



Case study title:	Mercury (Clinical case)
Target group:	Paediatricians, General practitioners, Public health professionals
Linked to modules:	Mercury, Heavy metals, Paediatric environmental and health history
Source of case study:	
Case handling:	Use powerpoint presentation and/or handouts based on the case description. Stepwise approach. Includes a post test.

A 14-year old male has complaints of a fever, itchy rash, and difficulty breathing for the past four days. He tells you that he has a history of asthma. He has had asthma since he was three years old. The asthma is generally well managed with inhalers. However, yesterday his family brought him to the hospital in respiratory distress. He was given albuterol nebs x3, Solumedrol IV and Benadryl IM. After the treatment he felt some relief and eventually was discharged home.

Some more information on his medical history. He uses albuterol and Azmacort inhalers plus ibuprofen occasionally for headaches. He states he uses his inhalers only when needed and usually before engaging in strenuous activity, such as sport activities. He has been hospitalised four times since age three for exacerbation of his asthma symptoms. The last time he was hospitalized was more than two years ago. He has never been intubated. He has no known history of drug allergies. He lives in an apartment with his parents and 17 year-old sister. There are no smokers at home. He also denies any alcohol or other substance abuse.

Physical Examination: he is a well-developed youngster, 1.75 meter tall, weighing 60 kg. He is alert and cooperative. Oral temperature is 98 degrees F/37 degrees C. His pulse is 110/minute, respiratory rate is 24/minute and slightly labored, blood pressure 125/95mm Hg. His oxygen saturation is 90% on room air. Head and neck exam reveals 4mm pupils, equal and reactive to light. His neck is supple; there is no adenopathy. His throat shows no erythema and no oedema. Lung examination: there is a bilateral wheeze during both inspiration and exhalation with a prolonged expiratory phase. There are no rhonchi, no rales and no intercostals retractions. Chest expansion is symmetrical. His PEFr is 360 (67% of predicted). His cardio-vascular exam is normal with a capillary refill < 2 seconds. His abdominal examination shows soft with bowel sounds present in 4 quadrants. There is no distension or abdominal tenderness. His skin reveals a red, irregular macular rash covering his thighs, arms and hands, and his trunk, front and back. No petechiae or vesicles are noted. There is desquamation of the digits on both hands, particularly on the palmar side.



QUESTION 1: What are the problems for this young man. Please list your main findings.

ANSWER TO QUESTION 1

Compare your list to the completed list.

Answer: your list should include:

- Dyspnea
- Wheeze
- Macular rash
- Desquamation of digits

QUESTION 2: Question: can you develop the differential diagnosis? Use Dyspnea and rash from the problems that were listed.



ANSWER TO QUESTION 2

Dyspnea

- Asthma exacerbation
- URI
- Bronchitis
- Pneumonia
- Cardiac disease/ congestive heart failure (highly unlikely)

The patient has known asthma and the physical exam with inspiratory and expiratory wheeze is consistent with an exacerbation of his reactive airway disease. The history of fever and minimal relief following treatment for asthma in the hospital less than 24 hours ago, you must also consider an infectious process and rule out pneumonia.

Rash

- Allergic reaction
- Infectious Disease – viral
- Toxic exposure
- Autoimmune disease/syndrome- e.g., lupus, vasculitis

The rash is macular with palmar distribution, plus there is desquamation of the digits. An allergic reaction is possible, however digit desquamation is unusual in such cases. Many infectious processes may present with both respiratory and skin manifestation. Viruses generally spare palms; bacteria, mycoplasma and rickettsia cause palmar manifestation; bacteria is the most common of the three.

A drug reaction is unlikely since he denies using any new medications or illicit substances.

Exposure to several different toxins can cause rash, including pesticides, metals and solvents. You could perform an internet search to determine which toxins may cause these symptoms.

Autoimmune diseases and syndromes such as lupus and vasculitis may show symptoms as described.

NEW INFORMATION

There may be some type of environmental exposure. You need to obtain a more detailed environmental history from the patient. You may follow the pediatric history taking list as presented in the module on this. Following is an example of questions that should be in your environmental history.



PAEDIATRIC ENVIRONMENTAL HISTORY

You need to know the **environmental health history** to diagnose the case.

Screening Questions for Environmental Exposures (should be asked in most cases):

- Do you think the child's health problems are related to the home, daycare, school, or other location?
- Has there been any exposure to pesticides, solvents or other chemicals, dusts, fumes, radiation, or loud noise?
- What kind of work do the parents or other household members engage in?

Detailed Environmental History (should be asked when environmental etiology is suspected):

1. Do you live next to or near an industrial plant, commercial business, dump site, or nonresidential property?
2. Which of the following do you have in your home? *Please circle all that apply.*

Air conditioner	Electric Stove
Gas Stove	Humidifier
Wood Stove	Central Heating (gas or oil)
Air Purifier	Fireplace
3. Have you recently acquired new furniture or carpet, refinished furniture or remodeled your home?
4. Have you weatherized/insulated your home recently?
5. Are pesticides or herbicides (bug or weed killers, flea and tick sprays, collars, powders, or shampoos) used in your home or garden or on pets?
6. Do you (or any household member) have a hobby or a craft?
7. Do you work on your car?
8. Have you ever changed your residence because of a health problem?
9. Does your drinking water come from a private well, city water supply, or grocery store?
10. Approximately what year was your home built? _____

If you answered *yes* to any of the questions, please explain.



Environmental History for our patient

This family occupies a three bedroom apartment. The water supply is city water piped from groundwater sources. All food is bought at a supermarket. Some fresh vegetables come from a grandmothers garden. There are no unusual hobbies. The mother works as a secretary at a nursing home. The father works at an insurance company. The patient and his sister are in high school. They do not have part-time jobs. They play a lot of sports during the weekend. The family has no pets, except some fishes.

Answers from the history form:

1. Do you live next to or near an industrial plant, commercial business, dump site, or nonresidential property? **No**

2. Which of the following do you have in your home? *Please circle all that apply.*

Air conditioner	Electric Stove
Gas Stove	Humidifier
Wood Stove	Central Heating (gas or oil)
Air Purifier	Fireplace

3. Have you recently acquired new furniture or carpet, refinished furniture or remodeled your home? **No**

4. Have you weatherized your home recently? **No**

5. Are pesticides or herbicides (bug or weed killers, flea and tick sprays, collars, powders, or shampoos) used in your home or garden or on pets? **No**

6. Do you (or any household member) have a hobby or a craft? **Yes**

7. Do you work on your car? **No**

8. Have you ever changed your residence because of a health problem? **No**

9. Does your drinking water come from a private well, city water supply, or grocery store? **City water supply**

10. Approximately what year was your home built? **1938**

If you answered yes to any of the questions, please explain.

6. My father and I are building a sailing boat. My mother likes to make beaded jewelry. About two weeks ago someone brought over a jar of liquid mercury so my mother could clean some silver beads she was making into a necklace.

Question 3: the mention of mercury should raise your interest. What do you ask next?



ANSWER TO QUESTION 3 : you determine that the mercury was stored in a plastic container on a shelf in front of the living room window air conditioner. The mother had spilled some of it on the sofa. After vacuuming up the spill, the patient and his sister watched TV in that room. In addition, each had slept on the sofa or on the living room rug during the recent hot weather since it is the only room in the apartment that is air-conditioned.

NEW INFORMATION

The possibility grows that your patient may be suffering from mercury toxicity. You should consult with a Clinical Toxicologist or environmental health specialist.

The toxicologist or environmental health specialist agrees that the patient's symptoms are consistent with elemental mercury poisoning. He recommends obtaining a spot urine specimen for mercury level, plus a serum mercury level. You should also order a chest x-ray.

Before proceeding to the lab, the patient receives a nebulizer treatment. Twenty minutes later, his PEFr still shows no improvement. He appears to be in no acute distress.

The laboratory gives you the following results:

Ranges:

Reference range = <1 microgram/dl in serum

Potentially toxic = > 5 microgram/dl in serum

Acceptable range for non-exposed subjects is up to 20 microgram/l. in urine

Acceptable range for industrial exposure is up to 150 microgram/l. in urine

The chest films show no infiltrates.

Patient's Results:

Serum mercury = 18 microgram/dl

Spot urine mercury = 545 microgram/l

QUESTION 4: what would be your action now?



Answer to question 4: the patient should be admitted to the Pediatric ICU with a diagnosis of asthma exacerbation and mercury toxicity. He will be administered bronchodilators and anti-inflammatory medication plus supportive care for his asthma, and he will be started on chelation therapy with Succimer (dimercaptosuccinic acid) for his mercury poisoning. Once his asthma is under control, his chelation will continue at home.

Chelation protocol for mercury toxicity is Dimercaptosuccinic Acid (DMSA) 10 mg/kg by mouth every 8 hours for 5 days, followed by 10 mg/kg every 12 hours for 14 days.

You also inform the patient's parents that they and the other child, as well as anyone who might have spent some time in their apartment since the mercury was spilled and vacuumed, should be tested for mercury exposure and possible toxicity. The parents obtain acid-washed 24-hour urine collection bottles from the hospital laboratory.

QUESTION 5: what to do with the location of source?



Answer to question 5: Cleaning mercury spills are difficult to do well. A spill this size must be handled professionally. The apartment must be sampled for mercury vapors following clean up efforts. Mercury spills should never be vacuumed as that will aerosolize the mercury vapors and increase potential inhalation risk.

Additional information

What needs to be done if elemental (Metallic) Mercury is spilled in a house.

Mercury spills should be considered a hazardous material incident. Never use a vacuum cleaner to clean mercury spills. If any amount greater than that from a small thermometer is spilled, or if mercury from a fever thermometer is spilled on a porous surface, call your local environmental health department, local board of health, poison control center or your physician, even if no one has symptoms. Do not attempt to clean the spills by yourself. Open windows to ventilate and evacuate the area until professionally assessed and cleaned.

If a small amount of mercury is spilled (the amount in a fever thermometer) on a hard, non-porous surface, it can be cleaned following the instructions below:

- Remove all gold jewelry
- Using an index card or other stiff paper, gather the droplets together into a glass jar with a tight lid or a "ziplock" plastic bag. Masking, cellophane or duct tape may be helpful in picking up the mercury.
- Avoid skin contact.
- Contact your local health department for proper disposal instructions.

For more information on the hazards of mercury see:

<http://www.atsdr.cdc.gov/toxprofiles/phs46.html>

Though asymptomatic, the patient's parents and sister also had urine mercury levels greater than 300 microgram/l and required chelation on an outpatient basis.

The patient was followed in the clinic one week after discharge from the hospital. His 24 hour urine mercury level was 65 microgram/l and a second round of chelation therapy was ordered (Succimer 10 milligram/kg bid for 14 days). Following the second round of therapy, his urine mercury level was 45 microgram/l. His skin rashes had cleared. His lungs remained reactive and required a change in his management plan to obtain optimal control.

He is advised to return to the clinic in three months for follow-up, or sooner if needed. At the follow-up visit, a repeat 24 hour urine for mercury will be sent for analysis. By this time you would expect that the mercury level has continued to drop since the body will continue to excrete mercury on its own. The normal half-life of mercury is 60 days, meaning in 60 days the amount of mercury in the body will be reduced by half.

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