

case report

Atropine toxicity caused by erroneous intranasal administration in a pediatric patient: case report

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A 28-month-old boy mistakenly received intranasal atropine sulfate instead of Otrivin (xylometazoline hydrochloride) for the treatment of adenoid hypertrophy. Later on, he came to the emergency department with anticholinergic manifestations after the administration of multiple drops. The child presented with a tonic-clonic seizure lasting for a few minutes, followed by a brief loss of consciousness, vomiting, agitation, and irritability, all of which were stabilized by a dose of intravenous lorazepam. Subsequently, he was admitted to the pediatric intensive care unit for observation. Afterwards, he developed agitation and unsteady gait, both of which resolved after receiving neostigmine. Eventually, the child became asymptomatic and was discharged home. To the best of our knowledge, only one similar case has been reported in the literature.

SIMILAR CASES PUBLISHED: 1

Adenoid hypertrophy (AH) is common among pediatric patients with nasal obstruction, rhinorrhea, hyponasalality, cough, or snoring.^{1,2} Several studies have suggested its association with infectious and allergic stimuli.² AH can lead to chronic sinusitis, recurrent otitis media, obstructive sleep apnea, neurocognitive deficits, and craniofacial growth abnormalities.^{1,2} History taking and physical examination via nasendoscopy may be adequate to diagnose AH.¹ In severe cases, adenoidectomy can resolve the obstructive symptoms,² whereas in less severe cases, intranasal steroids and nasal decongestants are used.² A commonly used topical decongestant is Otrivin (xylometazoline hydrochloride), which is an alpha agonist that constricts the blood vessels in the nasal mucosa, thus reducing nasal lumen swelling and improving the airflow.³ In the field of otorhinolaryngology, Otrivin, can sound similar to atropine when pronounced, is frequently prescribed to relieve nasal congestion. Atropine inhibits the parasympathetic nervous system by disrupting the binding of acetylcholine to the muscarinic receptors in the motor cortex.⁴ Routinely, atropine is used for treating symptomatic bradycardia and muscarinic poisoning.⁵ Its side effects include dry mouth, rapid heart rate, light sensitivity, distorted vision, skin warmth, and rarely, exfoliation resulting from hypersensitivity reactions.⁵ Moreover, high doses can lead to toxicity presenting with dilated pupils, blurred vision, tachycardia, urinary retention, agitation, delusions, and seizures.⁵ In severe cases, it can manifest with a coma or cardiovascular collapse.⁵ To reverse an overdose, physostigmine is administered.⁶ In this case report, we describe a 28-month-old boy who presented to the emer-

gency department with atropine toxicity after being prescribed intranasal atropine sulfate as a medication error. To our best knowledge, only one similar case has been reported.⁷

CASE

We describe a 28-month-old healthy boy who presented to the emergency department after visiting an otorhinolaryngology clinic where he was diagnosed with adenoid hypertrophy by a junior otorhinolaryngology resident. The patient erroneously had an electronic prescription of intranasal atropine sulfate 1% instead of Otrivin, with a dose of one drop in each nostril, once daily for 3 days. The hospital pharmacist contacted the resident and asked if the drug was intended to be used as eye or nasal drops, and the resident confirmed that it was for nasal use. However, the pharmacist did not question the use of intranasal atropine, indication, or dosage. Three hours after administration by his mother, he developed a tonic-clonic seizure involving the upper limbs and upward rolling of the eyes lasting for a few minutes, followed by loss of consciousness for 2 minutes, and then vomiting, agitation, and irritability. He was immediately stabilized with intravenous lorazepam 0.1 mg/kg, which was to be repeated as needed every 5 minutes, and was admitted to the pediatric intensive care unit. Over the next few hours, he was aggressive and had an unsteady gait, which resolved after administration of neostigmine 0.03 mg/kg. Upon taking a history, the child's mother revealed that each dose was administered as multiple drops in each nostril, twice on the first day and on the day of presentation. The child received a total of five doses of lorazepam, administered as needed over the next 2 days. He was monitored for 2 more days until he was asymptomatic. Eventually, he was discharged with instructions and follow-up appointments with his pediatrician. The parents provided consent to publish this report.

DISCUSSION

Adenoid hypertrophy (AH) is a common health concern affecting 40% to 70% of the pediatric population.¹ Its typical clinical features include nasal congestion, runny nose, hyponasal speech, cough, and noisy breathing during sleep.² One of the most frequent indications for surgery in pediatrics is AH.² To avoid the risks of adenoidectomy, pharmacotherapy is used.² Intranasal steroids and nasal decongestants are effective in yielding symptomatic relief.⁸ Xylometazoline, also known as Otrivin, is a derivative of imidazoline, which is known for its vasoconstrictive properties.⁹ Our patient was prescribed atropine sulfate instead of Otrivin by mistake,

as these two drug names sound similar. Atropine is a parasympatholytic drug that competitively blocks muscarinic receptors.¹⁰ The clinical presentation of atropine intoxication is determined by the dose administered.¹¹ A dose of 1 mg produces a sensation of dry mucous membranes and bradycardia; a dose of 2 mg causes xerostomia, dilated pupils, blurred vision, tachycardia, and skin dryness; and a dose of 5 mg causes dysarthria, dysphagia, headache, restlessness, and muscle weakness.¹¹ An overdose of 10 mg, which is the average fatal dose, causes ataxia, disorientation, confusion, delirium, and circulatory collapse resulting from respiratory failure.^{6,11} Our patient was prescribed a 6-cm³ bottle with 2 mL of atropine sulfate ophthalmic solution USP 1%. Each drop contains 0.05 mL of atropine sulfate, which is equal to 0.5 mg of atropine sulfate. A drop in each nostril would yield a total dose of 1 mg, which would cause the above-mentioned symptoms. Because atropine poisoning is associated with a broad range of signs and symptoms, establishing an accurate diagnosis can be difficult. Serum concentration of atropine are not routinely measured; therefore, the diagnosis is established on the basis of history taking and physical examination.⁶ Therapeutically, atropine dose is determined by the clinical condition and patient's age. For example, to treat muscarinic poisoning, a dose of 2-3 mg is administered every 20-30 min.⁵ For bradycardia, 1 mg is administered every 3-5 min until the heart rate is stabilized.⁵ In pediatric patients, the minimum dose is 0.1 mg and the maximum dose is 0.5 mg.⁵ Common administration methods include intravenous, subcutaneous, intramuscular, and endotracheal routes. Although intranasal delivery is uncommon, it was prescribed to treat severe rhinorrhea in the past.⁶ In a previous study, nasal atropine sulfate was effective in reducing symptoms of rhinorrhea and postnasal drip with no systemic adverse events in adult patients with perennial allergic rhinitis.¹² Additionally, anticholinergic toxicity has been reported in a patient after instillation of multiple eye drops of atropine.¹³ Another case reported a colicky infant with toxic symptoms after 12 hours of ingesting a mixture containing atropine.¹⁴ The treatment of atropine toxicity depends upon the severity of symptoms. Given that atropine has a long duration of action, patients are admitted and observed under supportive care until symptoms resolve.⁶ For convulsions, diazepam can be administered.⁵ Physostigmine is capable of crossing the blood brain barrier and abolishing the central and peripheral toxic effects of atropine.⁶ It is indicated in patients with severe toxicity, for symptoms persisting for >48 hours, psychiatric manifestations, or coma.⁶ An intravenous dose of 0.02 mg/kg over 3 minutes is rec-

ommended for a child, with the maximum dose being 0.5 mg/dose.¹⁵ Since physostigmine has a rapid onset of action, it may be repeatedly administered every 10-15 minutes until anticholinergic symptoms resolve.¹⁵ However, physostigmine should only be administered where continuous monitoring and resuscitation are available, as its duration of action is <60 minutes.¹⁵ Awareness of the clinical pharmacology of a drug is beneficial to ensure patient safety and avoid medication errors.

A medication error is defined as a lack of success in the treatment process in which serious consequences can occur for patients.¹⁶ Mistakes include imprecise selection of drugs, doses, forms, frequencies, or routes.¹⁶ Several studies have evaluated the frequency of medication errors among junior staff. One study identified 905 errors in a teaching hospital, 864 of which were made by junior doctors.¹⁶ Another study showed that 472 out of 482 medication mistakes were made by junior physicians.¹⁶ A study concluded that junior doctors were 1.57 times more likely to commit an error than senior physicians.¹⁶ A systematic review that evaluated the common elements leading to medication errors in the Middle East showed lack of knowledge to be the main factor.¹⁶ Accordingly, educational programs, such as medication safety courses, must be taken by healthcare providers to curtail such errors.¹⁶ One study found that 41% of medication errors were attributable

to written and verbal miscommunications between pharmacists and physicians; thus, communication must be encouraged between pharmacists and prescribing doctors, especially for high-risk medications, unusual routes, and unusual indications.¹⁷ Another reason a patient is advised to take the wrong drug is that it sounds or is spelled like another medication, and such errors are known as sound-alike errors.¹⁸ Sound-alike medication errors account for 25% of all medication errors, with an estimate of 1 in every 1000 prescriptions.^{18,19} They occur due to resemblance of names, unclear handwriting, poor knowledge, verbal prescriptions, and miscommunication between the staff.¹⁸ One proposed strategy that has been shown to be effective in reducing sound-alike errors is using both generic and brand names.¹⁹ Another way to avoid medication errors is installing a computerized pop-up alert system when a common sound-alike medication is ordered.²⁰

Acknowledging the clinical severity of drugs is critical to medication safety; therefore, one must be aware of such consequences to avoid causing harm to patients. Of all factors leading to medication errors, sound-alike medication errors remain a prevalent one. Strategies such as writing down brand and generic names, using computerized alerts, and improving communication in the workplace should be implemented to decrease the incidence of sound-alike medication errors.

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