



Pathology & Biology Section – 2004

G35 Acute Bacterial Meningitis With Predominance of Immature Granulocytes

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This presentation highlights three cases of acute meningitis with a predominance of immature granulocytes and compares these cases to a retrospective evaluation of cases diagnosed as “acute meningitis.”

While a rare phenomenon, knowledge of the fact that immature granulocytes may constitute the principle cell type in the CSF and subarachnoid space of acute bacterial meningitis may prevent misclassification of these cells at the time of evaluation of CSF in the hematology and cytopathology laboratories and during surgical and autopsy pathology examinations.

Background: Bacterial meningitis, in its acute stage, is typically characterized by a “purulent” inflammatory cell infiltrate of abundant polymorphonuclear cells and necrotic debris. Intracellular or extracellular bacteria can be observed in some cases. The neutrophils seen are typically mature, or degenerating. As the process gains chronicity, neutrophils are eventually replaced by mononuclear cells. Recognition of neutrophils in the cerebrospinal fluid (CSF), as opposed to mononuclear cells (macrophages and lymphocytes), is a key clinical finding that guides therapy.

Case Reports: During a period of a year, at two institutions, a total of three fatal cases of acute bacterial meningitis were evaluated at autopsy in which the predominant cell type was immature granulocytes with only rare polymorphonuclear cells recognized.

Case 1: The first case involved a 12-year-old female with a history of morbid obesity and systemic lupus erythematosus, treated with corticosteroids. She was reported to have collapsed suddenly after a two day history of fever, diarrhea, and dark urine. Despite resuscitation efforts, the patient could not be revived and she was pronounced brain-dead the following day. Peripheral blood evaluation had demonstrated a marked left shift. CSF was not evaluated. She had been treated for 1.5 days with antibiotics prior to her demise. An autopsy revealed an inflammatory infiltrate composed of predominantly immature and mature granulocytes within the meninges, lungs, gastric mucosa, and adrenal glands. The bone marrow was normal, suggesting that these cells were the result of a left shift. Organisms were not initially identified by histology, histochemistry, or culture, but subsequent immunohistochemical testing performed at the Center for Disease Control was positive for *Neisseria meningitidis*.

Case 2: The second case involved a one day old female infant, born at 36 weeks estimated gestational age. At birth the infant was unresponsive with Apgar scores of 0, 1, and 5, requiring aggressive resuscitation. Blood cultures identified a *Listeria monocytogenes* bacteremia, and the patient died the following day. Development of a marked left shift occurred during a 20 hour period on a series of three peripheral blood smears. CSF was not evaluated. Antibiotics had been administered prior to death. An autopsy demonstrated miliary microabscesses involving the trachea, lungs, esophagus, stomach, intestine, liver, spleen, and adrenal glands. In addition, an inflammatory infiltrate within the leptomeninges showed a predominance of immature granulocytes rather than mature neutrophils. *Listeria monocytogenes* was cultured from lung and meningeal samples.

Case 3: The third case involved a 44-year-old male with a history of paranoid schizophrenia. He had no known history of immunosuppression and did not drink alcohol or abuse drugs. He had been in his usual state of health until one day prior to his demise when he had complained that he “felt bad.” The next morning he was found unresponsive on the floor next to his bed. He was not taking antibiotics prior to his demise. At autopsy, histologic examination of the meninges revealed a dense inflammatory infiltrate of immature granulocytes. Postmortem cultures of cerebrospinal fluid were positive for *Neisseria meningitidis*.

Materials and Methods: Histologic sections were evaluated by hematoxylin and eosin and Gram stains and immunohistochemically for CD68, CD20, CD3, and myeloperoxidase. Findings from these cases were compared to and contrasted with, by retrospective evaluation, all routinely diagnosed acute bacterial meningitis cases in our database.

Results: Myeloperoxidase positive immature granulocytes constituted the predominant cell type in each of the three cases; only very rare segmented forms were identified. Scattered admixed CD68 positive macrophages and CD3 positive T lymphocytes were identified; only rare CD20 positive B lymphocytes were identified. Gram stain failed to identify bacterial clusters in any of the three index cases.

Discussion: While a rare phenomenon, knowledge of the fact that immature granulocytes may constitute the principle cell type in the CSF and subarachnoid space of acute bacterial meningitis may prevent misclassification of these cells at the time of evaluation of CSF in the hematology and cytopathology



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laboratories and during surgical and autopsy pathology examinations. The organism, treatment, and host factors that may predispose toward manifestation of immature granulocytes in these patients remains unclear.

Acute Bacterial Meningitis, Autopsy, Forensic Science