Does Low Dose Lidocaine Cause Convulsions?

Meltem Ayas, Berrin Işık

Department of Anaesthesiology and Reanimation, Gazi University Faculty of Medicine, Ankara, Turkey

In anaesthesiology practice, lidocaine is commonly used for local and regional anaesthesia as well as to decrease haemodynamic response to intubation. Lidocaine usage within the safe dose range is suggested and in case of overdose; systemic intoxication, central nervous system and cardiovascular system toxicity may occur. Convulsions, cardiac collapse and coma are reported in relation to overdoses of lidocaine. In this report; the convulsion event, which occurred after injection of intravenous 1 mg kg⁻¹ 1% lidocaine to inhibit intubation-related hemodynamic side effects in patients scheduled for vitrectomy under general anaesthesia due to retinal detachment, is presented.

Key Words: Lidocaine, toxicity, convulsion

Introduction

Lidocaine is the first amide-type local anaesthetic introduced into clinical use. Due to its high efficacy and rapid onset of action, lidocaine is commonly used in infiltration anaesthesia, extremity blocks, topical anaesthesia, intravenous regional anaesthesia (IVRA) and in general anaesthesia for the suppression of intubation related haemodynamic changes (1). It is commonly used at 1-1.5 mg kg⁻¹ doses intravenously (IV) before intubation, to suppress haemodynamic responses to intubation.

The recommended maximum dose of lidocaine in regional anaesthesia is 7 mg kg⁻¹ (500 mg) at a single dose with adrenalin combination and 4 mg kg⁻¹ without adrenalin (2). The maximum dose of lidocaine in children has been reported as 3 mg kg⁻¹ at a single dose.

Similar to all local anaesthetics, toxicity signs occur with lidocaine overdose. It has been reported that central nervous system (CNS) symptoms like tongue numbness, visual impairment, muscle twitches and somnolence may occur in local anaesthetic toxicity, while the most serious findings are convulsion, coma, respiratory arrest and cardiovascular depression (3, 4).

In this paper, a patient who was scheduled for vitrectomy under general anaesthesia due to retinal detachment and developed generalized tonic-clonic seizures after intravenous administration of 1 mg kg⁻¹ of 1% lidocaine (Aritmal®) for the suppression of intubation-related hemodynamic changes, is presented and discussed in the light of literature information.

Case Presentation

A 12 year old male patient, 32 kg in weight and 135 cm in height, with an American Society of Anesthesiologists (ASA) score of I and with no medical history of epilepsy, was scheduled for vitrectomy surgery under general anaesthesia for retinal detachment.

In the preoperative assessments, medical and family history was unremarkable. In physical examination, other than ophthalmological findings, there was no problem related to the other systems. Complete blood count and routine biochemical test results were within normal clinical ranges (albumin: 3.9 mg dL⁻¹). There was normal sinus rhythm in the ECG, heart rate was 76 beats per minute, and PA chest X-ray was normal.

No sedative premedication was given to the patient who was taken into the operating room. Routine ECG, peripheral oxygen saturation (SpO_2) and non-invasive blood pressure monitoring was carried out. SpO_2 was measured as 98%, heart rate as 82/min and blood pressure as 120/60 mmHg. A 22G cannula was inserted on the dorsum of the left hand and venous access was established. Infusion of a balanced electrolyte solution at a rate of $10 \text{ mL kg}^{-1} \text{ hour}^{-1}$ was started.

After preoxygenation, 40 mg of 1% lidocaine was administered through a peripheral venous line. A convulsion starting with visual fixation and then generalized to whole body was developed 20-30 seconds after injection. Approximately after 30 seconds, 1 mg kg^{-1} of propofol was infused through the peripheral venous line, spasms slowed down and the seizure was terminated. ECG signals could not be obtained during the seizure, SpO_2 decreased to 85%, but increased after oxygen was administered to the patient through an oxygen mask after propofol administration. After the patient was given 50 mg of propofol and 20 mg of atracurium, orotracheal intubation was performed. Pupillary reflexes could not be evaluated as a cycloplegic agent was used; the pupils were mydriatic and there was no light reflex. Blood glucose was analysed from the fingertip sample (114 mg dL^{-1}). Blood pressure was measured as 100/60 mmHg, and HR was $85 \text{ beats min}^{-1}$. Anaesthesia was maintained with 2% sevoflurane in 50% O_2 /air mixture with a tidal volume 8 mL kg^{-1} and a respiratory rate of $14 \text{ breaths min}^{-1}$. In order to see whether the right drug was administered at the correct dose, the empty vials and syringes were examined. It was verified that the used drug was 1% lidocaine obtained from Aritmal 2% and the administered dose was 40 mg. Haemodynamic data were within normal clinical ranges and stable during the intervention that continued for about 3 hours. At the end of the surgery, the patient was extubated without any problems and was transferred to the recovery room. After it was observed that the patient was fully conscious and had no complaints in the assessment made thirty minutes later, he was transferred to the ward. The patient, who was hospitalized for post-surgical monitoring and treatment for 3 days, was discharged from the hospital without any problems at the end of the third day. The case is presented after consent was obtained from the parents of the patient.

Discussion

Lidocaine is an amide-type local anaesthetic with high efficacy, rapid onset of action and medium duration of action. The longer duration of systemic effects of amide type local anaesthetics in comparison to ester type local anaesthetics results from the slower disintegration in the liver by the microsomal enzymes. Although lidocaine is a reliable agent, side effects related to overdose are frequently reported due to its wide area of use. Among the side effects, vertigo, numbness of tongue and lips, ataxia, agitation, convulsion, respiratory depression, coma and cardiovascular system collapse due to CNS involvement, are well known (1-4).

Various factors like dose, administration speed, presence or absence of concomitant disease and patient age have a role in the systemic toxicity of local anaesthetics (4). Systemic toxicity may occur even at lower blood concentrations of the local anaesthetic in alpha-1-acid glycoprotein and albumin deficiencies (5). It has been reported that erroneous administration of a very low dose local anaesthetic to the vertebral artery causes convulsions as the local anaesthetic directly goes to the CNS without being diluted (6).

There were no abnormal findings either in the preoperative or post-operative assessments of the patient presented in this case report. Blood protein values were also in normal ranges. The dose of the local anaesthetic used was in the normal dose ranges recommended for the IV route.

Çelik et al. (7) reported that a 5-year-old girl was applied 2.5 mg kg^{-1} (40 mg) of lidocaine for tooth extraction and immediately after application, the patient had a seizure that continued for 10-15 minutes; cyanosis on the lips, paleness on the face, eyes rolled upwards, convulsions in the arms and legs, increased salivary secretion, dyspnoea together with loss of tonus and consciousness and respiratory arrest. They stated that the patient survived after successful resuscitation. Klein and colleagues (8) reported that after 4 minutes of administration of 50 mg IV bolus lidocaine for the treatment of supraventricular tachycardia in a 62 year old diabetic patient with a history of myocardial infarction, a generalized grand mal seizure developed and the seizure terminated after giving 2 mg of IV diazepam. In the case we presented herein, we suggest that the seizure, similar to the cases reported by the two researchers, occurred although lidocaine was used in the safe dose range (7, 8).

In children, causes of seizure can be summarized as metabolic causes such as hypoglycaemia, hypocalcaemia, hypomagnesaemia, hyponatremia and hypernatremia, CNS infections, CNS trauma and fever. Conditions such as cardiac syncope (valvular heart disease, blocks, arrhythmia etc.), anoxic seizures, drug intoxications and paroxysmal movement disorders may also be confused with epileptic seizures (9). The blood glucose, protein and electrolyte levels, body temperature, SpO_2 values and ECG recordings of the presented case was normal.

Conclusion

Development of a convulsion after IV lidocaine use in safe dose ranges, suggests that individual factors may also be important in drug response. Serious side effects may even occur during the use of the most innocent local anaesthetics by experienced staff although treatment standards are met, the recommended dosages for weight and age are used and suitable techniques are applied. Therefore, measures to cope with rare complications should be taken in all conditions that a local anaesthetic is planned to be used.

Informed Consent: Written informed consent was obtained from parents of patient's who participated in this case.

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