effects of Remimazolam and Propofol on Ca²⁺ Regulation by Ryanodine Receptor 1 with Malignant Hyperthermia Mutation. *Biomed Res Int.* 2021;2021:8845129. <https://doi.org/10.1155/2021/8845129>.
3. GE Healthcare. Technical Report, <https://www.gehealthcare.com/-/jssmedia/global/products/files/anesthesia-delivery/anesthesia-machine-malignant-hypothermia.pdf?rev=-1>. Accessed 6 Sept 2021.
4. Mathews EL, Dhamee MS. Propofol in patients susceptible to malignant hyperthermia: a case report and review of the literature. *J Clin Anesth.* 1992;4:331–2. [https://doi.org/10.1016/0952-8180\(92\)90141-m](https://doi.org/10.1016/0952-8180(92)90141-m).
5. Dewachter P, Kopac P, Laguna JJ, Mertes PM, Sabato V, Volcheck GW, et al. Anaesthetic management of patients with pre-existing allergic conditions: a narrative review. *Br J Anaesth.* 2019;123:e65–81. <https://doi.org/10.1016/j.bja.2019.01.020>.
6. Doi M, Morita K, Takeda J, Sakamoto A, Yamakage M, Suzuki T. Efficacy and safety of remimazolam versus propofol for general anesthesia: a multicenter, single-blind, randomized, parallel-group, phase IIb/III trial. *J Anesth.* 2020;34:543–53. <https://doi.org/10.1007/s00540-020-02788-6>.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Submit your manuscript to a SpringerOpen[®] journal and benefit from:

- Convenient online submission
- Rigorous peer review
- Open access: articles freely available online
- High visibility within the field
- Retaining the copyright to your article

Submit your next manuscript at ► [springeropen.com](https://www.springeropen.com)