

중증 루팍콩 중독: 항콜린 증독증후군

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Severe lupin bean intoxication: an anticholinergic toxidrome

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Lupin beans are the yellow legume seeds of the genus *Lupinus*. They are traditionally eaten as a pickled snack in many countries. Bitter lupin beans have a high amount of alkaloids called lupanine. Because the alkaloid is responsible for anticholinergic toxidrome, the beans should pass a debittering process before consumption. Only few pediatric cases of lupin bean intoxication were reported. We present a 12-year-old boy who visited the emergency department for the unexpected onset of anticholinergic toxidrome.

Key words: Alkaloids; Anticholinergic Syndrome; Child; Lupinus; Poisoning

Introduction

Lupin or lupini beans are the yellow legume seeds of the genus *Lupinus*, which included 450 species in the world¹. In the Mediterranean, Latin America, and Turkey, the beans are traditionally eaten as a pickled snack². Although lupin beans have medical advantages, toxicity is observed in humans because the bitter lupin beans have a high amount of alkaloids called lupanine, which has anticholinergic effects unless processed³. Before consumption,

the lupin seeds should pass a debittering process to remove the toxic alkaloid². In children, acute anticholinergic toxidrome is uncommon, and caused by a wide variety of prescription drugs and hallucinogenic plants, such as *Datura stramonium*⁴. In this case report, we report a child with anticholinergic toxidrome associated with the ingestion of lupin beans.

Case

A previously healthy, 12-year-old boy weighing 50 kg visited the emergency department for ongoing generalized tonic-clonic seizure and vomiting. These manifestations occurred 30 minutes after eating 2 handfuls (approximately 300 mg) of raw lupin beans. The initial vital signs were as follows: blood pressure, 150/110 mmHg; heart rate, 151 beats per minute; respiratory rate, 32 breaths per minute;

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temperature, 36.5°C; oxygen saturation, 99% on room air; and a Glasgow Coma Scale of 12. Because he was considered to be in status epilepticus, intravenous midazolam (0.1 mg/kg) was administered, and intubation was performed to protect the airway. The physical examination showed bilateral mydriasis with weak light reflexes, increased muscle tone, flushing, piloerection, and dry oral mucosa. Deep tendon reflexes were normal, but bilateral Babinski reflexes were observed. Capillary refill time was shorter than 2 seconds. No abnormal findings in the chest and abdomen were found. Laboratory findings were unremarkable. The cranial computed tomography showed normal findings. After 6 hours of the ingestion, he was transferred to the intensive care unit (ICU).

In the ICU, sinus tachycardia and hypertension were sustained for the first 24 hours. His echocardiogram was normal. The tachycardia resolved gradually and spontaneously within 24 hours. The electroencephalographic finding suggested diffuse encephalopathy. Midazolam and fentanyl infusion were continued to maintain the patient-ventilator synchrony with daily interruption. No clinical and electroencephalographic seizures were observed in the ICU while receiving midazolam infusion (0.1 mg/kg/hour). On day 3, the boy underwent extubation. During the hospitalization, he underwent only supportive care. On day 5, the Glasgow Coma Scale became 14, and he was transferred to the general ward. Later, the ingested beans were turned out to be farm products of the boy's relatives.

Discussion

Although lupin beans have been generally used for animal feed, medical research has recently shown that eating lupins can provide benefits for human health¹¹. Using sweet lupin flour in making bread maintains to reduce its glycemic index and energy intake, and to increase satiety of the participants. Lupin seeds are consumed as appetizer and herbal therapy for diabetes mellitus in the Middle East and

Southern Europe⁵⁻⁷. Although the case patient and his family have eaten lupine products sold in the market, they have never experienced an allergic reaction or toxicity. Of note, the boy ingested a large amount of raw beans that were his relatives' farm products, which did not pass a debittering process.

Quinolizidine alkaloids are found in various species of the genus *Lupinus*. The nature and concentration of quinolizidine and piperidine alkaloids are different between the species⁸. The alkaloids can induce anticholinergic toxidrome⁸. These alkaloids, which account for 0.05%–3% by weight of fresh plants, give the characteristic bitter taste⁹.

Alkaloid-rich lupin beans inhibit the excitatory neurotransmission via the nicotinic acetylcholine receptors and also act as muscarinic antagonists. Quinolizidine alkaloids with high affinities to the nicotinic receptors have a lower affinity to the muscarinic receptors. Lupanine, lupinine, and sparteine are listed as the main alkaloids in seeds of the genus *Lupinus*, which are used for the production of foods. Quinolizidine alkaloids whose concentrations vary depending on the species produce the pharmacologic and toxicologic effects. The alkaloids develop inhibitory effects on the nicotinic and muscarinic receptors, impair the function of the sodium and potassium channels, and caused cardiac, oxytocic, and ganglioplegic effects. The typical manifestations of intoxication predominantly affect the neurological, and/or cardiovascular, and digestive systems. Thus, it develops dizziness, confusion, tachycardia, gastrointestinal complaints, nausea, mydriasis, dry mouth, loss of motor control; and in high doses, bradycardia, respiratory paralysis, and cardiac arrest.

In our case, the anticholinergic toxidrome was suggested by the manifestations along with tachycardia and hypertension. At that time, it was unknown about the chemical composition and botanical origin. Thus, it was challenging to associate the manifestations with the ingested doses or a specific alkaloid. Lupanine may be the chief cause of anticholinergic effects¹⁰.

The proper consumption of lupin seeds requires the removal of toxic alkaloids. The process for debittering and cleaning the impurities are listed in the order of sequence: soaking for 1 day, cooking in water for 1 hour, and placing in containers and exposing to running water for 4–5 days²⁾. This process reduces alkaloid contents of lupin beans from 13,000 to 500 mg/kg^{1,8,10)}. The lethal dose is about 30 mg/kg body weight, and few fatal cases have been reported⁸⁾. It is lower than the ingested doses of this case (60 mg/kg).

In children, acute anticholinergic toxidrome is uncommon. This toxidrome generally develops after exposure to various drugs, including some antihistamines, antipsychotics, antispasmodics, and antidepressants, as well as ingestion of some mushrooms and plants⁴⁾. Acute ingestion can firstly induce agitation, blurry vision, fever, flushed and dry skin; and subsequently, tachycardia, mydriasis, seizures, dry mouth, urinary retention, ileus, delirium, and even death^{11,12)}. Chronic ingestion may incur permanent neurological effects, such as hyperreflexia, fasciculation, dysarthria, dysphagia, and pyramidal signs¹³⁾. Children with manifestations suggestive of the toxidrome must be questioned about their recent food consumption, particularly lupin bean-containing products.

The half-life of the alkaloid is 6 hours, and it is usually cleared within the next 24 hours due to the rapid urinary excretion⁹⁾. Thus, treatment is mainly supportive and is limited to the symptomatic period. At the first step, orogastric lavage and activated charcoal administration are recommended to prevent absorption. Dysrhythmias other than sinus tachycardia may require specific treatment. Benzodiazepines can be employed for anxiety or seizures. Physostigmine (0.02 mg/kg intravenous) can be administered for refractory seizures^{2,14)}. The case patient's manifestations developed at 30 min-

utes, and the transfer to the ICU was performed at 6 hours after the ingestion. However, orogastric lavage was performed because bean particles were detected in the gastric content.

Only few pediatric cases have been reported with lupin bean intoxication. Daverio et al.⁴⁾ reported a 6-year-old girl with anticholinergic toxidrome who has eaten a small amount of lupin beans. The girl was discharged after supportive care. In our case, the severe manifestations might be due to the larger ingested amount of lupin beans and bypassing the debittering process.

Lupin beans are consumed worldwide for their protein contents. Acute anticholinergic toxidrome is caused by rich quinolizidine alkaloids. Therefore, lupin bean intoxication should be considered if children have anticholinergic toxidrome.

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Conflicts of interest

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