Case Report

A case report of suspected malignant hyperthermia where patient survived the episode

ABSTRACT

Malignant hyperthermia is rare inherited disorder in our part of the world; there are only few cases reported in literature in India who were suspected of having this condition. The overall incidence of malignant hyperthermia during general anesthesia is estimated to range from 1: 5000 to 1: 50,000–100,000 and mortality rate is estimated to be <5% in the presence of standard care. In India, there is no center where *in vitro* halothane caffeine contraction test is performed to confirm diagnosis in suspected cases. Second, dantrolene drug of choice for this condition is not freely available in market in India and is stored only in some hospitals in few major cities. Among the cases reported of suspected of malignant hyperthermia in India almost 50% have survived the condition despite nonavailability of dantrolene emphasizing role of early detection and aggressive management in these cases.

Key words: Caffeine; contraction; dantrolene; halothane; malignant hyperthermia

Introduction

Malignant hyperthermia is a relatively rare disease in India with very few case reports present in the literature in this regard. Malignant hyperthermia was brought into attention for anesthetic world by deaths attributable to general anesthetics in a family living in Melbourne, Australia.[1] Incidence of malignant hyperthermia during general anesthesia is estimated to range from 1: 5000 to 1: 50,000–100,000.[2,3] The mortality rate is estimated to be <5%, with early detection of malignant hyperthermia episode, using capnography, prompt use of the drug dantrolene, and the introduction of diagnostic testing.[2]

Case Report

We present a case report of a 45-year-old female operated for parotid tumor presenting with features suspected of malignant hyperthermia. On preanesthetic evaluation, patient had no comorbid condition was not on any drugs had no previous anesthetic exposure. She was suspected to have difficult airway in view of swelling due to tumor and mallampati Grade 3. On the day of surgery, venous access was established minimum basic monitoring was attached to the patient. Her blood pressure was 130/80 mmHg, heart rate 78 beats/min and oxygen saturation were 98% on the operation table on the day of surgery.

Anesthesia was induced on propofol and suxamethonium and ventilated with oxygen and halothane. Laryngoscopy was difficult due to masseter rigidity attributed to suxamethonium; patient was intubated with size 7.5 ID cuffed polyvinyl endotrachial tube and connected to ventillator. The

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patient was given morphine for analgesia; anesthesia was maintained with 50% oxygen: 50% nitrous oxide and isoflurane with boluses of atracurium.

Ten minutes into surgery a rising trend in endtidal CO_2 was noticed, initially, adjustment in minute ventilation, circuit check, sodalime replacement was done, but endtidal CO_2 continued to rise with maximum rise of endtidal to 80 mmHg. There was associated rise in temperature with maximum reading of 104 F recorded by nasopharyngeal probe. The patient also had risen in heart rate and blood pressure with maximum reading of 150 beats/min and 180 mmHg, respectively. Suspecting malignant hyperthermia isoflurane was stopped propofol infusion was started, and patient was ventilated with 100% oxygen through a fresh banes circuit using higher gas flows and higher minute ventilation.

Surgeon was informed and asked to expedite surgery. Active cooling was started with ice cold saline intravenously and irrigation through Ryles tube and bladder catheter. Ice packs and cold towels were used for surface cooling to control the rising temperature. Blood gas sample at this time showed the following result: pH-7.12, pCO_2-96 mmHg, pO_2-224 mmHg, base excess-6, HCO_3-20 mEq/L, Na-142 mEq/L, and K-5.5 mEq/L suggestive mixed respiratory and metabolic acidosis. Patient's other tests done intraoperatively were creatinine kinase −1300 IU LDH-120 IU, blood urea-20 mg%, s.creatinine-1.2 mg%, blood sugar 138.9 mg%. Patient also showed features of rigidity in limbs along with mottling. Dantrolene drug of choice for malignant hyperthermia could not be used due nonavailability of the drug in our hospital.

With active cooling patients temperature stabilized and then started to drop toward normal. With high minute ventilation and higher flows end tidal and $PaCO_2$ were also controlled and then started to drop. Surgery was completed within 2 h and patient was shifted to Intensive Care Unit for postoperatively management. Blood samples including thyroid function test and urine for myoglobin sent from Intensive Care Unit were within normal limits. The patient was extubated after 2 h of ventilation once endtidal CO_2 temperature and acid-base status returned to normal and patient achieved criteria for extubation.

Patient and her attendants were made aware of suspected diagnosis of malignant hyperthermia in her and risks of recurrence in the patient and other family members on future exposure to anesthesia. The episode was also mentioned in anesthesia record of the patient for future reference.

Discussion

Malignant hyperthermia is a myopathy associated with abnormal skeletal muscle calcium homeostasis in response to triggering agents such as succinylcholine and halothane. Sustained high levels of calcium in sarcoplasmic reticulum lead to increased aerobic and glycolytic metabolism leading to acidosis, rigidity, altered permeability, and hyperkalemia.[4] Diagnosis of malignant hyperthermia is based on clinical parameters at the time of crisis which is later confirmed by muscle biopsy test.

Larach *et al*.[5] described a scoring system to label a patient of hypermetabolic crisis as malignant hyperthermia using different patient parameters during this crisis [Tables 1 and 2]. According to this grading, a patient with a score >50 points is definitely a case of malignant hyperthermia. Our patient had a score of 68 points [Table 3] which was highly suggestive of malignant hyperthermia in this patient. Furthermore, other causes of hypermetabolic crisis such as thyroid storm, neuroleptic malignant syndrome, and pheochromocytoma were ruled out by normal thyroid function test, patient not being on any antipsychotic drugs and having no history suggestive of pheochromocytoma.

Table 1: Malignant hyperthermia clinical grading scale[5]

Clinical indicators	Points
Muscle rigidity	
Generalized rigidity	15
Masseter rigidity	15
Process II: Myonecrosis	
Elevated CK >20,000 (after succinylcholine administration)	15
Elevated CK >10,000 (without exposure to succinylcholine)	15
Cola-colored urine 10	
Myoglobin in urine >60 mg/L	5
Blood/plasma/serum K^+ >6 mEg/L	3
Process III: Respiratory acidosis	
$PETCO_2$ >55 with controlled ventilation	15
$PACO_2$ >60 with controlled ventilation	15
$PETCO_2$ >60 with spontaneous ventilation	15
Inappropriate hypercarbia	15
Inappropriate tachypnea	10
Process IV: Temperature increase	
Rapid increase in temperature	15
Inappropriate temperature >38.8°C in perioperative period	10
Process V: Cardiac involvement	
Inappropriate tachycardia	3
Ventricular tachycardia or fibrillation	3
Others	
Arterial base excess more negative than−8 mEq/L	10
Arterial pH <7.25	10
Rapid reversal of malignant hyperthermia signs of metabolic and/or respiratory acidosis with IV dantrolene	5

IV: Intravenous; CK: Creatine kinase

Table 2: Clinical significance of malignant hyperthermia raw score and its rank[5]

Raw score	Malignant hyperthermia rank	Description of likelihood
0	1	Almost never
3-9	2	Unlikely
10-19	3	Somewhat less than likely
20-34	4	Somewhat greater than likely
35-49	5	Very likely
50+	6	Almost certain

Table 3: Malignant hyperthermia score in patient

Clinical Indicator	Points
Arterial $PaCO_2$ >60 mmHg with appropriately controlled ventilation	15
$PETCO_2$ >55 with controlled ventilation	15
Rise in temperature >39.9°C (104°F) in perioperative period	10
Arterial blood pH <7.25	10
Inappropriate tachycardia	3
Masseter spasm shortly following succinylcholine administration	15
Total score	68

For definitive diagnosis of malignant hyperthermia *in vitro* halothane caffeine contraction test is used.[6] This test has to be done after 3 months of hypermetabolic crisis[7] genetic research into the condition implicate the ryanodine receptor gene (RYR1) located on chromosome 19[8,9] as cause of malignant hyperthermia. DNA testing is now used routinely for diagnosis before muscle biopsy when a familial RYR1 mutation is known.[10]

First case of malignant hyperthermia in India was reported in 2001 by Punj *et al*.[11] patient 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*.[12] and Pillai *et al*.[13] who succumbed in spite of aggressive supportive measures.

Saxena and Dua[4] and Gopalakrishnan *et al*.[14] also reported cases who survived the episode of malignant hyperthermia without use dantrolene as was the case in our patient.

Currently, there is no center in India which performs IVHCT, so we were not able to offer it to the patient in order to confirm the diagnosis of malignant hyperthermia. Dantrolene, the drug of choice for this disease, is not freely available in market is stocked in only few hospitals in our country. Hence, could not be used in this patient as it was not available in our hospital. Although license for import of dantrolene can be obtained within few days dantrolene is not available in market due to its limited use, its cost, and storage facility needed for the drug.

Since more cases of malignant hyperthermia have been recorded in people of Indian subcontinent descent in the United Kingdom than in India, this discrepancy may suggest lack of essential monitoring, as may be the case in some peripheral centers and nonavailability of accredited diagnostic center for diagnosis.[5]

Conclusion

Time has come for more awareness about possibility of malignant hyperthermia in our patient as early awareness and proper management even in the absence of dantrolene can improve survival in these patients. Furthermore, diagnostic center for diagnosis of malignant hyperthermia must be made available, and dantrolene must be kept available at many more hospitals so that these patients could have best chance of survival.

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Conflicts of interest
There are no conflicts of interest.

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