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

ABSTRACT
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. Incidence of malignant hyperthermia during general anesthesia is estimated to range from 1: 5000 to 1: 50,000–100,000. 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.

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. Incidence of malignant hyperthermia during general anesthesia is estimated to range from 1: 5000 to 1: 50,000–100,000. 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.

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 ventilator. The

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

How to cite this article: Iqbal A, Badoo S, Naqeeb R. A case report of suspected malignant hyperthermia where patient survived the episode. Saudi J Anaesth 2017;11:232-5.

Asif Iqbal, Shoaib Badoo, Ruqsana Naqeeb
Department of Anaesthesiology and Critical Care, SMHS Hospital, GMC, Srinagar, Jammu and Kashmir, India
Address for correspondence: Dr. Asif Iqbal, 36, Ram Bagh Extension, Near Noorani Masjid, Srinagar - 190 015, Jammu and Kashmir, India.
E-mail: bazazasif@yahoo.com
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\textsubscript{2} was noticed, initially, adjustment in minute ventilation, circuit check, sodalime replacement was done, but endtidal CO\textsubscript{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\textsubscript{2}=96 mmHg, pO\textsubscript{2}=224 mmHg, base excess-6, HCO\textsubscript{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\textsubscript{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 also controlled 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\textsubscript{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. 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. 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

| Clinical indicators | Points |
|--------------------|--------|
| Muscle rigidity    | 15     |
| 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 mEq/L | 3 |
| Process III: Respiratory acidosis |        |
| PETCO₂ >55 with controlled ventilation | 15 |
| PACO₂ > 60 with controlled ventilation | 15 |
| PETCO₂ >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
Almost never

Somewhat less than likely

Somewhat greater than likely

Almost certain

Table 3: Malignant hyperthermia score in patient

| Clinical Indicator | Points |
|--------------------|--------|
| Arterial PaCO₂ > 60 mmHg with appropriately controlled ventilation | 15 |
| PETCO₂ > 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. This test has to be done after 3 months of hypermetabolic crisis genetic research into the condition implicates the ryanodine receptor gene (RYR1) located on chromosome 19 as cause of malignant hyperthermia. DNA testing is now used routinely for diagnosis before muscle biopsy when a familial RYR1 mutation is known.

First case of malignant hyperthermia in India was reported in 2001 by Punj et al., patient developed a gradual increase in heart rate, PaCO₂, 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. and Pillai et al. who succumbed in spite of aggressive supportive measures.

Saxena and Dua and Gopalkrishnan et al. 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 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.

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.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Denborough MA, Lovell RR. Anaesthetic deaths in a family. Lancet 1960;276:45.
2. Rosenberg H, Davis M, James D, Pollock N, Stowell K. Malignant hyperthermia. Orphanet J Rare Dis 2007;2:21.
3. Rosero EB, Adesanya AO, Timaran CH, Joshi GP. Trends and outcomes of malignant hyperthermia in the United States, 2000 to 2005. Anesthesiology 2009;110:89-94.
4. Saxena KN, Dua CK. Malignant hyperthermia a case report. Indian J Anaesth 2007;51:534-5.
5. Larach MG, Localio AR, Allen GC, Denborough MA, Ellis FR, Gronert GA, et al. A clinical grading scale to predict malignant hyperthermia susceptibility. Anesthesiology 1994;80:771-9.
6. Gupta PK, Hopkins PM. Editorial Malignant hyperthermia in India. Anaesthesia 2010;65:1059-68.
7. A protocol for the investigation of malignant hyperpyrexia (MH) susceptibility. The European Malignant Hyperpyrexia Group. Br J Anaesth 1984;56:1267-9.
8. McCarthy TV, Healy JM, Heffron JJ, Lehane M, Deufel T, Lehmann-Horn F, et al. Localization of the malignant hyperthermia susceptibility locus to human chromosome 19q12-13.2. Nature 1990;343:562-4.
9. MacLennan DH, Duff C, Zorzato F, Fujii J, Phillips M, Korneluk RG, et al. Ryanodine receptor gene is a candidate for predisposition to malignant hyperthermia. Nature 1990;343:559-61.
10. Urwyler A, Deufel T, McCarthy T, West S; European Malignant Hyperthermia Group. Guidelines for molecular genetic detection of susceptibility to malignant hyperthermia. Br J Anaesth 2001;86:283-7.
11. Punj J, Bhatnagar S, Saxena A. Malignant hyperthermia in the Indian...
subcontinent: Non-availability of dantrolene a cause for concern. Internet J Pharmacol 2001;1:1. [Doi.org/10.5580/1a7].
12. Gupta D, Ramakant, Singh PK. Postoperative hyperpyrexia: Retracing malignant hyperthermia. J Anaesthesiol Clin Pharmacol 2012;28:405-6.
13. Pillai VS, Koshy RC, Balakrishnan M, Ramakrishnan R. Egypt J Anaesth 2015;31:81-3.
14. Gopalakrishnan CV, Suparna B, Arun V. A rare case of malignant hyperthermia in the Indian subcontinent. Anaesthesia 2010;65:1141-2.