

Case 1

W.Y. is a 19-month-old male who presented to the ED with fever. He was well until 5 months of age when he suffered his first episode of pneumonia. He had one additional episode of pneumonia and three episodes of otitis media.¹ In the Emergency Room, his vital signs were: T 104°F, HR 140, respiratory rate 26, and BP 150/90. He appeared small for his age. The remainder of his physical exam was notable for bulging tympanic membranes and râles² over the left lower lung field. Laboratory examination was notable for leukocytosis³ to 18⁴ with 90% polys⁵ (normal 40-70%), 7% bands⁶ (normal 3-5%), and 3% lymphocytes (normal 10-50%). Chest X-ray showed a dense infiltrate in the left lower lobe.⁷ The patient was admitted for treatment of pneumonia and otitis media. In the hospital, additional testing was performed to investigate the reason for this child's frequent bacterial infections. An HIV test was negative. RBC adenosine deaminase (ADA) and purine nucleoside phosphorylase (PNP) were normal. Serum protein electrophoresis showed decreased gamma globulins and quantitative serum immunoglobulins showed an IgM of 20 mg/dl, IgG 50 mg/dl, and IgA of 10 mg/dl (normal values are IgG > 800, IgA > 50, and IgM > 40 mg/dl). Analysis of the child's peripheral blood lymphocytes by flow cytometry showed that they were all T-cells.

¹Middle ear infection. Although this is often viral in etiology, the three most common bacterial etiologies are *Streptococcus pneumoniae* (pneumococcus), *Haemophilus influenzae* and *Moraxella catarrhalis*.

²Velcro-like lung sounds, usually upon inspiration. This physical sign is non-specific, but is typical of pulmonary edema (excess lung water) or consolidation (e.g., reflecting the exudate that accompanies bacterial pneumonia). To impress your Ward Attending next year, be certain to pronounce this word correctly ("rahles").

³Elevated white blood cell (WBC) count

⁴In case presentations, units for many values are often omitted. In this case "18" refers to 18 X 10⁹/liter, which is equivalent to 18,000 cells/ μ l.

⁵A common abbreviation for polymorphonuclear leukocytes, or neutrophils

⁶Bands are immature neutrophils whose nuclei appear "band-like" rather than multi-lobed. This is indicative of rapid production and egress of neutrophils from the bone marrow, typically stimulated by infection.

⁷Synonymous terms include "left lower lobe (LLL) consolidation." On chest radiographs, this appears as confluent shadows in the left lower lobe, which is indicative of an alveolar filling process, such as bacterial pneumonia.

Questions for Case 1

- (1) What disease does this child have? How do the cells and molecules absent/diminished in this patient normally protect an individual from infection?
- (2) What types of infections would this child be expected to have frequently? What types of infections should not pose a serious threat to this child?
- (3) Why did this child not have any infections during his first few months of life?
- (4) At what stage in development are this patient's B-lineage lymphocytes arrested? How might you attempt to demonstrate this in the laboratory?
- (5) All the peripheral blood lymphocytes were T-cells. What cell surface markers might have been used to confirm this?
- (6) Describe known genetic defects that lead to hypogammaglobulinemia.

(7) What therapeutic options are available for this patient?