Suxamethonium Apnoea: The Forgotten Episode in Current Practice

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We present the first case in Bahrain of suxamethonium apnea in a parturient for an emergency Cesarian section. Immediate onset of action, optimal intubating conditions and rapid recovery are the key features that promote the use of suxamethonium. Suxamethonium apnea is critical and occurs in patients with pseudocholinesterase (PChE) deficiency either inherited or due to an acquired cause. Early suspicion of suxamethonium apnea and appropriate management with adequate sedation and mechanical ventilation whilst waiting for spontaneous recovery are all essential for a successful outcome.

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Succinylcholine apnea is one of the known documented adverse events following suxamethonium use for securing the airway. Although the documented duration of action of the drug is 5 to 13 minutes, it may cause an apnea up to several hours in individuals with reduced pseudocholinesterase activity. It is metabolized in the bloodstream by the enzyme pseudocholinesterase (PChE), which is produced by the liver[1]. Patients with an abnormal PChE level are incapable of metabolizing suxamethonium, resulting in prolonged muscle paralysis[2]. The causes of suxamethonium apnea are either hereditary from an autosomal recessive disorder or acquired through various diseases and drugs.

The aim of this report is to present a case of suxamethonium apnea in a parturient who underwent Cesarian section. The cause was most likely hereditary.

THE CASE

A twenty-two-year-old full-term pregnant woman presented to the Emergency Department with a history of abdominal pain and watery vaginal discharge. The patient was hemodynamically stable. She had a history of gestational diabetes mellitus with no known allergies and had no previous surgeries. She was labelled Category 1 Cesarian-section, extremely urgent because of fetal distress[3].

The Cesarean section was performed under general anesthesia. Rapid sequence induction was achieved with 200 mg of propofol and 100 mg of succinylcholine. Ten minutes after induction, 25 mg atracurium was administered to provide continued muscle relaxation after the normal cessation of the suxamethonium effect. Anesthesia was maintained with sevoflurane in oxygen and air mixture to achieve a minimum alveolar concentration (MAC) of 1.0.

The Cesarean section was uneventful. Intraoperatively, the patient received 5 mg of morphine, paracetamol 1 gm and 100 mg of diclofenac rectally for intraoperative and postoperative analgesia. At the end of surgery, sevoflurane was discontinued and the patient was given glycopyrrolate (0.01 mg/kg) and neostigmine (0.05 mg/kg) for reversal of residual neuromuscular block. The patient did not achieve motor recovery as expected. Her respiratory efforts were feeble and inadequate. Her motor power (limbs) was grade two of five. Her pupils were constricted; hence, 50 microgram naloxone was administered to rule out morphine overdosage. However, the patient showed no improvement. A nerve stimulator was attached to the patient to assess the train of four ratios, which were between 35% to 40%, indicating only partial recovery from the muscle relaxant. A suspicion of suxamethonium-induced apnea was contemplated.

The patient was kept intubated, sedated and ventilated until she gained full motor power. The patient was transferred to the ICU, where she was sedated with a propofol infusion. Blood samples were sent for PChE assay. Meanwhile, a thorough medical history was obtained from the patient's family. It was found that the patient's sister had experienced a similar episode in which she spent three days in the ICU after an anesthetic. The family members were informed of the possibility of hereditary or pregnancy-induced succinylcholine apnea and the need for ventilation until full motor power returned.

After six hours in the ICU, the patient's motor weakness started to improve and weaning from mechanical ventilation was commenced. Sedation was decreased, and the patient started to wake up gradually. She regained full motor power, extubated and maintained on 1 to 2 L/min oxygen via nasal cannula. The patient was transferred to the postnatal ward and discharged two days later. The PChE enzyme assay was sent to Germany, it was extremely low, at 1.4 kU/L; the reference range is 4.3 to 11.3 kU/L, which confirmed our diagnosis.

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DISCUSSION

Hackett et al found that the length of paralysis ranges from 50 minutes to ten hours[4]. The first documented case report was in 1956[4]. In 1978 Viby-Mogensen et al reviewed 225 cases of prolonged apnea following suxamethonium[5].

Suxamethonium is an ultra-short acting depolarizing muscle relaxant with a rapid onset of action[6]. One mg/kg dose suxamethonium produces excellent intubating conditions in 30 to 45 seconds and provides a short period of neuromuscular blockade for 9 to 13 minutes[7]. The short duration of action is due to rapid metabolism of suxamethonium by pseudocholinesterase enzyme, synthesized in the liver[8].

Suxamethonium apnea is thought to occur in 1 in 1,800 patients after administration of suxamethonium[9]. Patients with PChE deficiency will not show any clinical manifestation unless they are exposed to suxamethonium[1,10]. There is no specific age group; however, it could be predicted from history. The causes of suxamethonium apnea are both hereditary and/or acquired. Genetically, BCHE gene codes for PChE are located on the chromosome 3p26.1 to 26.2[1,11,12]. Any mutation in this gene would result in an autosomal recessive disorder. There are 65 genetic alterations; the most prevalent are atypical (dibucaine-resistant), K-Variant, fluoride-resistant and silent type, with the K-Variant being the most common[1,10,12]. The homozygous form occurs at a lower incidence of 1 in 3,000 to 5,000 compared to the heterozygous form occurring at 1 in 25 to 50[2,13,14]. Patients with the heterozygous mutations display a mild PChE deficiency, whereas homozygous mutations are severely affected with prolonged PChE deficiency[2,15].

Serum PChE levels change in several conditions. Anderson et al and Garcia et al provided a list of conditions and drugs that contribute to the acquired PChE deficiency[11,13]. Extremes of age and pregnancy could both lead to a physiological reduction in the PChE level[11]. During pregnancy, the reduction starts in the tenth week, and it could take six weeks postpartum to normalize.

The reduction in PChE is usually less than 25% and rarely causes prolonged apnea[13]. However, if there is a co-existing genetic variation, PChE reduction would be clinically significant[1].

Measurement of serum PChE level should be taken from the onset of the apnea. The biochemical analysis involves the dibucaine and fluoride inhibition tests, which provide a quantitative measure of the PChE level[1,2,12]. The dibucaine number represent the percentage of the enzyme inhibited by the local anesthetic dibucaine[1,14,15,16]. A dibucaine number above 70 is labeled as normal; a number between 40 and 70 is labeled as intermediate phenotype (heterozygotes) and a number less than 20 is labeled as atypical phenotype (homozygotes). A repeated test of PChE level six weeks postpartum is advised[1]. If hereditary induced apnea is suspected, genetic testing with polymerase chain reaction (PCR) is required for both patient and family members[1,14].

The immediate management of suxamethonium apnea is to continue appropriate sedation and mechanical ventilation and wait for a spontaneous recovery in the ICU setting[1,12]. The use of pharmacological reversal agents, such as anticholinesterases and neostigmine, are avoided as they could lead to worsening of the condition[1,4].

A study by Epstein et al revealed considerable activity of pseudocholinesterase in stored blood and its clinical significance[17]. This makes it possible to use a transfusion of whole blood or fresh frozen plasma to speed the recovery period from the prolonged paralysis in PChE deficient patients[18]. However, caution is advised, as blood transfusions in PChE deficient patients carry all the risks and complications of blood transfusion. The only well-founded management of suxamethonium apnea is to wait for the patient's spontaneous recovery[1,12]. A promising animal study of plant-derived recombinant PChE reverses the suxamethonium-induced apnea[19].

CONCLUSION

Suxamethonium apnea is a life threatening condition. Family history has a vital role in avoiding PChE-dependent agents, such as suxamethonium and mivacurium. Other precautionary measures include checking PChE levels in both the patients and their family members, along with genetic counselling. A warning card or medical alert bracelet should be provided to the patient to prevent a similar episode from occurring in the future.

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