Journal of Vessels and Circulation

Severe Neurological Complications Caused by Lidocaine Ingestion in an Infant: A Case Report

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Article Info

Article type:
Case Report

Article History:
Received: 28 December 2020
Revised: 20 January2021
Accepted: 03 March 2021

Keywords:
Case report
Infant
Lidocaine
Neurological disorders

A B S T R A C T

Background: Lidocaine ingestion in children can cause lethal neurological and cardiac effects. We report the case of severe neurological disorders due to lidocaine ingestion.

Case Report: An 8-month-old girl presented to the emergency ward in full cardiac and respiratory arrest, was cyanotic, and hypoxic due to ingestion of 7-8 puffs of lidocaine administered to her mistakenly by her grandmother instead of common cold medication. Cardiopulmonary resuscitation was conducted on the infant. Afterward, intralipid emulsion therapy was performed in addition to respiratory ventilation, bicarbonate treatment, and anticonvulsive therapy. The child was breathing spontaneously two days later and was extubated. Subsequently, the infant opened her eyes and had a low response to stimuli. She was later discharged with severe neurological disorders due to low reflection and hypotonia without swallowing and movement.

Conclusion: The use of lidocaine may result in cardiovascular and CNS toxicity, particularly in children. Regarding the potential disadvantages of lidocaine, physicians have to give instructions to minimize the risk of overuse or accidental ingestion of lidocaine by patients.

➢ **How to cite this paper**
Mollamohammadi M, Farnaghi F, Modarresy Z. Severe Neurological Complications Caused by Lidocaine Ingestion in an Infant: A Case Report. J Vessel Circ. Summer 2020; 1(3): 18-21. DOI: 10.29252/jvesselcirc.1.3.18

Introduction

Lidocaine is a commonly used amino-amide local anesthetic in medical procedures and is rapidly absorbed from the gastrointestinal tract, with a peak plasma level occurring within 30-60 minutes (1). After ingestion, lidocaine undergoes extensive first-pass hepatic metabolism with a bioavailability of about 35% (2). Cytochrome P450 enzyme, which is primarily found in liver cells, is necessary to metabolize lidocaine (3). Lidocaine has one of the shortest elimination half-life (nearly 96 min in most patients) among all local anesthetics. The maximum recommended dose of lidocaine is 4 to 5 mg/kg or 300 mg in total, when used alone (1). It should be noted that lidocaine can be toxic even at low doses which may amount to as little as a teaspoon in children younger than six years old. Drug toxicity may occur unintentionally or due to therapeutic mishaps and can cause a false impression about the general safety of its use as an oral agent. Most of the studies on the toxicity of lidocaine involved parenteral therapy (4).

Methemoglobinemia (MetHba) caused by increased blood levels of methemoglobin (MetHb) may lead to cyanosis. MetHb cannot carry oxygen; therefore, if its level is increased, it results in functional anemia (5). Young infants are at increased risk of developing MetHba because fetal hemoglobin is more easily oxidized than adult-type hemoglobin. Besides, during the first four months of life, the cytochrome-b5 reductase is lower in red blood cells, which causes reduced capacity for methemoglobin (5). Acquired MetHba is more prevalent and is typically caused by exposure to specific drugs or common oxidants that increase

the production of methemoglobin, most notably nitrates, chlorates, aniline compounds, benzocaine, and dapsone (6). Methylene blue can paradoxically exacerbate MetHba in all patients at 4-15 mg/kg doses (7). In this study, we reported a case of an 8-month-old infant to whom topical spray of lidocaine, rather than cold syrup, was mistakenly administered orally.

Case Report

An 8-month-old girl was presented to the emergency ward in full cardiac and respiratory arrest and was cyanotic and hypoxic. According to the infant's relatives, approximately less than one hour before referring to the hospital, 7-8 puffs of topical lidocaine spray, rather than cold syrup, were orally administered to the infant by mistake. Subsequently, the infant became lethargic and hypotonic gradually and eventually developed full cardiac arrest and cyanosis. During the examination, the patient's extremities were cold and pulseless. Upon arrival to the emergency ward, the infant underwent cardiopulmonary resuscitation (CPR). It is worth mentioning that, although the infant had a pulse, her respiration was not spontaneous. Moreover, the patient's heart rate pattern was sinusoidal and double mydriasis was observed. The infant's O_2 saturation was 97% while she was receiving mechanical ventilation. Although arterial oxygen saturation was good, the infant suddenly developed central cyanosis. During CPR, an intraosseous line was established and the patient's heart rate returned after the injection of intraosseous epinephrine.

Subsequently, the infant was transferred to the pediatric intensive care unit, and frequent doses of bicarbonate were administered to her. Over the course of several hours, her confusedness increased. Neurological examination revealed a depressed level of consciousness. Despite several interventions, the infant remained unresponsive. Mydriasis gradually turned to Miosis; however, status epilepticus occurred and was hardly controlled. Intralipid emulsion therapy was also provided in addition to mechanical ventilation, bicarbonate treatment, and anticonvulsant therapy (1.5 mL/kg of 20% intralipid within 3 minutes, followed by 0.25 mL/kg infusion within 30-60 minutes).

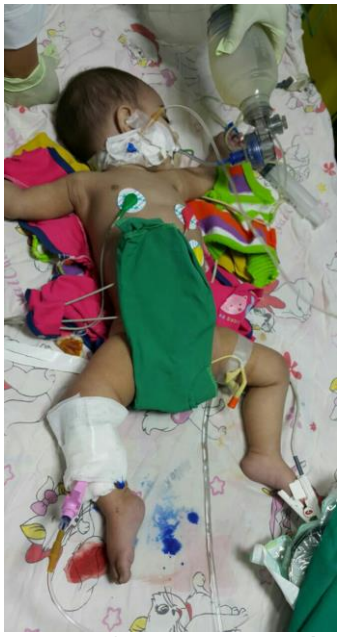

Figure 1. Infant at emergency ward

On the first day, the case received the STAT dose. On the third day, she started to breathe spontaneously and was extubated. Afterward, the infant opened her eyes, had a low response to stimuli, and difficulty swallowing. Therefore, the infant was fed by a nasogastric tube and gavage. Magnetic resonance imaging showed signs of brain atrophy and ventricular dilatation.

Five days later the infant developed a severe neurological disorder. Therefore, she was transferred to the neurology ward and was kept there for a month. On the day of discharge, the patient could not swallow, had no reflex and voluntary movements; however, a sleep-wake cycle existed.

Discussion

This study reported a case of lidocaine-induced cardiac arrest that was unresponsive to all conventional resuscitation measures followed by severe neurological disorders. Lidocaine, a widely used local anesthetics, may cause major complications, such as seizure, arrhythmia, and MetHba in children (8). Each spray contains lidocaine 10 mg and ingestion of more than 5 mg/kg (e.g., 3.0 mL of 2% solution by a 15-kg child) can cause a seizure. In our case, the infant weighed 10 kg and received 10 mg/kg of lidocaine. As mentioned before, ingestion of lidocaine by children may lead to potentially lethal neurologic and cardiac effects, anaphylactoid reaction, and poisoning (9, 10).

Intralipid emulsion therapy is the most commonly used treatment for local anesthetic systemic toxicities since lidocaine is lipophilic and bonds to intralipid (11). MetHba is a rare condition that is caused by the conversion of iron from ferrous to ferric form in the hemoglobin. As a result, oxygen cannot bind to the hemoglobin, which eventually causes hypoxia and possibly death (1). The most common cause of acquired MetHba is through ingestion or the exposure of skin to an oxidizing agent, such as lidocaine and prilocaine (12). Since appropriate management of MetHba depends on prompt recognition, clinicians who administer or prescribe oxidizing agents must be

aware of the clinical symptoms of MetHba, including cyanosis, pulse oximetry values that do not respond to increased oxygen delivery, and altered mental status. Currently, methylene blue, (0.1-0.2 mL/kg over 5 min; repeated every 30-60 min, 1% solution) is the most common drug used to manage MetHba (1). It is worth mentioning that, methylene blue should not be prescribed for G6PD deficient patients since it is contraindicated with G6PD deficiency. Therefore, the treatment is usually based on the administration of ascorbic acid and intravenous methylene blue. Intralipid emulsion rescue therapy is another potential strategy to reverse many drug toxicities, most likely by providing a lipid layer safety net for drug overdose through passive diffusion. Clinicians are urged to adopt intralipid emulsion rescue therapy, not only in cases of local anesthetic drug toxicities but also for other lipophilic drug overdoses (11). Methylene blue is the primary treatment for MetHba (a dose of 1-2 mg/kg). Moreover, bicarbonate can be used to manage arrhythmia. Since metabolism varies from person to person, exposure to the aforementioned agents does not always result in MetHba (13). However, in cases that it is not possible to detect MetHba, an arterial blood gas test can be used. High arterial oxygen level (>100%) in addition to O2 saturation less than 90% determined by pulse oximeter indicates MetHba. Another important issue in lidocaine toxicity is its sodium channel blocker property and the necessity to treat the patient with bicarbonate for correcting QRS complex widening.

A study conducted by Nisse et al. reported an 18-month-old case of fatal intoxication with 2% viscous lidocaine admitted after cardiorespiratory arrest at home. She was resuscitated and developed seizures before arriving at the hospital. Treatment was symptomatic and included CPR and administration of anticonvulsants (14). Dix et al. reported a case of lidocaine-induced cardiac arrest unresponsive to all conventional resuscitation interventions. However, the condition was successfully and rapidly reversed by the application of lipid emulsion therapy (15). In the same line, a study conducted by Aminiahidashti et al. reported a case of a 4-year-old boy with recurrent seizures after lidocaine ingestion. A computed tomography scan did not reveal any evidence of intracranial ischemic or hemorrhagic lesions. No further seizures occurred, the condition of the patient remained stable, and she was discharged two days after the admission (2).

Similarly, another study conducted by Kargl et al. reported a 2-year-old boy case who developed posterior reversible encephalopathy syndrome two days after unobserved ingestion of about 500 mg viscous lidocaine (40 mg/kg). Initially, CPR was performed for 8 min on the child presented with convulsive status epilepticus and subsequent cardiac arrest. After two days of full recovery, the patient presented with progressive disorientation, dizziness, and visual neglect. The symptoms lasted for two days and disappeared completely afterward. No neurologic and visual abnormalities were found two weeks after the ingestion. No further seizures occurred and the patient remained stable and was discharged two days after the admission (9). A similar study conducted by Li et al. reported a case of central nervous system (CNS) lidocaine toxicity after the ingestion of a self-mixture of lidocaine and antacid (16).

The presentation of neurotoxic manifestations appears at lower concentrations than cardiotoxic ones, and are correlated with plasma levels of Lidocaine. Initial symptoms of lidocaine toxicity include headache, hallucinations, seizure, coma, respiratory arrest, and circulatory collapse. These symptoms may persist even after the decreased concentration of lidocaine. Currently, there is no antidote and acute lidocaine toxicity is managed by supportive therapy, including diazepam for seizures, intubation, and chronotropic agents (14).

Conclusion

Although lidocaine has many advantages, it may cause cardiovascular and CNS toxicity, particularly in children. Conservative management is the best option to treat lidocaine-induced seizures. Therefore, physicians should give instructions that minimize the risk of overuse or accidental ingestion of lidocaine in patients. In general, it is suggested that lidocaine prescription should be limited. The majority of lidocaine toxicity signs and symptoms begin about 10-25 minutes after the administration (17). The infant reported in this study presented to the emergency ward in full cardiac and respiratory arrest and with cyanosis. Her symptoms seemed to be due to hypoxia. Unfortunately, she was discharged with severe neurological complications. This study aimed to emphasize the toxic and dangerous effects of lidocaine in children regarding the severe neurological complications of an 8-month-old infant who was orally exposed to lidocaine.

Acknowledgments

None.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this study.

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