CASE REPORT

Sudden cardiac arrest during induction of anaesthesia in paediatric patient with glutaric aciduria type II

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ABSTRACT

Glutaric aciduria type II (GA2) is an autosomal recessive metabolic disorder of amino acid and lipid metabolism, which is serious and rare. The most serious form is seen in early infancy and is associated with very high mortality rates. Here, we present an 8-month-old male patient with GA2 who had electrocardiographic ST segment depression and sudden cardiac arrest at 10th minute of emergency operation (central venous catheter placement). There is a very scarce amount of data in the literature about anaesthetic management of GA2 patients. There is also no previously published report about cardiac arrest during induction of anaesthesia in this condition. The present report highlights this serious complication.

KEYWORDS

Glutaric aciduria type II; Anaesthesia; Cardiac arrest.

INTRODUCTION

Glutaric aciduria type II (GA2) is also known as multiple acyl-coenzyme A dehydrogenase deficiency (MADD) and is caused by defects of electron transfer flavoprotein (ETF) or ETF ubiquinone oxidoreductase (ETFQO) [1]. The signs and symptoms can vary widely depending on the age of onset and severity of the condition in each affected individual [2]. The presented patient was diagnosed as GA2 with metabolic crisis and characteristic odour resembling sweaty feet at newborn period. During the emergency operation of central venous catheter placement, we recorded fatal arrhythmias soon after the induction of anaesthesia which ended with cardiac arrest. This case is worth presenting to emphasise the difficulty of anaesthesia management in inborn metabolic diseases.

CASE REPORT

An 8-month-old male patient who was diagnosed with GA2 since newborn period has been

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hospitalised because of excessive vomiting for the past 24 hours and somnolence. He was the second living child of the family who are second-degree relatives. His parents informed that they lost two sons because of the GA2. Plasma acylcarnitine profile revealed the elevated concentrations of C4–C18 species in a pattern consistent with a biochemical diagnosis of GA2, postnatally. He was under low fat, low protein and high carbohydrate diet, with L-carnitine and riboflavin supplementation. He had no history of any neurologic pathology. His physical examination revealed head circumference of 43 cm (–1.1 SD), height of 69 cm (–0.3 SD), body weight of 7 kg (–1.5 SD), severely deteriorated general condition, confused consciousness, tachypnoea, abdominal distention and hepatomegaly. Initial laboratory results revealed increased transaminases (AST: 124 IU/l [normal 5–51] and ALT: 93 IU/l [normal 16–87]), mild hyperammonaemia (111 μ mol/l [normal 15–35]), mild metabolic acidosis (arterial blood: pH 7.2, PaCO₂: 34.1 mmHg, bicarbonate: 10.2 mmol/l, base gap: –11.2 mmol/l and lactate: 4.2 mmol/l), white blood cell count of 10.8×10^9 /l with 54% neutrophils, 42% lymphocytes, 3.5% monocytes and creatinine kinase 449 IU/l. Echocardiogram revealed left ventricular hypertrophy and tricuspid insufficiency. Telecardiogram revealed very enlarged heart. There was no peripheral venous access, so the patient was scheduled for emergency operation of central venous catheter placement under general anaesthesia. He was transferred to operation room without any premedication. In the operation room, we monitored and administered mask oxygen during monitorization (spO₂: 88%, heart rate: 177 beats/minute and blood pressure: 65/40 mmHg). After adequate preoxygenation, anaesthesia induction involved only 6%–8% sevoflurane inhalation. After induction, we opened peripheral venous access with intravenous (iv) branule and started iv fluid infusion. The patient had still spontaneous respiration during these procedures. Then, we administered iv 1 mg/kg propofol, 0.5 mcg/kg remifentanyl and 1 mg/kg rocuronium. After first minute, crush intubation was performed. After endotracheal intubation, hemodynamic vital signs were all stable. However, ST-segment depression was recorded at 10th minute. At the same time,

bradycardia was recorded (70 beats/minute). We administered atropine. Then, we could not detect the heart rate or blood pressure. Cardiac arrest was recorded. We started cardiopulmonary resuscitation (external thoracic compressions with heart massage). At the second minute of cardiopulmonary resuscitation, iv adrenaline 0.01 mg/kg was administered. Then, rhythm turned to pulseless ventricular tachycardia (VT). Consequently, we defibrillated with 4 j/kg. At the 10th minute of cardiopulmonary resuscitation, rhythm turned to sinus rhythm. Then, j-guide was advanced during the right internal jugular vein catheterisation process. Again, rhythm turned to ventricular fibrillation and pulseless VT. However, the patient did not respond to defibrillation, amiodarone, magnesium or other efforts. Eventually, rhythm turned to asystole after 60 minutes of continuous cardiopulmonary resuscitation, and then, the patient was declared dead.

DISCUSSION

ETF and ETFQO carry electrons to the respiratory chain from multiple FAD-linked dehydrogenases. These include enzymes of amino acid and choline metabolism in addition to the acyl-CoA dehydrogenases of β -oxidation. ETF and ETFQO defects lead to GA2, also known as MADD [1,2]. It is a clinically heterogeneous disorder ranging from a severe neonatal presentation with metabolic acidosis, cardiomyopathy and liver disease to a mild childhood/adult disease with episodic metabolic decompensation, muscle weakness and respiratory failure. There is usually an odour of sweaty feet. Patients with GA2 fall into three broad clinical phenotypes: (1) neonatal onset with congenital anomalies, (2) neonatal onset without anomalies (together called MADD-severe) and (3) mild and/or late onset (MADD-mild). Severely affected patients present in the first few days of life with hyperammonaemia, hypoketotic hypoglycaemia and acidosis accompanied by hypotonia. Most of them died during the first week(s) of life, but some have survived for several months, usually dying with severe cardiomyopathy [3,4]. The patient was diagnosed as GA2 with hypoketotic hypoglycaemia, mild hyperammonaemia and

odour of sweaty feet at the second day of life. There was no congenital anomaly.

GA2 anaesthesia management does not rely on a single scheme or method. There is very scarce information in literature about paediatric anaesthesia management of this specific disease [4–6]. In literature, we found information mostly about late-onset form, which are mainly sporadic case reports [5–9]. Volatile anaesthetic agents are reported to be used smoothly in late-onset form; nevertheless, one patient was reported to have malignant hyperthermia [4–6,9]. Inhalational anaesthetics decrease intracellular calcium concentration. Inhalational anaesthetics also inhibit sodium-calcium exchange mechanism which leads to myocardial depressant effect with lactic acidosis [5–9]. We had to use sevoflurane for induction because there was no intravenous route. Nevertheless, we administered propofol before fatal arrhythmias and propofol do not have myocardial depressant effect. Indeed, propofol is known to be cardioprotective according to the latest animal studies. In the case of lower blood pressure, intravenous (iv) administration rate of propofol should be decreased because faster iv administration may rarely lead to severe bradycardia and serious complications [10].

There are previous studies which show arrhythmias in this patient group during intensive care unit monitorization; however, those arrhythmias were not associated with anaesthesia management. Sudden acute events may cause cardiac dysfunction which eventually ends up with fatal arrhythmias and death [4,8,9]. Primary fatty acid oxidation defects lead to insufficient usage of long-chain fatty acids which constitute the heart primary energy source. Therefore, insufficient usage of long-chain fatty-acids may cause cardiomyopathy-associated dysrhythmias and lethal arrhythmias. Cardiomyopathy develops more likely due to defective fatty acid oxidation. Furthermore, there are some case reports that glutaric acidemia patients develop cardiomyopathy as well [4,6,7,9]. In this case, there is a pre-operative echocardiography which shows left ventricular hypertrophy and tricuspid insufficiency. Furthermore, pre-

operative telecardiogram showed an increased cardiothoracic ratio, which points out that the patient might also have cardiomyopathy as well.

We believe that cardiac toxicity and hemodynamic instability may be due to anaesthetic induction agents such as sevoflurane, propofol, remifentanyl and rocuronium in GA2 patients. This patient group has a high risk of sudden death and unexpected cardiorespiratory events.

CONCLUSION

Anaesthetic management of high-risk patients such as GA2 may be challenging because of high morbidity and mortality rates. Operation indications should be revised considering the risks and complications in high-risk patients such as GA2.

CONFLICTS OF INTEREST

There are no conflicts of interest.

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ETHICS

Informed consent for participation and publication of medical details was obtained from the parents of this child. Ethics clearance and approval of the study were granted from Eskisehir Osmangazi University Faculty of Medicine.

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