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Management of a Malignant Hyperthermia Crisis Without Immediate Access to Dantrolene: A Case Report

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Case Report

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Abstract

Background

Malignant hyperthermia (MH) is an inherited pharmacogenetic disorder characterized by a life-threatening hypermetabolic reaction in skeletal muscle triggered by exposure to volatile anesthetics and succinylcholine in susceptible individuals. Dantrolene is the cornerstone of treatment for MH crisis.

Case presentation

: Here we present the case of rescuing patients in MH crisis without dantrolene. An 18-year-old man underwent general anesthesia on July 7, 2026, He had no known family history of MH or other neuromuscular disorders. After induction and tracheal intubation, the patient's end-tidal carbon dioxide increased from 52 to 73 mmHg with severe acidemia(pH 7.077) and arterial carbon dioxide partial pressure of 66.9mmHg.And the patient's core body temperature raised to 39.7℃ 30 minutes after intubation. The treatment of MH is active cooling, management of hypercapnia with increasing minute ventilation, and correction of severe acidemia. When we got dantrolene ,the patient's body temperature and end-tide carbon dioxide returned to normality.

Conclusion

It is possible to rescue patients in MH crisis without dantrolene, with continuous $ETCO_2$ and core-temperature monitoring, bedside blood gas analysis, active-cooling equipment, and trained personnel. It is important for healthy facilities in regions where dantrolene is unavailable or difficult to obtain.

Background

Malignant hyperthermia (MH) is an inherited pharmacogenetic disorder characterized by a life-threatening hypermetabolic reaction in skeletal muscle triggered by exposure to volatile anesthetics and succinylcholine in susceptible individuals. Three key interventions for acute MH management are immediate discontinuation of triggering agents, intravenous dantrolene administration, and active cooling.[1] Dantrolene is the cornerstone of pharmacologic treatment for MH, and its introduction has been associated with a substantial reduction in mortality, from approximately 70% to 5%.[2] However, dantrolene is not readily available worldwide, particularly in low- and middle-income countries, because of its cost, storage conditions, and supply requirements.[3] In mainland China, MH management remains challenging because clinical experience with its diagnosis and treatment is limited and dantrolene can be difficult to obtain.[4]Here we presented the case to demonstrate the importance of continuous $ETCO_2$ and core-temperature monitoring, bedside blood gas analysis, active-cooling equipment, and trained personnel for rescuing the patients in MH crisis without dantrolene,particular given thecurrent reality of limited access to dantrolene in most countries worldwide.

Case presentation

An 18-year-old man underwent general anesthesia on July 7, 2026, for elective endoscopic nasal septoplasty and inferior turbinate reduction. He had no known family history of MH or other neuromuscular disorders. Preoperative laboratory test results were within the reference ranges, and electrocardiography showed sinus rhythm. The patient followed the prescribed preoperative fasting and fluid-restriction regimen.

In the operating room, baseline blood pressure was 110/60 mmHg, heart rate was 110 beats/min, and oxygen saturation (SpO_2) was 99% while the patient was breathing 100% oxygen. Anesthesia was induced using lidocaine (55 mg), sufentanyl (20 μg), propofol (11 mL), and succinylcholine (55 mg). Tracheal intubation was uneventful. Mechanical ventilation was initiated with a tidal volume of 350 mL, and a respiratory rate of 15 breaths/min. General anesthesia was maintained with sevoflurane at an end-tidal concentration of 1%–2% and a remifentanil infusion at 0.1 $\mu g \cdot kg^{-1} \cdot min^{-1}$. Over approximately 5 min, end-tidal carbon dioxide ($ETCO_2$) increased from 52 to 73 mmHg despite mechanical ventilation, whereas blood pressure, heart rate, and SpO_2 remained stable at 120/56 mmHg, 100 beats/min, and 99%, respectively. Emergency bedside arterial blood gas analysis revealed severe acidemia (pH, 7.077), an arterial oxygen partial pressure of 319 mmHg, an arterial carbon dioxide partial pressure of 66.9 mmHg, a serum potassium concentration of 4.1 mmol/L, and a blood lactate concentration of 6.0 mmol/L. Core body temperature monitoring showed a baseline temperature of 36.8°C. MH was strongly suspected because of the rapid, unexplained increase in $ETCO_2$ accompanied by severe acidemia and hyperlactatemia. Dantrolene sodium, the specific treatment for MH, was urgently requested but was not immediately available. Minute ventilation was initially increased from 5.25 L/min (0.35 L × 15 breaths/min) to 8.64 L/min (0.48 L × 18 breaths/min). Potential MH-triggering agents, sevoflurane and neuromuscular blocking agents, were immediately discontinued. The carbon dioxide absorbent and breathing circuit were replaced, and the anesthesia machine was flushed with 100% oxygen at a flow rate of at least 10 L/min. An arterial catheter was placed for continuous hemodynamic monitoring and serial arterial blood gas measurements, including lactate assessment. Severe acidemia was treated with intravenous sodium bicarbonate, with subsequent administration guided by serial arterial blood gas results. Minute ventilation was subsequently increased to 10 L/min (0.5 L × 20 breaths/min) because $ETCO_2$ continued to increase. The patient's temperature began to increase after approximately 30 min of emergency treatment and reached 37.8°C. Active cooling was initiated with ice packs, continuous infusion of 4°C saline, application of 75% ethanol to major peripheral vascular regions and the axillae, and continuous gastric lavage with 4°C saline. Despite these measures, the temperature continued to increase and peaked at 39.7°C. Blood pressure and heart rate remained largely stable throughout emergency management. $ETCO_2$ peaked at 85 mmHg and gradually decreased to 40 mmHg after approximately 1 h of emergency treatment. Serial arterial blood gas analysis showed improvement in acidemia, with the pH increasing to 7.31 and the lactate concentration decreasing to 4.0 mmol/L. The patient's core temperature gradually returned to the normal range. Given the risk of recurrent MH-related complications, the endotracheal tube was left in place, and the patient was transferred to the intensive care unit (ICU) for close postoperative monitoring. Emergency postoperative laboratory testing showed a

serum myoglobin concentration greater than 3,000 μg/L, a creatine kinase concentration of 25,924 IU/L, and a lactate dehydrogenase concentration of 292 IU/L. In the ICU, the patient's temperature fluctuated and subsequently increased again to 37.8°C. Gastric lavage and bladder irrigation with cold saline and use of a cooling blanket reduced the core temperature to below 37°C. Dantrolene arrived in the ICU approximately 4 h after anesthesia induction. By that time, the patient had clinically stabilized, and the treating team decided not to administer it. The patient regained consciousness on postoperative day 1, and the endotracheal tube was successfully removed. Postoperative genetic testing identified a heterozygous mutation in the RYR1 gene associated with malignant hyperthermia susceptibility type 1. The patient was transferred from the ICU to the general ward on postoperative day 3 and discharged on postoperative day 11.

Discussion and conclusions

This case highlights that, when dantrolene is not immediately available, timely recognition of MH and prompt supportive management—including active cooling, management of hypercapnia by increasing minute ventilation, and correction of severe acidemia—may contribute to clinical stabilization while dantrolene is obtained. Dantrolene remains the first-line pharmacologic treatment and should be administered as soon as possible when indicated; supportive measures are not a substitute for it. Early recognition of abnormal clinical signs and prompt activation of emergency MH management are critical. In this case, the earliest abnormal finding was a progressive increase in $ETCO_2$, an established early indicator of MH. Healthcare facilities in regions where dantrolene is unavailable or difficult to obtain should have continuous $ETCO_2$ and core-temperature monitoring, bedside blood gas analysis, active-cooling equipment, and personnel trained to recognize and manage an MH crisis.

Abbreviations

$ETCO_2$
end-tidal carbon dioxide
ICU
intensive care unit
MH
malignant hyperthermia
SpO_2
oxygen saturation measured by pulse oximetry.

Declarations

Ethics approval and consent to participate

Informed consent was obtained before surgery.

Clinical trial number

Not applicable

Consent for publication

To be confirmed by the authors. The patient gave written informed consent for their personal or clinical details along with any identifying images to be published in this study.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request

Competing interests

The authors declare that they have no competing interests.

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Authors’ contributions

MCD and KXY: data curation and investigation. YG: methodology, supervision, and validation. All authors read and approved the final manuscript.

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Use of artificial intelligence tools

The authors declare that no artificial intelligence tools were used.

Prior presentation

None.

References

1. Hopkins PM, Girard T, Dalay S, et al. Malignant hyperthermia 2020: guideline from the Association of Anaesthetists. Anaesthesia. 2021;76:655–64. 10.1111/anae.15317.
2. Denborough M. Malignant hyperthermia. Lancet. 1998;352:1131–6. 10.1016/S0140-6736(98)03078-5.
3. Smith A, Brandom B, Miner L, Henker R. Donating dantrolene: development and implementation of a malignant hyperthermia program in a scarce resource setting. AANA J. 2022;90:271–7.
4. Wang J, Yu Y, Gao Y, et al. The anesthesiologists' perception of malignant hyperthermia and availability of dantrolene in China: a cross-sectional survey. Risk Manag Healthc Policy. 2024;17:763–73. 10.2147/RMHP.S454895.