Case Report

# Malignant Hyperthermia Following Succinylcholine Administration: A Case Report

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**ABSTRACT**

This is a case of suspected malignant hyperthermia probably the 11th reported case in India and third from Kerala in the last 2 decades. Our patient is a 22-year-old female who was posted for emergency laproscopic ovarian cystectomy for left adnexal cyst torsion, masseter spasm was noted intra operatively after succinylcholine administration and the patient was intubated and connected to ventilator but continued to show increased ETCO2 60-70 mmHg intra-operatively. The temperature showed 37.8°C and a BP of 160/90, meanwhile other measure was taken to rule out other causes of hypercapnia. The surgery got over in 60 minutes and the $ETCO_2$ found close to normal towards the end of surgery. The hyper dynamic response was managed using nitroglycerin and beta blockers. After conferring adequate tidal volume and muscle power, patient was extubated in post operative ICU. Post operation was uneventful and the patient was discharged in stable condition. This is a good example of how the patient can be managed in the unavailability of the lifesaving antidote – Dantrolene and emphasizes the need to ensure adequate awareness among health professionals about this life threatening condition that is rarely found and reported in Indian population and the diagnostic and therapeutic measures that can be taken in such a situation.

**Keywords:** Malignant hyperthermia, Succynylcholine, Laproscopic ovarian cystectomy, Anesthetics.

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## INTRODUCTION

Malignant hyperthermia (MH) is a rare inherited disorder of skeletal muscle which can be triggered by all inhalational anesthetics (except nitrous oxide) and succinylcholine[1].

Due to the cellular defect involved, there is an abnormal calcium release from the sarcoplasmic reticulum of skeletal muscle. It is a potential disease and those carrying the gene are considered MH susceptible (MHS) because they are usually asymptomatic until exposed to a trigger[1].

The overall incidence of MH in literature is quoted to be 1:40,000 to 1:50,000 in adults and 1: 15,000 in children; however, incidence of masseter muscle rigidity has been reported to be less than 1% in children and in adults it is unknown[2].

The clinical signs that ensue from this exposure in susceptible individuals include hypercapnia, masseter muscle and / or generalized muscle rigidity, acidosis, peaked T waves that indicate hyperkalemia and hyperthermia that are caused by the dysregulated entry of myoplasmic calcium, which results in a hypermetabolic cascade involving sustained muscular contractures, depletion of adenosine triphosphate and muscle cell death[3].

### Case report

A 22 year old female who was diagnosed with dermoid cyst (a hamartoma- a non cancerous tumor made of an abnormal mixture of normal tissues and cells) in March 2021 and was advised to do surgery for the same in July 2021. Currently she was admitted with lower abdominal pain, vomiting and loose stools with no history of bleeding and fever. The patient was diagnosed with Ovarian dermoid cyst with suspected torsion after ultrasound scan and was kept nil per oral and planned for surgery if pain progresses. On the next day the patient was posted for Emergency laparoscopic left cystectomy under General Anesthesia (GA). The patient was given Inj Cefotaxim 1g Q12h and Inj Ranitidine 50 mg Q12h. Her baseline vitals in the OT were within normal range, pulse rate 80 b/min, blood pressure 140/80 mmHg, and saturation 99% on room air. In the theater she was premedicated with IV Glycopyrrolate 0.2mg and Midazolam 1mg and IV Fentanyl 50 mcg in titrated doses. After adequate preoxygenation, anaesthesia was induced with propofol 100 mg and check ventilation was done and succinylcholine 100mg was given followed by ventilation with oxygen and sevoflurane. After one minute laryngoscopy was done using Mackintosh blade which revealed inadequate relaxation and gave a Cormack Lehane (CL) grade 3. Patient was taken under more propofol and laryngoscopy done with Mc Coy's

laryngoscope and intubated with size 7 mm ID cuffed endotracheal tube with bougie assisted. ET tube fixed after confirming equal bilateral air entry and connected to ventilator. Anesthesia was maintained with 50% oxygen: 50% air and Fentanyl 50mcg repeated with sevoflurane and boluses of atracurium. Patient was positioned, draped and pneumoperitonium of 12 mmHg created and surgery started. Meantime intraoperative rising of ETCO2 noted. Malfunctioning of machine and causes of hypercapnia was ruled out. Meanwhile increased airway pressure noted. Kinking of ET tube due to jaw tightness (due to suspected masseter spasm) and compression of tube was identified. It was immediately relieved by using an oral airway and deepening of plane of anesthesia using propofol and atracurium. Sevoflurane was immediately discontinued. Patient was taken on Ambu bag to change the anesthesia machine. At the same time the surgery was almost over and further proceedings done.

The temperature was 37.8°C and the BP was 160/90mmHg and heart rate 120 beats/min. She was administered nitroglycerin and esmolol (for the hyperdynamic response) in view of the above event along with mechanical ventilation. Intraoperatively ABG was done and report showed respiratory acidosis [pH 7.08, $PO_2$ 464 mmHg, $PCO_2$ 93mmHg, Lactate 4 mmol/L, $HCO_3$ 27.6 mmol/ L $HCO_3$ std 21 mmol/L, BE -5.1, Na 134 mmol/L, K 4.1 mmol/L, CA-1.05 mmol/L] and sodium bicarbonate administered for the same. Ventilatory parameters were modified to control the hypercapnia and respiratory acidosis. Hypermetabolic crisis due to other causes such as thyroid storm, neuroleptic malignant syndrome, pheochromocytoma were ruled out by normal thyroid function test, and the patient not being on any antipsychotic drugs and having no history suggestive of pheochromocytoma. Intravenous hydrocortisone 100mg and dexamethasone 8 mg were given in addition to adequate ventilation and the surgery was completed in 60 minutes. The hyper dynamic response was managed using nitroglycerin and beta blockers.

Patient was shifted to post operation ICU on ventilation for further management. ABG was repeated in post operation ICU and found that the elevated $PCO_2$ values declined (ph 7.38, $PO_2$ 20$_3$ mmHg, $PCO_2$ 41 mmHg, Lactate 0.9 mmol/L, $HCO_3$ 24.3 mmol/ L, $HCO_3$ std 24.4 mmol/L, BE -0.8, Na 123 mmol/L, K 3.7 mmol/L, Ca-0.78 mmol/L and is shown in Table 1. After confirming adequate tidal volume and muscle power, patient was extubated post op. The patient was evaluated further under neurology consult and checked for urine myoglobin levels and CPK values. The CPK value was elevated to 3172 mU/ml (normal range-25-200 mU/ml) post operation (12/07//2021), 22310 mU/ml on (14/07/2021) after 48hrs, decreased to 8860 mU/ml on (15/07/2021) after 72hrs. The urine myoglobin on elevated to 179.70 mcg/L on (14/07/2021) (Normal range -0-1000mcg/L) after 48hrs and the urine colour was normal. SGOT was elevated to 404 U/L and SGPT to 124U/L on (15/07/2021) (normal upto 40U/L) after 72 hrs. LDH was elevated to 1420 U/L (Normal value 200- 400 U/L) on (14/07/2021) 48hrs and decreased to 1360 U/L on (15/07/2021) after 72hrs. Post op was uneventful and the patient and parents were counselled about the implications about this and to alert the anaesthesiologist if any future surgery needs to be done. She received Inj. Ceftriaxone sulbactum 1.5g postoperatively for 3 days, Calcium gluconate (10% in 10ml IV Q8h for one day) was given for calcium correction, Nebulisation with Duolin (Salbutamol+Ipratropium bromide) and Budecort (Budesonide) and other supportive care drugs. She was discharged in stable condition.

**Table 1**: ABG during and after surgery

| Clinical parameters | ABG during surgery | ABG after surgery |
|---|---|---|
| pH | 7.08 | 7.38 |
| $PO_2$ | 464mmHg | 203 mmHg |
| $PCO_2$ | 93mmHg | 41 mmHg |
| Lactate | 4mmol/L | 0.9 mmol/L |
| $HCO_3$ | 27.6mmol/L | 24.3 mmol/ L |
| $HCO_3$ std | 21mmol/L | 24.4 mmol/L |
| Base excess | 5.1 mmol/L | 0.8 mmol/L |
| Sodium | 134 mmol/L | 123 mmol/L |
| Potassium | 4.1 mmol/L | 3.7 mmol/L |
| Calcium | 1.05 mmol/L | 0.78 mmol/L |

**Diagnosis**

Diagnosis of malignant hyperthermia is based on clinical parameters at the time of crisis which is later confirmed by muscle biopsy test. The in vitro halothane caffeine contraction test is considered as the gold standard test to detect malignant hyperthermia. This test has to be done after 3 months of hypermetabolic crisis[4].

In India, there is no center where in vitro halothane caffeine contraction test can be performed to confirm diagnosis in suspected cases[4].

Larach et al. described a scoring system to label a patient of hypermetabolic crisis as malignant hyperthermia using different patient parameters during this crisis[5].

**Table 2**: Malignant hyperthermia grading score[5]

| Clinical indicators | Points | Our patient (Y/N) |
|---|---|---|
| Process 1 Muscle rigidity | | |
| Generalized rigidity | 15 | N |
| Masseter rigidity | 15 | Y |
| Process II: Myonecrosis | | |
| Elevated CK >20,000 (after succinylcholine administration) | 15 | Y |
| Elevated CK >10,000 (without exposure to succinylcholine) | 15 | N |
| Cola-colored urine | 10 | N |

| | | |
|---|---|---|
| Myoglobin in urine >60 mg/L | 5 | Y |
| Blood/plasma/serum K+ >6 mEq/L | 3 | N |
| Process III: Respiratory acidosis | | |
| PETCO2 >55 with controlled ventilation | 15 | Y |
| PACO2 >60 with controlled ventilation | 15 | N |
| $PETCO_2$ >60 with spontaneous ventilation | 15 | N |
| Inappropriate hypercarbia | 15 | N |
| Inappropriate tachypnea | 10 | N |
| Process IV: Temperature increase | | |
| Rapid increase in temperature | 15 | N |
| Inappropriate temperature >38.8°C in perioperative period | 10 | N |
| Process V: Cardiac involvement | | |
| Inappropriate tachycardia | 3 | N |
| Ventricular tachycardia or fibrillation | 3 | N |
| Others | | |
| Arterial base excess more negative than−8 mEq/L | 10 | N |
| Arterial pH <7.25 | 10 | Y |
| Rapid reversal of malignant hyperthermia signs of metabolic and/or respiratory acidosis with IV dantrolene | 10 | N |
| IV: Intravenous; CK: Creatine kinase | | |

According to this grading as in Table 2, a patient with a score >50 points is definitely a case of malignant hyperthermia. Our patient had score of 60 which is suggestive of malignant hyperthermia.

Causality was assessed using WHO UMC scale and found to be Probable, Hartwig's severity assessment scale as Moderate and Naranjo ADR probability scale found to be Probable.

The specific antidote for this condition is Dantrolene, it is a direct acting muscle relaxant[6]. There would be a rapid resolution of symptoms like hyperthermia, dysrhythmias, muscle rigidity, tachycardia, hypercapnia, metabolic acidosis and normalization of myoglobinuria and elevated CPK levels.

Dantrolene is dosed at 2.5mg/kg as a rapid IV bolus and a maintenance dose of 1mg/kg IV every Q4-Q6 hrs, it is to be reconstituted in 60 mL of sterile water for injection and given as a rapid IV push. It is available in vials of 20 mg each. The most common adverse drug reactions are skeletal muscle weakness and phlebitis. Also dantrolene is not freely available in the Indian markets and is stored only in few hospitals in major cities. Among the cases reported of suspected of malignant hyperthermia in India almost 50% have survived the condition despite nonavailability of dantrolene, which emphasizes the need for early detection and aggressive management in these cases[4].

## DISSCUSSION

First case of malignant hyperthermia in India was reported in 2001 by Punj et al.[2] patients developed a gradual increase in heart rate, $PaCO_2$, temperature 44°C, pH 7.17, bicarbonate concentration 19.7 mmol/L, potassium concentration 6 mmol/L, and creatine kinase concentration 29,900 IU/L. Followed by disseminated intravascular coagulation with hematuria and patient died 12 h after the initial episode.

Similar cases were reported by Gupta et al. [7] and Pillai et al. [8] who passed away in spite of aggressive supportive measures. Saxena and Dua[9] and Gopalakrishnan et al.[10] also reported cases who survived the episode of malignant hyperthermia without use dantrolene which was similar to our case where the specific antidote was not available and was treated symptomatically and the patient recovered the condition and got discharged in stable condition. In our case the onset of spasm was slow and the patient recovered with adequate IV medications and ventilation without the use of dantrolene.

## CONCLUSION

Currently, in India, there is no center where in vitro halothane caffeine contraction test can be performed to confirm diagnosis in suspected cases[2]. So, it is difficult to confirm the diagnosis of malignant hyperthermia in our case, only clinical diagnosis of the event can be made which further emphasises the need for diagnostic testing measures and the availability of the specific antidote dantrolene. It furthermore necessitates education among health care professionals about this life threatening condition and the possible treatment options that can be provided in case of unavailability of the antidote. In our case the specific antidote was not available and the patient was treated symptomatically.

**Source of Support and Conflicts of Interest**

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