## Teaching Script

**Authors:** Sara Sanders, M.D. and Katelyn Cushanick, M.D.  
**Topic:** Evaluation CSF pleocytosis in traumatic lumbar punctures

| **Identify the Trigger**  
| Based on patient situation/learner | “The patient had a lumbar puncture with significantly elevated CSF RBC count and based on the CSF WBC count correction calculator/correction factor, she/he does not have CSF pleocytosis consistent with meningitis.” |
| **High Yield Teaching Point**  
| What do they need to know that will impact their care of patients? | The safest interpretation of a traumatic tap is to count the total number of WBC and disregard the RBC count; if the CSF meets age based criteria for elevated CSF WBC count consider this as CSF pleocytosis and treat for bacterial meningitis while following CSF culture results. There are studies that evaluate correcting the CSF WBC count for total CSF RBC count including development of correction factors and use in calculators, but this may miss some patients with bacterial meningitis. |
| **Identify EBM**  
Using a linear regression model, a CSF RBCs:WBCs correction ratio of 877.1:1 was developed to corrected CSF WBC count in traumatic lumbar punctures (>10K RBCs). The corrected CSF WBC count had lower sensitivity, but did result in fewer infants with CSF pleocytosis. There was misclassification of 7/33 infants with bacterial meningitis as not having CSF pleocytosis.  
Identified 2519 traumatic lumbar punctures of which 114 (1.8%) of these had bacterial meningitis. This study evaluated the area under the receiver operating characteristic curve for WBC count unadjusted and adjusted. By all methods evaluated, the curves were similar concluding that adjustment of CSF WBC count to account for increased RBC count does not improve diagnostic utility. Authors concluded that adjustment of the WBC counts in the setting of traumatic LP does not aid in diagnosis of bacterial and fungal meningitis. |
| **Describe Strategy**  
| Interactive, analogies, visuals | Questioning: When provided with a patient example of a traumatic lumbar puncture, start with the lowest level learner asking each member on the team to commit to calling the CSF WBC as pleocytosis/concerning for meningitis or not.  
Probe further: Ask each member why they think that.  
Teaching: Use the correction calculator below and plug in the specific CSF cell counts into the calculator to see if it would change the diagnosis of pleocytosis. |

Probe: “What is the evidence for using a correction factor? Are you concerned about missing cases of bacterial meningitis?”

Teaching script: use the EBM highlighted points from the articles above to emphasize the lack of evidence for correcting CSF WBC counts in traumatic lumbar punctures and the evidence showing risk of missing cases of bacterial meningitis by misclassifying as not having CSF pleocytosis.

Reinforcing/constructive feedback: dependent on learner response; identify gaps in knowledge and use the scripts provided to do the most direct teaching

It is important to reiterate that CSF pleocytosis in traumatic lumbar punctures does not commit these patients to a full course of empiric antibiotics, however, it is important to consider the CSF pleocytosis as real and empirically treat while following the clinical status of the patient and the CSF cultures.

Additional scripts:
“What are other causes of elevated RBCs in the CSF other than traumatic taps?”
HSV meningitis or subarachnoid hemorrhage can present with significantly elevated RBC count on CSF analysis.

“What is the rationale behind correcting CSF WBC count in traumatic lumbar punctures?”
In a traumatic lumbar puncture, peripheral blood is introduced into the CSF thereby distorting the true cell counts. One proposed formula for correcting is: Corrected CSF WBC count= Reported CSF WBC – [(WBC in peripheral blood x RBC in CSF)/(RBC in peripheral blood)]. Others suggest a correction ratio of 1 CSF WBC:500-1000 RBCs. There is no evidence that use of this formula can fully exclude meningitis.

“Can you think of a clinical scenario where we may be more dependent on the traumatic LP results?” If lumbar punctures are pretreated with one or more doses of antibiotics, the CSF cultures may not be reliable for ruling out meningitis.


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