CASE REPORT

Failed reversal of neuromuscular blockade despite sugammadex: A case of undiagnosed pseudocholinesterase deficiency

Gozde Inan, MD*, Elif Yayla, MD** and Berrin Gunaydin, MD***

**Consultant; **Resident; ***Professor*
Department of Anesthesiology and Reanimation, Gazi University, School of Medicine, Besevler, Ankara (Turkey)

Correspondence: Gozde Inan, MD, Gazi University School of Medicine, Department of Anaesthesiology and Reanimation, Besevler, Ankara (Turkey); Tel: +90 312 202 4166; Fax: +90 312 202 4166;
E-mail address: inangozde@yahoo.com

ABSTRACT

The management of an undetected pseudocholinesterase deficiency in a parturient who underwent urgent cesarean section has been presented. After rapid sequence induction with succinylcholine, rocuronium was used for maintenance of neuromuscular block. At the end of the operation neostigmine was given to antagonize the residual block. Upon persistent prolonged neuromuscular blockade sugammadex was administered. Probable reasons, drug interactions, the importance of suspecting pseudocholinesterase deficiency and the need of neuromuscular monitoring have been argued in this case report.

Key words: Pseudocholinesterase deficiency; Cesarean section; Sugammadex

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INTRODUCTION

Prolonged neuromuscular blockade is a common complication that every anesthesiologist has experienced sometime in his clinical practice. Pseudocholinesterase (PChE) deficiency should be suspected in case of prolonged neuromuscular blockade.[1] PChE is an enzyme synthesized in the liver, which hydrolyses esters such as in muscle relaxants (succinylcholine, mivacurium) and ester type local anesthetics. Mostly, in clinic practice PChE deficiency presents challenge to the anesthesiologist causing prolonged paralysis following succinylcholine or mivacrium administration. There is no treatment for PChE deficiency and diagnosis is confirmed by laboratory findings. The suspicion and awareness of this condition can help management of such cases. When suspected, supportive care should be obtained with possible postoperative ventilation need.

This situation can complicate anesthetic management, especially if it is undetected. A case of unrecognized PChE deficiency is reported, in which induction of neuromuscular block was provided by succinylcholine and maintained with rocuronium, neostigmine and sugammadex were administered to antagonize the blockade. We aimed to discuss the management of prolonged neuromuscular block probably due to an undetected PChE deficiency in a parturient who underwent emergency cesarean section (C/S).

CASE REPORT

Thirty-six year-old, G2P1 parturient at 38.3 weeks of gestation admitted for an emergency cesarean delivery. Her prior surgeries included a C/S and a hysteroscopy due to secondary infertility. She described a prolonged emergence after her previous C/S but we were unable to reach any anesthetic records. Her pregnancy remained uneventful till delivery of the new born.

On arrival to the operating room, the patient presented with deceleration and emergent C/S was planned. Night shift team from anesthesia department decided to perform spinal anesthesia but after 3 failed attempts, anesthesia plan was

converted to general anesthesia.

Anesthesia was induced with propofol 2 mg/kg and succinylcholine 1 mg/kg IV after preoxygenation for 3 min and maintained with 0.75 MAC of sevoflurane in 50% air-oxygen mixture. After the delivery of the newborn, remifentanil infusion (0.1-0.2 μg/kg/min) and bolus dose of rocuronium (20 mg) were administered. The surgical procedure continued for approximately 50 min. Five minutes after discontinuation of anesthetics, neostigmine (2 mg) with atropine (1 mg) were administered to antagonize the residual neuromuscular blockade. Since the patient failed to provide adequate tidal volume following 10 min, sugammadex 2 mg/kg was given IV. After the patient was able to open her eyes on command and her spontaneous breathing improved, she was extubated. However, 1 hour later she developed dyspnea and tachycardia in the ward. The patient was sedated with intermittent boluses of midazolam (1 mg) and her ventilation was supported using continuous positive airway pressure (CPAP) 5 cmH_2O with pressure support (PS) 10 cmH_2O. She gradually regained muscle strength and provided adequate tidal volume 3.5 hours after the induction of succinylcholine dose. Oxygen was administered by nasal cannula afterwards. Blood gas analysis revealed normal oxygenation, ventilation and acid–base status (pH: 7.47, $PaCO_2$: 29 mmHg, PaO_2: 113 mmHg, HCO_3: 23.7 meq/L, SaO_2: 97 %, BE: 1.1).

On the following day laboratory analysis demonstrated a serum PChE activity of 64 U/L (normal 4000-12000 U/L). The patient was discharged home 2 days later. Three months after her C/S serum PChE level was repeated and found out to be 214 U/L.

DISCUSSION

Our case presents a parturient suffering from postoperative respiratory insufficiency after C/S under general anesthesia. Night shift team failed to diagnose the possible PChE deficiency and subsequently administered anticholinesterase for reversal of neuromuscular blockade.

Once prolonged neuromuscular blockade occurs, to determine the possible reason all causes like electrolyte imbalances (hypokalemia, hypocalcemia, hypermagnesemia), hypothermia, several drugs, renal and hepatic diseases should be reviewed. In case of succinylcholine or mivacurium administration as neuromuscular blocker agent, a deficiency in PChE should be suspected as these drugs are metabolized by plasma cholinesterase.[1]

PChE deficiency can be inherited, acquired or iatrogenic and results in impairment of esters.[2] Non-genetic factors include; physiologic causes like advanced age and pregnancy, diseases like renal disease, malnutrition, liver disease, malignancy, collagen vascular disease, burns, hypothyroidism, and some medications (oral contraceptives, clindamycine, insecticides, metoclopramide).[3-6]

A literature search revealed reports of PChE deficiency mostly from obstetrical literature. Two main reasons could explain this finding; initially pregnancy, itself leads to PChE deficiency. Blitt et al.[7], found significantly lower cholinesterase activity in pregnant patients than in nonpregnant patients. In a case series of patients with PChE deficiency, PChE level of a 31-year old gravid in whom prolonged paralysis developed following mivacurium administration to facilitate tracheal intubation in C/S, increased to normal range after the following 2 months (initially; 1017 IU/L, later; 3124 IU/L, normal; 2000-11000 IU/L).[8] It was estimated that in parturients, PChE deficiency incidence is nearly 1:3200.[9] Screening the enzyme levels during pregnancy before birth giving in such a risky population might be beneficial. The enzyme levels should be repeated after several months to show as if this situation is due to pregnancy. In the presented case report, serum pseudocholinesterase activity which was studied on the next day of the operation found 64 U/L (normal 4000-12000 U/L), and after 3 months control level of serum pseudocholinesterase increased to 214 U/L but still was lower than the normal clinical range.

Succinylcholine is the most preferred neuromuscular blocker especially in emergency procedures. By a questionnaire, 170 anesthetists were surveyed to assess their usage of succinylcholine in adult elective and emergency anesthesia practice.[10] Ninety-seven percent of the respondents told that they prefer succinylcholine in emergency mainly in anticipated difficult intubation (74%), C/S (54%) and obesity (49%). Prolonged blockade was reported as an incidence of 39% in that questionnaire.[10]

In patients undergoing C/S, succinylcholine has been the mainstay of rapid sequence intubation process with its favourable features like quick onset and short duration of action. However, since the development and introduction of sugammadex into clinic practice, a new approach for reversal of neuromuscular blockade, the on-going usage of succinylcholine has been questioned.[11] Recently, replacement of succinylcholine with rocuronium and sugammadex combination has been suggested

for rapid sequence intubation.[12] In a patient with catatonic schizophrenia and pseudocholinesterase deficiency, rocuronium was selectively antagonized by sugammadex, safely and efficiently for intubation during electroconvulsive therapy.[13]

Succinylcholine should not have been chosen for the present case because of the patient's previous prolonged recovery history should maintain a suspicion of PChE deficiency. Even it was used neostigmine should not be the choice of drug for reversal of neuromuscular blockade. But the situation was thought to be a residual block, neostigmine and sugammadex were adjusted subsequently to reverse rocuronium induced neuromuscular blockade. Probably attempts to reverse the block with neostigmine failed, because anticholinesterase agents like neostigmine inhibit plasma esterase activity and lead to paradoxical worsening of paralysis, whereas with sugammadex reversal due to rocuronium succeeded. In a case with unrecognized atypical PChE, similar phase II block induced with neostigmine following succinylcholine administration was reported.[14]

This report also underlines the importance of using neuromuscular monitoring. If a neuromuscular stimulator have been used it would help to confirm succinylcholine-induced paralysis with train of four stimulation. The patient might be kept sedated and mechanically ventilated till she regained her muscular strength.

It is also very important to identify these patients to ensure their future healthcare by informing them and the family about the situation. A PChE level would help to diagnose PChE deficiency and a dibucaine number would help to identify if PChE deficiency is genetic or not. In high-risk population, screening family members is also recommended.[15]

In conclusion, all cases of inadequate reversal of neuromuscular block despite use of sugammadex must lead to suspicion of PChE deficiency and managed accordingly.

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