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AN INVESTIGATIONAL CASE STUDY ON MDMA AND ATRACURIUM INDUCED MALIGNANT HYPERTHERMIA

Anaesthesiology

Jiji K Department of clinical pharmacy, IQRAA International Hospital And Research Centre, Calicut

Neethu M Shaji Department of clinical pharmacy, IQRAA International Hospital And Research Centre, Calicut

ABSTRACT

A 27 year old male was scheduled to undergo open reduction and internal fixation (ORIF) with PHILOS plate for left shoulder proximal humerus fracture. Aneasthesia was induced with atracurium. Patient developed tachycardia and fall in saturation within 20 minutes, which was managed conservatively and procedure was continued. During intraoperative period patient developed muscle rigidity on left hand along with hypotension and hyperthermia, which confused the surgeon and anesthesiologist whether it is attributed to the drug or some other genetic factors. Patient underwent first episode of cardiac arrest after 45 minutes induction of general anaesthesia. He was resuscitated but developed second episode of cardiac arrest after a few minutes. Patient was shifted to MICU, all supportive and resuscitation measures were given. Despite all resuscitative measures, patient could not be revived and expired on post op day 2. Later on postmortem report revealed presence of 3,4-methylenedioxymethamphetamine (MDMA) in blood and body fluids. There has only been one evidence of atracurium induced malignant hyperthermia reported before, but the probablity of devoloping hyperthermia in this case was probably high. The aim of this study was to investigate whether MDMA or Atracurium is a trigger of malignant hyperthermia in this patient.

KEYWORDS

Malignant hyperthermia. Atracurium. MDMA

INTRODUCTION

Malignant hyperthermia is a skeletal muscle disorder characterized by respiratory acidosis, hyperthermia and muscular rigidity that develops after receiving certain anesthetic agents or neuromuscular blocking agents. Depolarizing neuromuscular blocking agents are known to cause malignant hyperthermia. However, there are few reported cases associated with non-depolarizing agents. Hyperthermia is a severe complication associated with the recreational use of 3,4-methylenedioxymethamphetamine (MDMA) commonly known as “ecstasy”. It is a ring-substituted amphetamine derivative with stimulant and hallucinogenic properties, used as a popular "recreational drug" . Effects, for which such a psychoactive substance isusually used by young people, are experiences of a relaxed, euphoric state characterized byincreased empathy, openness, communication, and tranquility. Although MDMA is often considered as being a “safe”drug, use of this stimulant is associated with significant morbidity and mortality. The side-effects of ecstasy vary from mild to severe, potentially life-threatening. Mild clinical symptoms and signs seen with MDMA are tachy-cardia, mydriasis, feeling of dry mouth, profound sweating, and bruxism(jaw clenching). Severe adverse reaction as hyperthermia, seizures, hypertensive crises, cardiac dysrhythmias, metabolic disturbances, disseminated intravascular coagulation (DIC), rhabdomyolysis,acute kidney or liver failure, cerebrovascular episodes, psychiatric disturbances, or accidents/ injuries can lead to fatalities related to MDMA intoxication.

Case study

A 27 year old male patient admitted under orthopaedics department , with the histroy of road traffic accident and was diaganosed with left shoulder proximal humerus fracture. Patient was not having any other medical and medication history as well as any other comorbid conditions. He was sheduled for open reduction and internal fixation(ORIF) with PHILOS plate on the 3rd day of admission because he was presented with edema at surgical site. He was pre-oxygenated with 100% oxygen for 3min, anesthesia was induced with Inj. Fentanyl 100mcg, Inj. Propofol 50+30mg , bag mask ventilation (O_2/ N_2 O)started with Inj. Atracuriuam 40mg followed by Inj. Xylocard 60mg . During surgery 10mg of actracuriuam was given as maintance dose for every 30 min. After 30mins patient exhibited tachycardia(HR: 132/min) and an episode of desaturation(100-97-95-85-80-95-97-100%) , it was resolved with continuing 100% O_2 and discontinuing N_2O. But tachycardia was still persisting and Inj. Propofol 30mg IV, Inj. Actracurium 5+5mg and Inj. Metoprolol 1+1mg IV were given . Again another episode of desaturation was noted. Ventilation continued with 100% O_2 along with Isoflurane, saturation was restored. Procedure was continued, but surgeon noted muscle rigidity and faced dificulty in fixing PHILOS plate. Inj. Atracurium 5+5mg was repeated and noted 3rd episode of desaturation , tachycardia and blood pressure went high (160/90mmHg), generalized muscle rigidity, increased body temparature (102-103^0 C) and $EtCO_2$ noted as greater than 220. Isoflurane was discontinued since this symptoms atributed to malignant hyperthermia. In this case the only anesthetic drug that has a possibility to trigger maliganant hyperthermia was Isoflurane, so it was discontinued and circuit was changed. Ventilated patient with 100% O_2 and saturation picked up. Patient had respiratory acidosis, as $EtCO_2$ greater than 220. The chances of occuring hyperkalemia was high since patient had acidosis and it was maitanined with Inj. Calcium, gluconate 10mg IV over 10mins, insulin-dexstrose infusion started Inj. Bicarbonate 50+50mg Intravenously given. The surgical site was closed immediately, patient underwent first episode of cardiac arrest after 45 minutes induction of general anaesthesia. He was resuscitated but developed second episode of cardiac arrest after a few minutes. Patient was shifted to MICU, all supportive and resuscitation measures were given with noradrenaline and Dopamine. Patient developed disseminated intravascular coagulation and multi-organ failure. Multiple vasopressors has been given but, patient did not respond. He was expired on day 2 of post OP. Malignant hyperthermia can be precipitated with many factors but here the suspections are use of anaesthetic drug, genetic factors and MDMA, since patient had previous history of MDMA misuse.This case is under investigation to rule out the cause of malignant hyperthermia.

DISCUSSION

Malignant hyperthermia should be suspected even in the presence of a single suggestive clinical feature in those who have received any triggering agent, like Isoflurane, Atracurium, Genetic factors and 3,4-methylenedioxymethamphetamine (MDMA) as delayed treatment can have adverse outcomes, including disseminated intravascular coagulation and increased mortality. Treatment must be started emergently with discontinuation of the inciting agent and administration of dantrolene, which is known to reverse the process within minutes[1]. In Indian scenarion dantrolene is not widly used due to its high price and even though cases of malignant hyperthermia with atracurium have not been reported in the past. Similarly, 3,4-Methylenedioxymethamphetamine (MDMA, "ecstasy") can mediate acute toxic effects such as muscle rigidity, metabolic acidosis, and hyperthermia. Because of close clinical similarities, an association between MDMA intoxication and malignant hyperthermia (MH) was suggested[2]. In most cases, the gene that puts you at risk of malignant hyperthermia is inherited, though sometimes it's the result of a random genetic change. Genetic testing can reveal whether you have an affected gene. MH is usually determined by a history of a family member developing a positive episode during general anesthesia and then confirmed by an invasive caffeine halothane contracture test (CHCT)[3].

CONCLUSION

There remains an ethical question. In spite of the rarity of MH are we justified in providing anaesthetic services without stocking Dantrolene to deal with that one case occurring once in a decade knowing that MH is potentially lethal and also there should be measures to check the presence of drugs like MDMA before administration of any anesthetic agents.

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