4.3 Findings Suggestive of Meningitis in Children

Although vaccination has significantly reduced its incidence, the possibility of bacterial meningitis (a bacterial infection of the area around the brain) remains scary for clinicians seeing young children with fevers. Israeli investigators reported on the diagnostic accuracy of clinical symptoms and signs of meningitis in children.[1] They enrolled 108 patients 2 months to 16 years old who underwent lumbar puncture (also called a spinal tap; using a needle in the back to remove spinal fluid) for suspected meningitis and correlated signs and symptoms with the diagnosis of meningitis.   The gold standard for meningitis was a white blood cell count of 6 or higher per microliter of cerebrospinal fluid (CSF).

(Clinical information: *bacterial* meningitis is more severe and less common than *aseptic* (viral) meningitis, and CSF white blood cell (WBC) counts with meningitis are typically much higher than 6 WBC/µL, especially in those with bacterial meningitis.)

From the abstract:

RESULTS: Meningitis was diagnosed in 58 patients (53.7%; 6 bacterial and 52 aseptic). Sensitivity and specificity were 76% and 53% for headache (among the verbal patients)… Photophobia {pain or discomfort from bright light} was highly specific (88%) but had low sensitivity (28%). Clinical examination revealed nuchal rigidity {stiff neck} (in patients without open fontanel) in 32 (65%) of the patients with meningitis and in 10 (33%) of the patients without meningitis.

These are disappointing results for some of the main symptoms and signs we use to decide whether to do a lumbar puncture.

Consider clinical findings such as headache as the index tests and the CSF cell count ≥ 6 as the gold standard for meningitis.

For each of the following statements, answer whether it is true or false and explain your answer.

a. The low sensitivity of the findings could be due to *partial verification bias*, because only subjects who received a lumbar puncture were included in the study. [2]

b. The higher specificity of photophobia could be due to *partial verification bias,* if clinicians deciding to do a lumbar puncture were particularly influenced to do so because photophobia was present. [2]

c. If we wished to use this study to estimate the sensitivity of clinical findings for *bacterial* meningitis, we would have to be concerned about falsely low sensitivity due to *spectrum bias*: sensitivity probably would have been higher if more of the meningitis group had bacterial meningitis. [2]

d. The low specificity of these tests could be due to *spectrum bias*: specificity probably would have been higher if more of the meningitis group had bacterial meningitis. [2]

Assume that the photophobia results were as in the following table:

Photophobia	CSF WBC Count per µL		
	>30	7-30	≤6
Yes	6	10	6
No	0	42	44
	6	52	50

e. If the authors had used a WBC cutoff of ≥ 30/µL for the meningitis gold standard, both sensitivity and specificity would have been higher. [2]

1.   Amarilyo G, Alper A, Ben-Tov A, Grisaru-Soen G. Diagnostic accuracy of clinical symptoms and signs in children with meningitis. Pediatr Emerg Care. 2011;27(3):196-9.