Bilirubin, Cerebrospinal Fluid

FOR USE IN THE EVALUATION OF SUSPECTED SUBARACHNOID HEMORRHAGE

Test Highlights

- The concentration of bilirubin in cerebrospinal fluid (CSF) is too low to be measured using standard chemical techniques, and the visual inspection of CSF for the presence of xanthochromia is an unreliable method of detecting bilirubin.
- Spectrophotometric detection of bilirubin in CSF can help detect subarachnoid hemorrhage (SAH) in patients in whom hemorrhage is suspected but who have a negative computed tomography scan. This method can also eliminate the possibility of SAH in the remainder without the need for angiography.

Clinical Background

- Most SAH cases occur due to the rupture of intracranial aneurysms that release blood into CSF, which rapidly increases intracranial pressure.
- The most frequent symptom of SAH is a sudden, severe headache often described by patients as the worst headache they have ever experienced. This symptom may or may not be accompanied by loss of consciousness, vomiting, and nuchal rigidity. Patients who present with these classic symptoms usually do not pose a diagnostic challenge, but up to half of all patients with SAH experience only minor bleeding and may not present with classic symptoms.
- Approximately 30 percent of SAH is not correctly diagnosed. In these cases, outcome is generally poor.
- A computed tomography (CT) scan of the head is the mainstay of an SAH diagnosis and is most sensitive when performed within the first 12 hours after the hemorrhage but is often negative in patients with a minor SAH. The sensitivity of a head CT scan decreases rapidly over time.
- Spectrophotometric detection of bilirubin in CSF can be useful in identifying SAH in those patients for whom a CT scan is unrevealing.

Pathophysiology

- Following an SAH, red blood cells rapidly disseminate through the subarachnoid space, where they are gradually lysed and release intracellular oxyhemoglobin. The released oxyhemoglobin is enzymatically metabolized to bilirubin in a time-dependent process that imparts a yellow tint to the CSF. This yellowish tint is commonly referred to as xanthochromia.
- The conversion of oxyhemoglobin to bilirubin only occurs in vivo. Thus, the presence of blood in the CSF from a traumatic lumbar puncture will not result in an increase in CSF bilirubin.

Indications for Ordering

To investigate the possibility of SAH in patients for whom a CT scan of the head is unrevealing.

Additional Ordering Note

A blood sample must be obtained at the time of CSF collection. This sample is used to aid in interpretation of the test result.

Interpretation

- The detection of bilirubin in the CSF supports a diagnosis of SAH in patients for whom it is suspected.
- The absence of bilirubin in the CSF in conjunction with a negative CT scan of the head is sufficient to rule out SAH.

Limitations

- CSF samples should be collected 12 hours after the suspected hemorrhage, as the formation of bilirubin from oxyhemoglobin is time-dependent, and bilirubin will not be detectable within 12 hours of an SAH.
- A traumatic lumbar puncture can increase the amount of oxyhemoglobin in the sample, which may interfere with the detection of bilirubin.
- Samples should be protected from light because bilirubin is degraded when exposed to light.

Methodology

Scanning spectrophotometry is used to determine the absorbance of a CSF sample at each wavelength between 350 and 550 nm. The number of absorbance units (AU) that the curve deviates from a base line at 476 and ~414 nm is recorded as the net bilirubin absorbance (NBA) and the net oxyhemoglobin absorbance (NOA), respectively. Reference limits for the NBA and NOA are ≤0.007 and ≤0.020 AU, respectively.

References

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2. Edlow JA and Caplan LR. Avoiding pitfalls in the diagnosis of subarachnoid hemorrhage. *New Eng J Med* 2000;342:29–36.
3. Perry JJ, et al. Is the combination of negative computed tomography result and negative lumbar puncture result sufficient to rule out subarachnoid hemorrhage? *Ann Emerg Med* 2008;51:707–13.

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Test Information

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For information on test selection, ordering, and interpretation, refer to ARUP Consult® at www.arupconsult.com.

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