

When Work Makes You Sick

A Farmworker's Experience in the Field

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Photo Credit: James Daniels

Part I. That Memorable Morning

"When will you be back this time, Daddy?" asked Juan with teary eyes.

"It will not be too long," replied Roberto as he embraced his 7-year-old son.

Roberto was a father who worked as a migrant farmworker in the United States so that he could make money for his family to have a better life. It saddened him greatly to leave his family, but this was an opportunity to provide for the very ones he loved. Roberto hugged his wife and headed off on his journey. Roberto's wife Melissa, son Juan, and 5-year-old daughter Gloria watched him from the door as he walked off into the night.

Over several months, Roberto moved from farm to farm, typically traveling by bus. This time he would work at a California farm that harvested iceberg lettuce as its main crop. He knew that he would work long days, reporting at 7 am, but was up for the challenge. Also, the other migrant farmworkers were very friendly and instantly felt like family to him. They always looked out for one another, and he always had an ear to talk to when he missed his family.

One morning at around 9:00 am while he was harvesting lettuce just a few days after starting employment on the farm, Roberto began to feel sick. He noticed that several other farmworkers appeared ill as well. Roberto was dizzy, his eyes started to tear up and he had trouble seeing. He also developed a headache and felt incredibly nauseated. Even though it was still cool outside, Roberto was sweating profusely. "What is going on?" he thought to himself. "I can't get sick now." He then noticed that some of the other farmworkers became frantic. A crew leader in the field drove to the machine shop to alert the farm owner. The owner of the farm rushed out to the field to figure out what was happening. When he discovered that the farmworkers were sick, the owner encouraged the workers to go to the hospital immediately. The ride to the hospital in the owner's truck was almost unbearable. Roberto also started to develop a pain in his chest, and he was having difficulty breathing. He groaned softly in discomfort.

Questions

1. What is/are the **most likely** cause(s) of Roberto's symptoms? Explain your answer.

2. It is possible that Roberto has experienced toxicity. What is the **most likely** type of toxicity Roberto is experiencing?

Part II. At the Hospital

At the hospital, Roberto was assigned a bed in the emergency department. When Dr. James comes to see Roberto, she asks him through an interpreter, "How are you feeling?" Roberto responds, "It is hard to take a deep breath. I am dizzy and feel like I am going to throw up. My eyes won't stop watering, and I have a headache." "How long has this been going on?" she asked. "Just this morning after I worked in the farm for a couple of hours," he replied. "What do you do for work, Roberto?" "I am a farmworker and pick lettuce."

Dr. James examines Roberto and noticed that his pupils were very small, that he was sweating excessively, drooling, had a runny nose and labored breathing, and was holding his stomach. Dr. James suspected that Roberto's symptoms were due to organophosphate poisoning and took a blood sample to confirm.

She explained to Roberto, "If you are exposed to certain types of pesticides, you may have a group of special symptoms. When you get sick from these pesticides, your body produces lots of excess fluids—you may have tearing (like from cutting an onion), a runny nose, excessive drooling, and profuse sweating. You might also have a stomachache, vomiting, and diarrhea. Your head may hurt and you may feel dizzy and tired. The most important way for someone else to know if you are sick from pesticides is to look at your eyes—the pupils in the center of the eye will be very small. It is very good that you came to the hospital, Roberto. If you have a very bad case of this poisoning and you wait before seeking medical care, you may have trouble breathing, seizures, or you may even 'black out' or die."

Roberto asked, "Is there anything that will make me feel better?"

"Yes. I will prescribe an antidote, a medication that will help treat your poisoning. First, you will need to wash with soap and water and change out of your contaminated clothing into a hospital gown. You will also be admitted to the hospital to manage your condition."

Questions

1. What is the **most likely** route of exposure through which Roberto came into contact with the organophosphate pesticide? Explain your answer.

- Using a diagram on which all key enzymes and chemicals are identified, explain how organophosphates could be responsible for the symptoms Roberto was experiencing.
- Outline what you would tell Roberto about how organophosphate pesticides work, bearing in mind that he does not have much science background.
- Using your knowledge of cholinergic signaling, propose a potential mechanism of action for an antidote to organophosphate poisoning.
- Distinguish between acute and chronic toxicity.

Part III. Test Results

From the hospital Roberto called his family back home to notify them of the events that transpired and his condition. "You won't believe this Melissa, but I was poisoned on the farm," described Roberto. "But don't worry, I am at the hospital and the doctors will treat me, so I will be fine. Please tell my little Juan and Gloria that daddy misses them." After this somewhat somber conversation, Roberto replayed the words that his wife had said to him, "I am so worried about you, Roberto." Roberto tried to stay strong for his family despite feeling very ill.

Soon after the conversation, Roberto's test results came back. His levels of plasma and red blood cell (RBC) cholinesterase were within normal limits. "This is quite unexpected," thought Dr. James. She had initially predicted that Roberto had suffered from organophosphate poisoning because of his clinical symptoms and possible exposure to pesticides as a farmworker. Additional information also supported Dr. James' diagnosis. Mevinphos, a pesticide classified as an organophosphate, was mistakenly sprayed on the lettuce the morning just prior to the farmworkers' arrival to the fields despite cancellation of the order. After this incident, the farm owner made sure that the fields would not be sprayed again with this pesticide. Still, however, it was unclear why Roberto had seemingly normal levels of plasma and red blood cell cholinesterase.

Investigators from the National Institute for Occupational Safety and Health (NIOSH) interviewed Roberto and the other farmworkers to try to pinpoint what had happened. Although Roberto still felt ill from the effects of exposure, he tried to answer their questions as best he could with the help of an interpreter, as he understood that they were there to help him and his fellow farmworkers. "This is so hard," Roberto thought to himself. "I hope it will get better soon."

The doctor discharged Roberto from the hospital when he regained his health after a few days. "I feel so much better, what a relief," thought Roberto. Six days after the exposure event, an order was sent to re-assess the plasma and red blood cell cholinesterase levels of all of the farmworkers from the site including Roberto. They had all experienced improved health. The results showed an increase in cholinesterase levels since the last measurement. NIOSH continued to monitor the cholinesterase levels of the farmworkers over 12 weeks. The statistically significant increases seen over time further confirmed mevinphos poisoning.

Roberto finishes his time on the farm and returns to his home country to be with his family. Regardless of all that he has gone through, he is grateful for his returned health and newfound awareness of pesticide toxicity and its impacts on him as a migrant farmworker.

Questions

1. LD50 is defined as the lethal dose of an acute toxicant estimated to kill half of the test animals in an experiment. Find and report the LD50 for mevinphos in rats. How does this compare to LD50s for other pesticides? What toxicity signal word is listed on the label for mevinphos? What is the relationship between the LD50 and toxicity signal word for a pesticide?

2. There are currently two antidotes for organophosphates, atropine and 2-PAM. Describe how the mechanisms of each of these antidotes could overcome the downstream effects of acetylcholinesterase inhibition.