Case Report

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A Case Report of Pseudocholinesterase Fergse Deficiency

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Abstract

Introduction: The drug metabolising enzyme pseudocholinesterase (butyrylcholinesterase) is responsible for the breakdown of the muscle relaxant medicines mivacurium and succinylcholine. Following infusion of mivacurium and succinylcholine, a deficiency of any kind might produce protracted paralysis and apnoea.

Case presentation: It's a case study of a patient who developed long-term apnea after taking mivacurium.

Conclusion: Prolonged blocks may be encountered due to mivacurium use. The diagnosis of pseudocholinesterase enzyme deficiency can be given after a careful clinic supervision and peripheral nerve stimulator monitoring. A decrease in the activity of pseudocholinesterase enzyme and improvement in neuromuscular function will help verifying our diagnosis. Instead of pharmacological applications that may further complicate the situation, what should be done in such patients is to wait until the block-effect goes down by the help of sedation and mechanical ventilation.

Keywords: Metabolising; Patient; Prolonged blocks; Block-effect.

Introduction

Pseudocholinesterase (PChE) is an enzyme with a complex molecular structure.[1] It is synthesized in the liver and immediately released into the plasma.[2] The plasma half-life has been estimated to be approximately 12 days.[3] Deficiency or reduced activity of this enzyme results in significant prolongation of mivacurium or succinylcholine induced neuromuscular blockade.[4] In addition, PCh E activity may be reduced by a number of disease states or by concomitant drug administration. Mivacurium, which is a nondepolarizing neuromuscular blocking drug administered in doses of 0.1 to 0.2 mg/kg, also produces rapid onset

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of neuromuscular blockade lasting 15 to 30 minutes.[5] The rapid ester hydrolysis of mivacurium by PChE results in the short duration of action of this drug, which is ideal for providing muscle relaxation for brief surgical procedures.[6] But, the duration of mivacurium in adults is inversely related to serum PChE activity.[7] In this case report, a patient who developed mivacurium apnea postoperatively due to congenital or acquired pseudocholinesterase enzyme deficiencies is discussed.

Pseudocholinesterase deficiency can be caused by mutations in the BCHE gene. This gene provides instructions for making the pseudocholinesterase enzyme, also known as butyrylcholinesterase, which is produced by the liver and circulates in the blood. The pseudocholinesterase enzyme is involved in the breakdown of choline ester drugs. It is likely that the enzyme has other functions in the body, but these functions are not well understood.

Studies suggest that the enzyme may be involved in the transmission of nerve signals.

Some BCHE gene mutations that cause pseudocholinesterase deficiency result in an abnormal pseudocholinesterase enzyme that does not function properly. Other mutations prevent the production of the pseudocholinesterase enzyme. A lack of functional pseudocholinesterase enzyme impairs the body's ability to break down choline ester drugs efficiently, leading to abnormally prolonged drug effects.

When due to genetic causes, this condition is inherited in an autosomal recessive pattern, which means both copies of the gene in each cell have mutations. Most often, the parents of an individual with an autosomal recessive disorder have one copy of the altered gene in each cell and are called carriers. They can pass on the gene mutation to their children, but they do not usually experience signs and symptoms of the disorder. In some cases, carriers of BCHE gene mutations take longer than usual to clear choline ester drugs from the body, but not as long as those with two copies of the altered gene in each cell.

Case presentation

A 31-year-old woman, weighing 78 kg, was scheduled for caesarean section under general anesthesia. She was not operated previously. Induction of anesthesia was achieved with 130 mg of propofol. Muscular relaxation was achieved before intubation with 12 mg of mivacurium. Isoflurane was used as the general anesthetic inhalation agent. The operation lasted for 30 minutes and the sectio-surgery was uneventful. After the surgery, the inhalation agent was discontinued and the patient received 100% oxygen. It was noted that emergence seemed to be prolonged after 10 minutes. All vital signs were stable, showing no signs of tachycardia or hypertension. Oxygen saturation remained 100%. After an additional 10 minutes, there was suspicion of a PChE deficiency. Peripheral nerve stimulator (PNS) produced zero twitches. Three milligrams of midazolam was administered intravenously for its sedation and amnestic effects. Later the patient was transferred to the post-anesthesia Care Unit (PACU) for observation and ventilator support. Sixty-two minutes later, spontaneous muscle twitching was noted. One hour and twenty-two minutes later from the initial use of mivacurium, the patient had regained sufficient motor function to meet extubation requirements. Blood samples were drawn and sent to confirm a PChE deficiency [Paitent's PChE value (normal range) 1017 IU/L (2000 to 11000 IU/L)]. The patient was transferred to a hospital ward for the evening and discharged two days later. The PChE values of the patient who was called for a control after two months was considered between the normal ranges (3124 IU/L).

Discussion

Mivacurium is a potent benzylisoquinoline, nondepolarizing neuromuscular blocking drug. A recommended intravenous dose of 0.15 to 0.2 mg/kg provides tracheal intubating conditions within 2 to 2.5 minutes, with a predicted duration of action of 15 to 25 minutes, making it an ideal drug for short procedures requiring tracheal intubation.[8] İt is a structural relative of atracurium, but it does not undergo Hofmann elimination and is rapidly hydrolysed by PChE.

Its duration of action is affected by the activity of this enzyme. PChE is a tetrameric glycoprotein enzyme produced by the liver that hydrolyzes choline esters, such as those found in succinylcholine, mivacurium, procaine, chloroprocaine, tetracaine, cocaine and heroine.[9]

In patients with a normal genotype for PChE, mivacurium's duration of action is inversely related to PChE activity and duration of action is slightly prolonged if activity is low.[10]

Reduced PChE activity may occur as a result of inherited causes related to mutations at a single autosomal location on the long arm of chromosome 3.[11] When there is a deficiency of this enzyme due to the presence of one or more atypical alleles, the mivacurium is not properly metabolized

and thus, muscle paralysis can last for several hours. There are two forms of inherited atypical pseudocholinesterase deficiency. The heterozygous atypical form affects anywhere from 1 in 25, to 1 in 480 individuals (depending on the severity of the condition).[9]

Patients heterozygous for an abnormal enzyme may show up to 50% prolongation of block.[12] The homozygous atypical form affecting approximately 1 in 3200 to 5000 individuals.[9]

In patients homozygous for an abnormal enzyme duration may be significantly prolonged, and even a small dose, (eg.0.03 mg/kg) can result in complete paralysis for up to 128 minutes.[13]

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