

CASE REPORT

Severe Masseter Muscle Rigidity Following Succinylcholine Administration in a Patient with Inconclusive Pharmacogenetic Results for Susceptibility to Malignant Hyperthermia

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KEYWORDS

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ABSTRACT

Masseter muscle rigidity following succinylcholine is traditionally viewed as a potential early indicator of malignant hyperthermia (MH), although most adult cases remain isolated without systemic progression. This report describes a 50-year-old woman who developed immediate, severe bilateral masseter rigidity after succinylcholine during induction of general anesthesia. Despite profound limitation in mouth opening of approximately 1.5 cm, videolaryngoscopic intubation was achieved on the first attempt, and mask ventilation remained uncomplicated. The rigidity persisted even after administration of cisatracurium, yet the patient demonstrated no systemic signs of MH, with normal hemodynamics, end-tidal CO₂, temperature, and laboratory values. Surgery was cancelled, and the rigidity gradually resolved during recovery in the intensive care unit. Targeted genetic testing for RYR1 and CACNA1S variants did not identify pathogenic mutations. However, given the limited scope of the tested variants, the result was considered inconclusive for determining MH susceptibility. This case illustrates that marked succinylcholine-induced masseter rigidity can occur without progression to systemic MH. It also highlights that nondiagnostic targeted genetic testing reflects current limitations in variant detection and should not be interpreted as definitively excluding susceptibility. In patients presenting with significant isolated masseter rigidity, continued MH preparedness remains warranted despite the absence of systemic manifestations during the initial event.

Introduction

Masseter muscle rigidity (MMR) following administration of succinylcholine is a recognized but rare event in adults; pediatric data suggest incidences below 1% (approximately 0.3% in selected series)^{1,2}. Because MMR has historically been considered a potential early indicator of MH¹⁻⁵, its occurrence warrants prompt assessment and perioperative vigilance^{2,4,5}. However, the majority of isolated MMR episodes do not progress to fulminant MH, especially in adult individuals, creating diagnostic uncertainty and complicating perioperative decision-making regarding future anesthetic techniques^{1,2,5}.

The increasing availability of genetic testing has added complexity to the evaluation of suspected MH. Although pathogenic variants in RYR1 and CACNA1S are strongly associated with MH susceptibility, current genetic testing approaches have limited sensitivity, and a substantial proportion of clinically susceptible individuals may not harbor identifiable pathogenic variants⁶⁻⁹. Most data regarding the diagnostic yield of genetic testing derive from broader MH-susceptible cohorts rather than from patients presenting specifically with succinylcholine-induced

masseter muscle rigidity. Nevertheless, because MMR may represent an early manifestation of MH in some cases, the limitations of genetic testing in MH populations are also relevant when interpreting such presentations. Therefore, nondiagnostic genetic findings must be interpreted in conjunction with clinical presentation rather than relied upon in isolation^{6,7}.

Here, we describe an adult patient who developed severe, isolated masseter rigidity immediately after succinylcholine administration, with persistent jaw stiffness despite nondepolarizing neuromuscular blockade but without systemic MH manifestations. The diagnostic ambiguity was further heightened by targeted pharmacogenetic testing that yielded an uncertain susceptibility classification. This case highlights the challenges in interpreting isolated MMR events, the limitations of limited-panel genetic testing, and the importance of maintaining MH precautions even when systemic features are absent.

Case report

This case report describes a 50-year-old woman (weight 57.5 kg, height 150.7 cm, BMI 25.3 kg/m²) with a history of

rheumatic mitral disease status post mechanical mitral valve replacement in 2014 and chronic atrial fibrillation, who was scheduled for elective extraction of an impacted mandibular molar. She was anticoagulated with warfarin and underwent perioperative bridging as recommended by the cardiology team. Preoperative transthoracic echocardiography demonstrated normal left ventricular systolic function (ejection fraction 67%) and a normally functioning mechanical mitral valve, with mild tricuspid regurgitation. Electrocardiography showed atrial fibrillation with nonspecific T-wave abnormalities, and chest radiography revealed mild cardiomegaly without pulmonary congestion. Airway examination was unremarkable, and the patient reported an uneventful previous general anesthetic in 2014 in which succinylcholine had not been administered. She reported no history of herbal medication use, substance abuse, or occupational exposure relevant to neuromuscular disorders.

In the operating room, standard monitoring was applied. Baseline vital signs were heart rate 64 beats/min, blood pressure 102/61 mmHg, SpO₂ 100%, and core temperature 36.1°C. After preoxygenation with 100% oxygen, anesthesia was induced with fentanyl 75 µg and propofol 100 mg, followed by succinylcholine 75 mg for neuromuscular relaxation. Immediately after fasciculations subsided, the anesthesiologist noted marked resistance to mouth opening using a cross-finger technique. Severe bilateral masseter muscle rigidity (MMR) was evident, and a second anesthesiologist was called to assist. Mask ventilation remained easy, with normal chest rise and an end-tidal CO₂ of 30–32 mmHg.

Videolaryngoscopic intubation was attempted and achieved on the first attempt with a Cormack–Lehane grade of 2, using a 7.0-mm oral RAE tube. Forced mouth opening was limited to approximately 1.5 cm. After intubation, MMR persisted, and attempts by the maxillofacial surgeon to open the mouth using a retractor were unsuccessful. Cisatracurium 8 mg was administered; however, jaw stiffness remained unchanged. A rolled-gauze bite block was carefully inserted to protect the endotracheal tube.

Given concern for an early presentation of MH, the team avoided volatile anesthetics, maintained anesthesia with propofol target-controlled infusion (3 µg/mL), flushed the circuit with high-flow oxygen/air (FiO₂ 0.5),

and inserted a radial arterial catheter. Arterial blood gases, serum electrolytes, creatine kinase (81 U/L), and temperature remained within acceptable limits. No tachycardia, hypercarbia, hyperthermia, generalized rigidity, or myoglobinuria occurred. Despite these reassuring findings, severe MMR persisted throughout the time in the operating room, lasting approximately two hours, and did not improve after administration of cisatracurium. The surgery was cancelled, and the patient was transferred intubated to the surgical intensive care unit (ICU) with dantrolene prepared but not administered.

Upon ICU arrival, propofol infusion was discontinued, and the patient became fully awake approximately 30 minutes later. Masseter muscle tone gradually returned to normal as consciousness improved, marking the first time the rigidity had resolved since succinylcholine administration. The patient was extubated two hours after ICU admission following a pressure-support trial (PS 5 cmH₂O, PEEP 5 cmH₂O). She was monitored in the ICU for 24 hours, during which no recurrent muscle rigidity, hemodynamic instability, or biochemical abnormalities were observed. She was then transferred to the general ward to resume anticoagulation therapy and undergo serial coagulation testing until the international normalized ratio reached the therapeutic target. She was discharged thereafter without complications, and the remainder of her hospitalization was unremarkable.

Targeted genetic testing for RYR1 (rs1801086, rs193922764, rs121918594) and CACNA1S (rs772226819) was performed at a certified molecular laboratory. All tested loci demonstrated homozygous wild-type genotypes. The accompanying report stated that these findings were not sufficient to determine MH susceptibility.

The patient was informed in detail about the intraoperative event and its possible implications. The findings were documented in her medical record, and she was provided with a malignant hyperthermia alert card. She was advised to avoid triggering agents, including volatile anesthetics and succinylcholine, in future procedures unless definitive diagnostic evaluation becomes available.

Table 1 summarizes the sequence of perioperative events, including the onset and persistence of masseter muscle rigidity, intraoperative management decisions, postoperative course, and subsequent genetic testing results.

Table 1 Chronological timeline of clinical events

Time point	Clinical event	Key findings / Actions
Preoperative	Routine evaluation	Stable cardiac status; airway examination unremarkable
Induction	Succinylcholine 75 mg administered	Fasciculations observed
Immediately after fasciculations	Severe bilateral masseter muscle rigidity	Marked resistance to mouth opening (~1.5 cm)
Airway management	Videolaryngoscopic intubation	Successful on first attempt; mask ventilation remained easy
Post-intubation	Persistent MMR despite cisatracurium 8 mg	No improvement in jaw stiffness
Intraoperative period (~2 hours)	Non-triggering anesthetic maintained	Normal ETCO ₂ , temperature, CK; no systemic MH features

Table 1 Continued

Time point	Clinical event	Key findings / Actions
End of procedure	Surgery cancelled	Transferred intubated to ICU; dantrolene prepared but not administered
ICU (30 minutes)	Propofol discontinued	Patient awake; rigidity resolved as consciousness returned
ICU (2 hours)	Extubation	Successful after pressure support trial
24 hours post-event	Observation	No recurrence of rigidity or biochemical abnormalities
Post-discharge	Genetic testing	No pathogenic variants; result inconclusive for MH susceptibility

Discussion

In this patient, the most striking feature was the severity and persistence of MMR immediately after succinylcholine administration, despite preserved ventilation and the absence of systemic MH features. Despite complete neuromuscular blockade with cisatracurium, the masseter muscles remained visibly and palpably rigid, with no improvement in mouth opening, and both anesthesiologists and the maxillofacial surgeon were unable to achieve adequate mouth opening, underscoring the magnitude of the localized response. Nevertheless, serial assessments—including end-tidal CO₂, core temperature, arterial blood gas analysis, electrolyte profile, and creatine kinase level—remained within normal limits throughout her intraoperative and intensive care course, making fulminant MH unlikely in this episode. This presentation is consistent with prior reports describing isolated MMR without progression to systemic MH in the adult population^{1,2,4,5}.

The mechanism of succinylcholine-induced MMR remains incompletely understood. Proposed explanations include exaggerated sarcoplasmic calcium release in masseter muscle fibers, transient dysfunction of the RYR1 calcium-release channel, or an acute localized contracture response that does not progress to systemic hypermetabolic activation¹⁰. This mechanistic overlap with MH physiology contributes to the diagnostic uncertainty surrounding isolated MMR.

Although targeted pharmacogenetic analysis of RYR1 and CACNA1S did not identify any pathogenic variants, the laboratory classified the overall result as “uncertain susceptibility.” This designation reflects the limited scope of the East Asian variant panel used and highlights the well-recognized limitation that negative findings on targeted testing do not exclude MH susceptibility^{6–8}. It is also important to consider ethnic background when interpreting genetic results. The patient in this case is of Thai ethnicity, and the frequency and spectrum of RYR1 and CACNA1S variants may differ across populations^{6,9}. Targeted panels developed based on variants more commonly reported in Western cohorts may therefore have reduced diagnostic yield in other ethnic groups, further contributing to inconclusive findings^{6,7,12}. Current European Malignant Hyperthermia Group (EMHG)⁷ and Clinical Pharmacogenetics Implementation Consortium (CPIC)¹² guidance similarly notes that only a subset of

pathogenic variants is detectable with such focused assays, and a substantial proportion of clinically susceptible individuals may exhibit no identifiable mutation even with broader sequencing^{6–9,12,13}. This reflects current guidance from the EMHG and CPIC, which state that genetic testing alone cannot exclude MH susceptibility. Only 30–50% of MH-susceptible individuals have identifiable pathogenic variants, even when full sequencing is used^{6–9}. Furthermore, targeted panel testing captures only a minority of established MH-associated variants^{6,7}. Consistent with these limitations, the pharmacogenomics report specifically advised cautious interpretation and clinical correlation.

Given the severity of MMR and the absence of systemic MH signs, the patient was immediately managed as potentially MH-susceptible based on clinical presentation alone, consistent with current recommendations^{1,2,4,5,7,11,13}. The subsequent genetic testing results, although nondiagnostic, did not alter the clinical classification. Isolated succinylcholine-induced MMR remains a meaningful perioperative warning sign, and MH preparedness is required even when systemic manifestations do not develop^{1,2,4,5,12–15}. For her future surgery, a non-triggering anesthetic technique—monitored anesthesia care with extensive local anesthetic infiltration—was selected as the safest strategy for individuals with possible but unconfirmed MH susceptibility^{6–8,12–15}.

Conclusions

This case underscores the challenges in interpreting isolated MMR when systemic MH features are absent and when pharmacogenetic testing provides nondiagnostic results. Until more comprehensive diagnostic tools such as *in vitro* contracture testing or whole-gene sequencing become widely available, clinicians should interpret isolated MMR conservatively, recognize the diagnostic limitations of limited-panel genetic assays, and tailor anesthetic management to balance clinical safety with the residual uncertainty intrinsic to current MH diagnostics.

Ethical statement

Written informed consent for publication was obtained from the patient on 13 November 2025, and all identifying information was anonymized to protect patient confidentiality.

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