

A 4-year-old male is brought to the physician with fever and headache. His symptoms began two days ago with low-grade fever, cough, and congestion. Last night, he developed a temperature of 102° F (38.9° C) and became fussy and less active. Today, he is crying and complaining of a headache. His parents report that he has vomited twice today. In the office, his temperature is 102.5° F (39.0° C), pulse is 110/min, and respiratory rate is 20/min. On examination, he is irritable and shows signs of photophobia. His oropharynx is erythematous. Nuchal rigidity is present and when the neck is flexed, the patient flexes his lower extremities. The remainder of the physical examination is normal. Lumbar puncture is performed and the results are shown below.

## CSF

Glucose	60 mg/dL
Protein	80 mg/dL
RBC	10/mm <sup>3</sup>
WBC	100/mm <sup>3</sup>
Neutrophils	10%
Lymphocytes	70%
Monocytes	20%
Gram stain	no organisms

Which of the following organisms is most likely responsible for this patient's presentation?

- ☐ A. *Streptococcus pneumoniae*
- ☐ B. *Mycobacterium tuberculosis*
- ☐ C. Epstein-Barr virus
- ☐ D. *Neisseria meningitidis*
- ☐ E. Echovirus



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Gram stain	no organisms

Which of the following organisms is most likely responsible for this patient's presentation?

- ☐ A. *Streptococcus pneumoniae* [5%]
- ☐ B. *Mycobacterium tuberculosis* [4%]
- ☐ C. Epstein-Barr virus [15%]
- ☐ D. *Neisseria meningitidis* [5%]
- ☒ E. **Echovirus** [72%]

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Explanation:

User Id:



Explanation:

User Id: 

Cerebrospinal fluid analysis			
Diagnosis	WBC count (cells/ $\mu$ L)	Glucose (mg/dL)	Protein (mg/dL)
Normal	0-5	40-70	<40
Bacterial meningitis	>1,000	<40	>250
Tuberculosis meningitis	5-1,000	<10	>250
Viral meningitis	100-1,000	40-70	<100
Guillain-Barré	0-5	40-70	45-1,000

WBC = white blood cell.

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Viral meningitis is a usually self-limited inflammation of the leptomeninges caused by a viral infection. Almost 90% of cases are caused by non-polio enteroviruses, such as echovirus and coxsackievirus. The incidence of viral meningitis decreases with increasing age. Infants are most commonly affected, and disease morbidity and mortality is highest in this group.

Patients with viral meningitis can present with a viral prodrome of constitutional and upper respiratory symptoms with low-grade fever. Over the next 36-48 hours, the patient develops a high fever, headache, irritability, and nuchal rigidity. Focal neurologic signs are not usually seen. The patient may also present with seizures. Other symptoms of enteroviral infection may also be seen such as pharyngitis, rash, or herpangina.

In viral meningitis, the cerebrospinal fluid (CSF) will show pleocytosis with lymphocytic predominance, although neutrophils may predominate early in the course. The protein level is normal to slightly elevated and the glucose level is normal. CSF gram stain will not show any organisms. Treatment is supportive; in most patients, symptoms resolve



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In viral meningitis, the cerebrospinal fluid (CSF) will show pleocytosis with lymphocytic predominance, although neutrophils may predominate early in the course. The protein level is normal to slightly elevated and the glucose level is normal. CSF gram stain will not show any organisms. Treatment is supportive; in most patients, symptoms resolve within 7-10 days.

Bacterial meningitis caused by *Streptococcus pneumoniae* (**Choice A**) or *Neisseria meningitidis* (**Choice D**) will have a similar presentation. However, CSF examination will show an increased cell count with a predominance of neutrophils, increased protein, and decreased glucose. Gram stain will show bacteria.

(**Choice B**) CSF in tuberculous meningitis also shows a mildly elevated white cell count with lymphocyte predominance; the protein will be very high and glucose will be low. However, the presentation tends to be subacute rather than acute.

(**Choice C**) Viral meningitis can be caused by Epstein-Barr virus, but this is a much less common cause than the enteroviruses.

#### Educational objective:

The most common causes of viral meningitis are the non-polio enteroviruses, such as echoviruses and coxsackieviruses.