

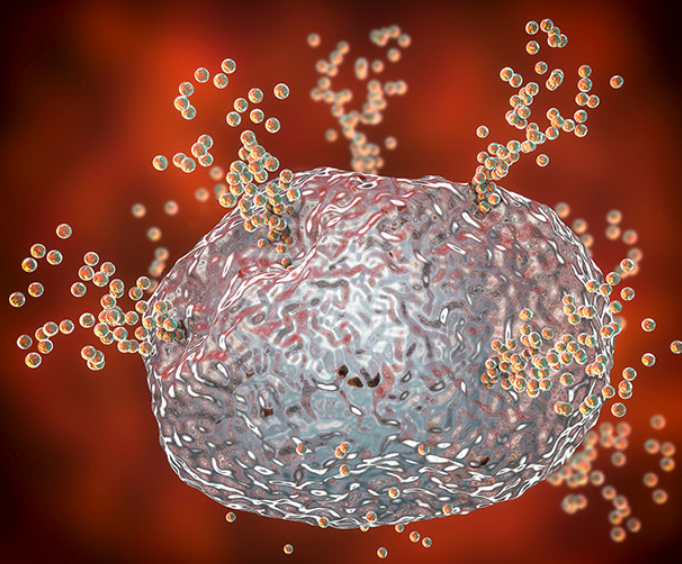
An Anaphylaxis Praxis

by

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Part I – Introduction

You’ve been a live-in nanny for two-year-old Amoria and her three-year-old sister Lucia since they were born. Their mother is an orthopedic surgeon at a local hospital and often works odd hours, so you live with the family.

“When Lucia and Amoria wake up, would you take them to the park today? It’s supposed to be beautiful!”

“Sure! Have a great day!” you say, as Dr. Villegas, the girls’ mother and your employer, heads out the door for the hospital.

Both girls are extremely high-energy, busy toddlers, and letting them run at the park for a few hours to burn off some energy sounds like a great idea; you’ll even pack a picnic. Amoria has several food allergies, and both girls are picky, which can make meals difficult. You make a turkey sandwich for each girl with no mayonnaise, mustard, or cheese (you know they would refuse to eat it if you put anything on it but cold cuts), and you grab a couple of apple juices.

A few hours later you arrive at the park with the girls. You spread out a blanket and get ready to have lunch. At that point, Lucia sees some ducks near the park’s pond and runs towards them. You race after Lucia and catch up to her when she is just inches from the water’s edge. Meanwhile, Amoria has toddled off to a family that is also having a picnic at the park. Carrying Lucia, you rush back to Amoria but don’t get there in time to prevent her from taking a bite from another child’s peanut butter and jelly sandwich. Apologizing to the family, you bring Amoria and Lucia back to the blanket to start your own picnic.

Lucia begins to eat, but Amoria is uninterested. Moments later, you notice Amoria’s skin is starting to turn red and she is developing circular, raised welts (hives). Thinking that she may be overheating or getting a heat rash, you move her out of the sun and to the shade of a nearby tree. You offer Amoria a drink of apple juice to try and help her cool down, but she refuses to drink and begins to pull at her lips and tongue, which are visibly starting to swell. Her breathing becomes quicker and in short bursts; she seems to be gasping for air. You call emergency services and her mother, and thankfully an ambulance quickly arrives.

On the way to the emergency room, the EMTs monitor Amoria’s vital signs. She registers the following:

Table 1. Amoria’s vital signs.

| <i>Vital Sign</i> | <i>Value</i> |
|-------------------|---------------|
| Blood Pressure | 77/36 mm Hg |
| Heart Rate | 167 BPM |
| Respiratory Rate | 44 |
| SpO ₂ | 72% |
| Body Temperature | 95.0°F (35°C) |

Due to her condition, the EMTs treat Amoria with the following medications while in the ambulance: saline IV, 0.15 mg epinephrine, 15 mg diphenhydramine, and an albuterol nebulizer.

You will likely need to use the table and figure provided, your textbook, and online resources to answer the questions included in this case study. A list of websites that you may find helpful is given in the “References” section at the end of the case.

Questions

- Riding in the ambulance with Amoria on the way to the hospital, you’re trying to remember everything you learned in the anatomy and physiology course you took several years ago. You know that several of Amoria’s vital signs are abnormal. Identify the normal range for each of the measured vital signs in an adult and the normal range for vital signs in a two-year-old (these vary slightly). Enter the ranges into the table below, then determine whether each of Amoria’s vitals are abnormal for her age group.

| <i>Vital Sign</i> | <i>Normal Adult Range</i> | <i>Normal Pediatric Range (Age = 2)</i> | <i>Abnormal?</i> |
|-------------------|---------------------------|-----------------------------------------|------------------|
| Blood Pressure | | | Yes / No |
| Heart Rate | | | Yes / No |
| Respiratory Rate | | | Yes / No |
| SpO ₂ | | | Yes / No |
| Body Temperature | | | Yes / No |

- Explain the purpose of each of the medications Amoria was given on the way to the hospital, and how they could help to move her vitals closer to the normal range.

Part II – Diagnosis

Since she was already working at the hospital, Amoria's mother, Dr. Villegas, makes it to the emergency room before you do. She is waiting in the ambulance bay as you pull up and is conversing with one of the ER doctors, explaining Amoria's history of allergies.

"She's had only localized reactions to allergens in the past, but I suspect based on the circumstances and her vitals that she is having a systemic reaction," Dr. Villegas says. The emergency room doctor agrees and orders blood work to help confirm this as they transport Amoria inside.

Questions

1. What is the difference between an allergic reaction that is localized versus one that is systemic?
2. Define "allergen" and explain how an allergen differs from an antigen.
3. What are some examples of allergens that typically cause anaphylactic reactions? Based on the events at the park, what is the likeliest allergen in Amoria's case?
4. The ER doctor ordered blood work, which was then analyzed by the hospital's lab. Identify the leukocyte from Amoria's blood sample in Figure 1. What are some key characteristics of this white blood cell type? What is contained within the granules visible on the cell's surface?

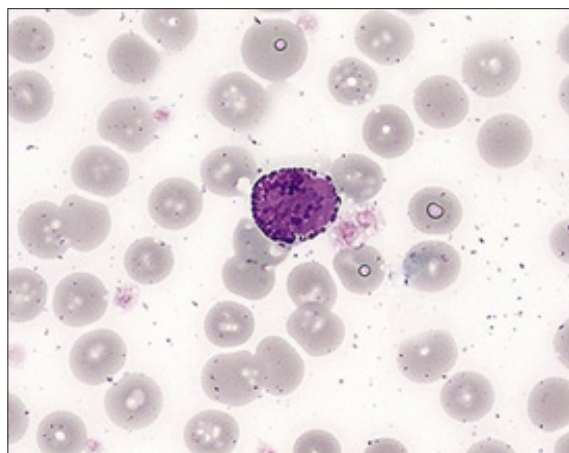


Figure 1. Amoria's blood sample under a microscope. (Credit: Animalculist, CC BY-SA 4.0, https://commons.wikimedia.org/wiki/File:Basophil_in_blood.jpg.)

5. How might a blood sample help to confirm a diagnosis of anaphylaxis?

Part III – Sensitization and the Secondary Response

You are still standing in the ambulance bay, feeling a little dazed, when one of the EMTs invites you to come to the emergency waiting room. Tears well up in your eyes as you think about Amoria and what has happened to her while in your care. The EMT notices, and asks if you are okay.

“This is my fault,” you say and start to sob.

The EMT puts a gentle arm around your shoulder, leads you to a chair and invites you to sit down.

“This is not your fault,” he begins. “What is happening with Amoria is due to a series of reactions in her body that you did not cause and didn’t know about.”

Questions

1. Circle the correct choice: *Amoria became sensitized to the allergen that caused her reaction (before / during / after) her visit to the park that morning.*
2. Draw a diagram illustrating the sensitization of basophils and mast cells to an allergen. Then explain in words what is happening in each part of your drawing.

3. Suppose the allergen Amoria reacted to looks like this: Δ . Which example from the figure below could be the form of the antibody produced when Amoria became sensitized? Explain why you made the choice you did.

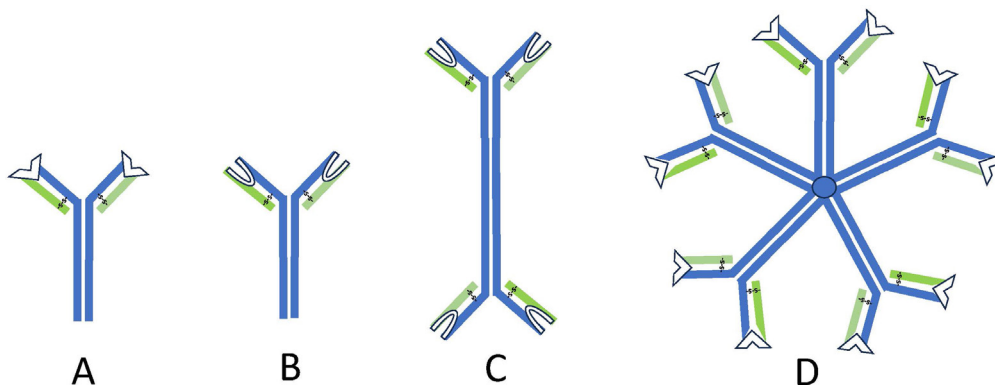


Figure 2. Examples of antibodies.

Part IV – Conclusion

The doctors and nurses in the hospital stabilize Amoria and her vitals return to the normal range. After a day in the hospital for monitoring, she is released home with a prescription for an epinephrine autoinjector (e.g., EpiPen, Auvi-Q) and an allergy action plan.

Questions

1. Explain what an epinephrine autoinjector is.
2. Describe what is included in an allergy action plan.
3. Under which situation(s) should an epinephrine autoinjector be administered? How are they administered?

Part V – Epilogue

A month after the incident you are back at the park with the girls. Amoria is running around barefoot and steps on a bee. It's her first bee sting and she is scared and crying. You remember your last episode at the park and feel a little panicked. You also remember that one of your classmates in elementary school was allergic to bees and carried an EpiPen because of it. You've got Amoria's epinephrine autoinjector in your bag and are trying to remember the doctor's instructions on when and how to use it.

Questions

1. Should you be worried about Amoria having an anaphylactic reaction in response to this bee sting? Why or why not?
2. Should you immediately use the EpiPen on Amoria? Why or why not?

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