

Unwashed grapes as a cause of organophosphate poisoning in a child in rural India

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SUMMARY

This report describes the symptoms of pesticide poisoning in a previously healthy teenage girl. After consuming unwashed grapes for several days, the girl developed the following symptoms: drowsiness, vomiting, truncal weakness and fasciculations in the tongue and hands. Blood tests confirmed exposure to a small amount of the organophosphate (OP) compound, a type of chemical found in certain pesticides. The girl was treated with supportive care and cholinesterase reactivators, which minimised the damage caused by OP poisoning. Within 48 hours, the girl's symptoms improved and she made a full recovery. This case highlights that OP poisoning can present without classic cholinergic crisis symptoms (SLUDGING), including miosis. Fasciculations, as observed in this case, are a significant clue to the diagnosis.

BACKGROUND

- ▶ Organophosphate (OP) insecticides are used in agriculture to increase crop yields and control pests. However, their use has a significant impact on health.¹
- ▶ OP insecticides are widely used in agriculture worldwide and are becoming readily available. Farmers, agricultural workers and children living in agricultural communities also face a constant risk of inhaling, ingesting or coming into contact with these toxic chemicals.^{2,3}
- ▶ The spread of OP poisoning is a cause for concern. According to the WHO, hundreds of thousands of cases of unintentional pesticide poisoning occur annually, with a significant number of deaths. In low- or middle-income countries, weak regulations and poor health facilities are the reasons.⁴
- ▶ As in many other countries, even India, OP use is regulated by laws and guidelines to ensure safe usage and prevent abuse. However, the enforcement of these regulations varies. In India, OP can be purchased relatively easily. This lack of regulation contributes to the risk of poisoning, particularly in rural areas, where enforcement is minimal. Globally, the regulation of OP varies, with stricter controls in developed countries compared with developing ones.

CASE PRESENTATION

A previously healthy adolescent girl from a rural area in India was brought to the emergency

department by school teachers with drowsiness and vomiting for 3–4 hours. She denied any recent illness, fever or intake of medications. Her mother mentioned that she had eaten about half a kilogram of grapes each day over the previous week, which were directly procured from a nearby farm without washing them. There was a history of recurrent abdominal pain and vomiting for the last 5 days.

Physical examination

On examination, she was drowsy. Vital signs were as follows: heart rate - 88 beats per minute, respiratory rate - 24 breaths per minute, blood pressure - 110/70 mm Hg. Pupils were normal in size. There was truncal weakness with normal tone, power and reflexes in both upper and lower limbs. There were fasciculations of the tongue and tremors involving the chin and hands (online supplemental video 1). There was no diaphoresis, salivation or lacrimation. Based on the clinical presentation and the possibility of OP residue ingestion, a blood test for cholinesterase and gastric lavage was ordered.

Laboratory tests

Complete blood count within normal limits; basic metabolic panel showing sodium at 150 mmol/L, potassium at 4.3 mmol/L, chloride at 114 mmol/L, calcium at 9.1 mg/dL and phosphorus at 5.4 mg/dL; liver function tests indicating AST at 20 IU/L, ALT at 35 IU/L and alkaline phosphatase at 219 IU/L; kidney function tests with BUN at 21 mg/dL and creatinine at 0.3 mg/dL; and glucose level at 90 mg/dL; arterial blood gas analysis: pH 7.38, pCO₂ 36 mm Hg, pO₂ 90 mm Hg.

Management

While awaiting gastric lavage and blood test results, supportive care was initiated, including monitoring vital signs and maintaining a clear airway. Given the mild symptoms and the absence of a cholinergic crisis, specific OP antidotes were not administered initially. Treatment of OP poisoning is typically based on signs and symptoms and is often administered empirically.

Treatment course

The blood test results showed low levels of serum cholinesterase 200 U/L at admission and increased to 673 U/L after 36 hours of admission (normal range: 3100–6500 U/L), confirming



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recent exposure to a low-dose OP compound and response to the treatment. Gastric lavage analysis detected OP residue but failed to identify the specific compound. Considering the potential for delayed onset of neuromuscular weakness due to the redistribution of highly lipophilic OP compounds from fat stores, we administered intravenous atropine along with a single dose of pralidoxime to counteract the effects.⁵⁻⁷ Her drowsiness gradually improved over several hours, and fasciculations subsided completely within 48 hours (online supplemental video 2). She was discharged after 7 days with instructions for follow-up and advised to wash all fruits and vegetables before consumption.

Follow-up

On the 7th day post-visit, the patient exhibited normal clinical parameters and was able to attend her school examination.

GLOBAL HEALTH PROBLEM LIST

- ▶ Lack of health education about washing fruits and vegetables before consumption.
- ▶ Improper storage of pesticides.
- ▶ Lack of clean water.
- ▶ Potential knowledge gaps among healthcare workers.
- ▶ Stricter legal regulation on the availability of OP compounds.

GLOBAL HEALTH PROBLEM ANALYSIS

Lack of health education about washing fruits and vegetables before consumption appears to be a significant health problem, especially a lack of understanding of the use of OP pesticides. This can lead to:

- ▶ Increased risk of OP poisoning: Ingestion of OP residue on unwashed produce can lead to acute or chronic poisoning with symptoms including nausea, vomiting, tremors, respiratory failure and death. Children's hand-mouth contact and poor nervous system development add to the risk.⁸
- ▶ Disparities in health outcomes: The burden of OP poisoning from contaminated products falls disproportionately on low- and middle-income countries (LMICs). Weak regulations on the use of pesticides, lack of clean water for washing and inadequate public health education are responsible for these preventable diseases.⁹
- ▶ Chronic health problems: Besides acute toxicity, chronic low-dose exposure to OP residues can lead to long-term health problems such as neurological impairments, memory problems, depression, diabetes, cancer, OPIDP (organophosphate-induced delayed polyneuropathy), reproductive system effects and possible risks of chronic diseases such as Parkinson's disease.⁴
- ▶ Heavy reliance on OP pesticides: OPs are widely used globally due to their effectiveness in controlling agricultural pests. However, their toxicity extends beyond target insects to pose a threat to human health.¹⁰
- ▶ Improper storage: OP pesticides is very dangerous for children. If stored in easy-to-reach cabinets or containers similar to food or beverages, pesticides can cause accidental poisoning, serious health problems or even death.¹¹
- ▶ Lack of clean water: In many areas, especially in LMICs, there is a lack of clean water for washing fruits and vegetables. Although there is knowledge of washing produce, this is not possible due to a lack of clean water, leading to the consumption of unwashed produce.¹²

- ▶ Lack of awareness: Many communities, especially in rural areas, are unaware of the dangers of OP residues on produce or the importance of proper washing techniques. There is also a lack of knowledge among health workers about the symptoms of OP poisoning and the importance of taking thorough histories of potential exposure.¹³
 - ▶ Stricter legal regulation: on the availability of OP compounds is essential to mitigate the significant health risks associated with acute and chronic exposure, particularly among vulnerable populations such as children and agricultural workers. Implementing uniform global standards, banning high-risk compounds and promoting safer alternatives can reduce healthcare costs and socioeconomic burdens while protecting public health.
- The effects of OP poisoning have a multidimensional impact, especially on the health system.
- ▶ Increased healthcare burden: The increase in cases of OP poisoning, along with the potential for chronic health problems, strain health systems, particularly in resource-limited areas.
 - ▶ Economic impact: The cost of treatment for OP poisoning, related health problems and loss of productivity due to illness create a significant financial burden for the family as well as society.

Solutions

- ▶ Multifaceted public health campaigns: Targeted campaigns using various channels (local media, community programmes, educational materials) will be critical to raise awareness about the dangers of OP residues and the importance of washing produce in communities, especially those involved in agriculture.
- ▶ Promoting behaviour change: Campaigns should go beyond raising awareness and providing practical guidance on effective washing techniques, even with limited water resources. Simple and sustainable solutions, like using clean water with a bit of vinegar or salt, can be promoted.
- ▶ Supporting healthcare workers: In LMICs, training healthcare professionals on recognising different presentations of OP poisoning, including mild symptoms and eliciting OP ingestion history in suspected cases can lead to earlier diagnosis and treatment.
- ▶ Regulation and alternatives: Strengthening regulations on pesticide use, establishing safe pre-harvest intervals and promoting the adoption of sustainable and organic farming practices can minimise reliance on OPs and reduce residue levels on crops.
- ▶ Product labelling: A disclosure regarding pesticide treatment at the time of sale should be included.

Patient's perspective

I never thought that those grapes my grandmother brought would get me into this mess! The morning started normally. For the past few days, I went to school with a bunch of grapes. They looked clean, and by midday at school, my stomach felt rumbling, and I fell asleep. The teacher took me to the doctor, and then my mother took me to the city hospital. The doctor said it might have been pesticide ingestion. When asked by the doctor, our mother explained to the doctor about eating unwashed grapes.

Learning points

- ▶ Organophosphate (OP) poisoning does not always have a dramatic onset. Symptoms such as abdominal pain, drowsiness and vomiting can develop gradually over several days, making diagnosis more challenging.
- ▶ Common symptoms can mimic other diseases. However, a history of consuming unwashed produce, especially when combined with neurological signs like fasciculations, raises suspicion for OP exposure.
- ▶ Cholinesterase blood test is crucial. Low levels confirm exposure to an OP compound, which disrupts nerve function.
- ▶ Wash all fruits and vegetables thoroughly before consumption to remove harmful residues such as OP.
- ▶ Consuming treated produce over several days can lead to repeated small exposures, resulting in a gradual onset of symptoms as cholinesterase inhibition may worsen with each subsequent exposure.

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Case reports provide a valuable learning resource for the scientific community and can indicate areas of interest for future research. They should not be used in isolation to guide treatment choices or public health policy.

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