

Review: Success of lumbar puncture is enhanced by reinserting the stylet before removing the needle

Straus SE, Thorpe KE, Holroyd-Leduc J. How do I perform a lumbar puncture and analyze the results to diagnose bacterial meningitis? JAMA. 2006;296:2012-22.

Clinical impact ratings: Emergency Med ★★★★★☆ Hospitalists ★★★★★☆ Infectious Disease ★★★★★☆ Neurology ★★★★★☆

QUESTIONS

In patients requiring lumbar puncture (LP), what interventions enhance the success and minimize the adverse effects of the procedure? How accurate is cerebrospinal fluid (CSF) analysis for diagnosis of bacterial meningitis?

METHODS

Data sources: Cochrane Library, MEDLINE (1966 to January 2006), EMBASE/Excerpta Medica (1980 to January 2006), and bibliographies of retrieved articles.

Study selection and assessment: Intervention: Randomized controlled trials (RCTs) in any language that evaluated interventions to reduce headache in patients ≥ 18 years of age having a diagnostic LP. Studies of LP during spinal anesthesia or myelography were excluded. Diagnosis: Studies that assessed the accuracy of CSF analysis in patients with suspected acute bacterial meningitis and described use of an appropriate reference standard in all patients. 15 RCTs (sample size range 44 to 600 patients) and 6 diagnostic studies (sample size range 80 to 2635 patients) met the selection criteria. Assessment of study quality included randomization procedure, blinding, and outcome assessment for intervention studies and reference standard, blinding, index test, and patient characteristics for diagnostic studies.

Outcomes: Headache ≤ 7 days after LP and accuracy of CSF analysis.

MAIN RESULTS

Meta-analysis using random effects showed a statistically nonsignificant decrease in headache when an atraumatic needle rather than a standard needle was used (Table). Reinsertion of the stylet before removing the atraumatic needle, as compared with no reinsertion, was associated with fewer patients having headache (Table). Incidence of decrease in headache did not differ with mobilization or bed rest after LP (Table). No trials were identified that evaluated operator experience or patient positioning. The number of outcomes was too small in 1 RCT of 100 patients to compare drinking 1.5 with 3 L of fluids/d for risk for headache.

Among the 6 diagnostic studies, 3 evaluated the accuracy of CSF Gram stain. Sensitivities ranged from 56% to 86%, with

1 study reporting specificity (100%). 4 studies reported the accuracy of biochemical analysis of CSF. Increased likelihood of bacterial meningitis was seen with a leukocyte count ≥ 500/μL (positive likelihood ratio [+LR] 15, 95% CI 10 to 22), blood glucose ratio ≤ 0.4 (+LR 18, CI 12 to 27), and lactate level ≥ 3.5 mmol/L (≥ 31.5 mg/dL) (+LR 21, CI 14 to 32).

CONCLUSIONS

In patients requiring lumbar puncture, reinsertion of the stylet before removal of the needle should be done. Biochemical analysis, including leukocyte count, blood glucose ratio, and lactate level from the cerebrospinal fluid, help in diagnosing bacterial meningitis.

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Interventions to reduce headache ≤ 7 days after lumbar puncture*

Comparisons	Number of trials (n)	ARR (95% CI)
Atraumatic vs standard needle	5 (587)	12% (-1.7 to 26)
Stylet reinsertion vs no reinsertion	1 (600)	11% (6.5 to 16)
Mobilization vs bed rest	4 (717)	2.9% (-3.4 to 9.3)

*Abbreviations defined in Glossary. A random-effects model was used.

COMMENTARY

LP was introduced over 100 years ago, and remarkably, very little about it has changed. Straus and colleagues reviewed practices to reduce post-LP headaches and to determine the accuracy of CSF analysis in diagnosing meningitis, which proved fairly challenging owing to the paucity of studies meeting inclusion criteria. Post-LP headache is the most common complication of LP and is theoretically caused by a reduction in CSF volume from a persistent leak through the LP puncture site. Straus and colleagues found fewer headaches when smaller needles or atraumatic needles were used and when the stylet was reinserted before the needle was removed. Although only 1 study compared small-gauge with standard-gauge needles and a nonsignificant trend was found when studies were combined evaluating the use of atraumatic needles, both interventions are probably efficacious because they so strongly mirror the findings of studies in the anesthesia literature. Straus and colleagues also found 1 large study that supported the practice of reinserting the stylet before removing the needle, theoretically preventing a strand of arachnoid from threading back through the dura as the needle is removed. This review also reported a nonsignificant decrease in

headaches in patients who were mobilized, which argues against the common practice of laying a patient flat following LP.

Although few studies addressed its accuracy, the CSF analysis was routinely used to identify patients with bacterial meningitis. The review found that the CSF Gram stain, leukocyte count, lactate level, and blood-glucose ratios were sufficiently accurate in ruling in meningitis but were not able to rule it out. This finding led to attempts to make clinical decision rules, but the only one prospectively derived was not adequately sensitive.

Does this review answer the questions posed? Yes, physicians can incorporate practices that reduce the incidence of post-LP headache. Selecting a small-gauge needle and reinserting the stylet is straightforward. An atraumatic needle is technically more difficult to use because of the blunt tip that requires an introducer to incise the skin. Bed rest is not necessary. The CSF analysis remains a useful tool to identify patients with meningitis but should not be relied on to exclude it; the patient's clinical presentation must also be considered.

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