

Pathophysiology Case - Acute Lymphocytic Leukemia

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CASE HISTORY

Maria is a 7-year-old girl who is brought to her physician by her mother with complaints of general fatigue, anorexia, and unexplained bruises and “rash” for the last month.

Past History

Maria was a full term infant of an uncomplicated pregnancy and delivery. She has never been exposed to ionizing radiation. All of her immunizations are current. She had only one childhood disease, chickenpox, at age 5. Maria has one bother, aged 4, who is in good health. The family history is unremarkable with the exception of one fraternal grandfather who dies at 61 from colon cancer.

Current Status

Maria’s vital signs are as follows: temperature 37 C, heart rate 92, respiration 18, blood pressure 90/60. Her height and weight are in the 55th percentile. Her skin is pale, warm and dry with ecchymosis on the trunk and extremities. The “rash” was found to be petechiae on her arms and chest. Heart rate and rhythm were normal without murmurs; breath sounds were clear and equal bilaterally. Neither her spleen or liver were palpable, however, there were three palpable non-tender lymph in the sub-maxillary chain. The pharynx was without redness or pain, the cranial nerves were intact, and reflexes were present and equal bilaterally. The CBC with differential count results were as follows: hemoglobin 8.8 g; hematocrit 26%; RBC 3.1 million/ mm³; WBC 13,000/mm³; neutrophils 6500; basophils 130; eosinophils 360; monocytes 1170; lymphocytes 3640; blasts 10%; platelets 50,000 mm³.

Maria was immediately referred to a pediatric oncologist and admitted to the children’s hospital for diagnosis and treatment. A bone marrow aspiration, lumbar puncture, blood work (complete blood count with differential platelet count, and hepatic and nephrotoxic function studies) and chest x-rays were performed. A diagnosis of Acute Lymphoblastic Leukemia (ALL), lacking T-cell or B-cell surface markers (null cell type), was made. The null cells were found to react positively with the common acute lymphoblastic leukemia antigen-positive (CALLA-positive). There was no evidence of mediastinal or central nervous system involvement.

1. Which physical finding is most alarming to the primary care provider:
 - A. Complaint of general fatigue in a 7-year-old
 - B. Anorexia in a 7-year-old
 - C. Petechiae and unexplained ecchymosis
 - D. Three palpable lymph nodes

2. What probably caused the above symptoms?

3. A diagnosis of leukemia was suspected from a CBC results on the basis of

- A. Hemoglobin of 8.8 g.
- B. Total white count of 13,000
- C. Platelets of 50,000 mm³
- D. 10% blasts

4. Is there anything in Maria's history that put her at risk for leukemia?

5. Which of the following factors would indicate an improved prognosis for Maria?

- A. Her age
- B. White blood count of 13,000 at diagnosis
- C. Absence of hepatomegaly
- D. Absence of splenomegaly
- E. All of the above

Maria started chemotherapy with vincristine, prednisone, and L-asparaginase. The induction phase of therapy with these drugs lasts until remission is attained. Since chemotherapeutic agents do not cross the blood-brain barrier, intrathecal methotrexate and cranial radiation is given to destroy the leukemic cells in the central nervous system. This is called the sanctuary phase.

Eight weeks after diagnosis, Maria's bone marrow and peripheral blood smear showed no evidence of leukemic cells, therefore, remission has been attained. With remission, Maria moves into the maintenance phase, during which she receives monthly medications, complete blood counts, and periodic bone marrow aspirations and lumbar punctures.

6. The rationale for the use of multiple drug therapy as opposed to single agent chemotherapy is that:

- A. Different drugs exert their effects on cells during the different phases of the life cycle of the cell.
- B. No drug works on more than one phase of the cell life cycle.
- C. Chemotherapeutic agents are only effective against cells during cell division.

Three months later, during one of her monthly visits, Maria's complete blood count results were as follows: hemoglobin 6.8 g; hematocrit 20.4%; RBC count 2.1 million/mm³; WBC totals 340: neutrophils 200 mm³; basophils 3 mm³; eosinophils 6 mm³; monocytes 30 mm³; lymphocytes 82 mm³; platelets 20,000 mm³. The physician withholds the chemotherapy dose and transfuses Maria with 1 unit packed red blood cells and 4 units of platelets.

7. What is pancytopenia?

8. The cause of Maria's pancytopenia is

- A. Deteriorating physical status caused by the disease process
- B. A known side effect of chemotherapy
- C. Aplastic anemia resulting from the toxic effects of chemotherapy

9. Maria is currently at risk for which of the following major complications of treatment? PICK THREE

- A. Anemia
- B. Hemorrhage
- C. Infection
- D. DIC – disseminated intravascular coagulation
- E. Gram-negative septic shock
- F. Shock
- G. Thrombocytopenia purpura

10. How would you support and minister to Maria's parents?

Name _____

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Please circle to correct answers and complete the short answers.

1. A) B) C) D)

2. What probably caused the above symptoms?

3. A) B) C) D)

4. Is there anything in Maria's history that put her at risk for leukemia?

5. A) B) C) D) E)

6. A) B) C)

7. What is pancytopenia?

8. A) B) C)

9. PICK THREE

- H. Anemia
- I. Hemorrhage
- J. Infection
- K. DIC – disseminated intravascular coagulation
- L. Gram-negative septic shock
- M. Shock
- N. Thrombocytopenia purpura

10. How would you support and minister to Maria's parents?
