NATIONAL CENTER FOR CASE STUDY TEACHING IN SCIENCE

Molly's Medical Mission Maladies

by

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Part I – Cameroon Contamination

Twenty-eight-year-old Molly Muldoon was a dental hygienist who had volunteered for years with Doctors Without Borders on their annual dental and medical mission trips to Cameroon. Aside from occasional bouts of mild abdominal discomfort, along with bloating and decreased appetite, she was in good physical health. She had experienced these symptoms intermittently for a couple of years but she had always attributed it to a stressful, busy life, which included occasional unhealthy fast-food meals. While in Cameroon, though, she ate as the locals did, which included lots of fresh root vegetables, poultry, and dairy products.

Towards the end of her most recent trip to Cameroon, her team saw many patients with febrile gastroenteritis. A microbiologist at the University of Bamenda determined that the causative agent was *Listeria monocytogenes*, linked to an outbreak of listeriosis. Local harvests of cassava and unpasteurized milk that were potentially fecally-contaminated were the likely sources.

Since the team of healthcare workers ate food provided by the local community and because Molly was hoping to get pregnant in the upcoming months, she was empirically treated with ampicillin.

Questions

1. Where is Cameroon? Besides listeriosis, what are occasional outbreaks in Cameroon?

2. What is *Listeria monocytogenes?* Explain its microbiological classification and pathogenesis.

3. What is the typical route of transmission?

4. Why should Molly's impending pregnancy be a concern?

5. What is the drug of choice for treating *Listeria monocytogenes?*

6. What other orally administered antibiotics might be considered for therapy if Molly is unable to tolerate the ampicillin?

7. Can ampicillin be taken by a pregnant woman without incurring danger to the fetus?

Part II – Polymorphonuclear Perplexity

Upon Molly's return to the United States, her abdominal discomfort grew. She sought the advice of Dr. Tim McCracken, an infectious disease specialist at Gogue General Hospital.

"Dr. McCracken, I've been on ampicillin for 12 days now. I would think that if I had contracted listeria, I would be better by now, but I'm frequently nauseated, tired, out of breath, dizzy, and have bouts of diarrhea and abdominal pain. My weight loss is also troubling. I know I'm not pregnant and am thankful for that in my present state because I would be so worried. This is affecting my ability to work now that I am back home. Oh, and I also have a rash," she said as she showed him the rash on her abdomen.

After asking Molly more about her medical mission trips, Dr. McCracken decided to do a full blood and immunological panel. Tables 1 and 2 below show Molly's results and reference comparisons based on her age.

Table 1. Blood panel.

Cell Type	*Value*	*Reference Range*
Leukocytes	8,800 cells/mcL	4,500 to 11,000 cells/mcL
Erythrocytes	3.9 million cells/mcL	4.7 to 6.1 million cells/mcL
Platelets	420,000/mcL	200,000-500,000/mcL
Neutrophils	3000 cells/mcL	2500 to 6000 cells/mcL
Monocytes	350 cells/mcL	200 to 800 cells/mcL
Basophils	190 cells/mcL	0 to 300 cells/mcL
Eosinophils	1200 cells/mcL	50 to 300 cells/mcL
Lymphocytes	2800 cells/mcL	800 to 5000 cell/s mcL

Table 2. Immunological panel (only aberrant values shown).

Component	*Value*	*Reference value*
IgE	950 IU/ml	~32 IU/ml
IL-3	6.9 pg/ml	~0.2 pg/ml
IL-5	8.1 pg/ml	~4.4 pg/ml
GM-CSF	38.4 pg/ml	~5.5 pg/ml

Questions

1. Based on these test results, what could be the cause(s) of Molly's eosinophilia?

2. At what value is hyper-eosinophilia defined? What could be the cause of her erythrocytopenia?

3. Explain Molly's immunological panel (Table 2). What could a spike in these immune components mean?

4. If you were Dr. McCracken, what additional tests, if any, would you order?

Part III – Helminths and Drug Side Effects

Dr. McCracken decided to do additional blood work on Molly and also requested a stool sample. He suspected that she may have picked up a parasitic worm or protozoan from contaminated food sources or water, which are sometimes common in areas such as Cameroon. Because she had had gastrointestinal issues for a while and because the life cycle of some helminths can take months, the doctor was aware that this might not be a recent infection.

A stool sample microscopy examination and a polymerase chain reaction performed on a sample showed evidence of *Ascaris lumbricoides* eggs and DNA, respectively. Dr. McCracken also suspected that the ampicillin exacerbated the problem because side effects such as a rash, nausea, and diarrhea can occur. Both can also cause a spike in eosinophils or can sometimes even result in asymptomatic eosinophilia.

Molly was asked to discontinue the use of the ampicillin since no signs of listeriosis were evident and since she was towards the end of her prescription. She was prescribed albendazole for 28 days, but was cautioned that abdominal discomfort and diarrhea may occur.

The pharmacist, Dr. Katrina Rybicki, counseled Molly regarding the use of the albendazole 200 mg tablets. Dr. Rybicki advised her to swallow the tablet whole, or if she preferred, she could crush the tablet, then mix the powder with a liquid and swallow the mixture.

"Molly, whichever form you decide to use, you should take the medication with a fatty meal," informed Dr. Rybicki. "Also, avoid drinking grapefruit juice while on the medication."

Five weeks later, Molly arrived for a follow-up visit. All of the side effects she had been experiencing had now disappeared. She felt better than she had in years. With a clean bill of health, she could now get back to life as normal. Maybe a pregnancy would be in her near future after all.

Questions

1. What was the likely source of ascariasis? Explain the modes of transmission and the life cycle of *Ascaris lumbricoides* and where it is geographically prevalent.

2. What other tests or procedures could have been used to identify the presence of this or other helminths?

3. What are other potential side effects of ampicillin?

4. Molly was concerned that she would not get the full dose if she crushed the albendazole tablet. She asked Dr. Rybicki if she could have a liquid product instead. What albendazole products are available in the United States?

5. Molly wanted Dr. Rybicki to make an oral solution for her. Could the pharmacist make an oral solution of albendazole with cherry syrup?

6. Why would the pharmacist recommend taking the drug with a high-fat meal?

7. Why should Molly avoid drinking grapefruit juice, which happens to be her favorite?

8. What is the mechanism of action of albendazole? Describe the ultimate cause of death of the helminths.